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Review of Interstate Analysis of Food Security in India's Hill States: Himachal and Uttarakhand

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Abstract

Food security continues to be a vital developmental issue in India, especially in geographically sensitive areas like the Himachal Pradesh and Uttarakhand hill states. This review of literature examines the four dimensions of food security-availability, accessibility, utilization, and stability-in the context of these two Himalayan states. Through review of current research, policy contexts, and empirical analyses, the review identifies inter-state differences and similarities in agricultural productivity, infrastructure, climate resilience, and socio-economic determinants of food security outcomes. Particular focus is placed on terrain-induced constraints like limited arable land, recurrent natural disasters, and logistic challenges in supply chains. The analysis also assesses government interventions such as the Public Distribution System (PDS), integrated farming schemes, and climate-smart agriculture with respect to effectiveness in combating food insecurity in hilly areas. The review ends by examining gaps in existing literature and suggesting a localized, terrain-specific approach in order to ensure sustainable food security in mountain states.

Keywords

Hilly region, Himachal Pradesh, Uttarakhand, Inter-state analysis, Agriculture sustainability, Climate resilience, India.

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1. Introduction

Food security has always been at the center of India's developmental agenda, inextricably linked with the socio-economic planning of the nation, public welfare programs, and poverty reduction strategies. Traditionally, the center of Indian food security has been the attainment of food grain self-sufficiency, specifically in the post-independence period when the country witnessed repeated famines, excessive reliance on food imports, and severe under-nourishment among vast sections of its population. The 1960s and 70s Green Revolution was a watershed moment in India's food production capability, shifting the nation from being a food-deficit economy to one with large surpluses in major staples like wheat and rice. But this aggregate-level hunger-reducing production-based model of food security, though effective, eventually showed its limitations in dealing with the multidimensionality of food insecurity. Modern concepts of food security, as identified by the Food and Agriculture Organization (FAO), include four main dimensions: availability, access, utilization, and stability. In India, these are heavily determined by a myriad of regional variations, socio-economic disparities, climatic exposures, and gaps in policy implementation.¹ Although the country as a whole might reflect encouraging trends in availability of food grains, serious inter-state as well as intra-state differences show up in real access to food and nutrition outcomes. Especially at risk in this regard are India's mountain and hill states, where topographical obstacles, lack of infrastructure, and climatic vulnerabilities add to the challenges of maintaining across-the-board food and nutritional security.²

One of the states that represent these challenges are Himachal Pradesh and Uttarakhand, both within the Western Himalayan region. Despite having geographical and ecological commonalities, they have differential socio-economic profiles, development paths, and policy competencies. Himachal Pradesh has historically

performed better than a number of other Indian states on major human development indicators and has pursued comparatively successful horticulture-based models of agriculture. In contrast, Uttarakhand-although endowed with natural resources-has perennial problems of out-migration, fragmented holdings, and poor infrastructure that directly affect food production and food distribution systems.³

The food security situation in these two hill states is influenced by a number of terrain-related problems. Steep topography and limited arable land prevent mechanized agriculture and high-value agricultural production. Road transport bottlenecks, which are augmented by seasonally triggered disruption such as landslides and heavy snowfall, obstruct the efficient operation of the Public Distribution System (PDS), a lifeline for food availability among rural and tribal populations. Further, altered climatic trends-such as irregular rainfall, glacial withdrawal, and high frequency of extreme weather events-create very serious threats to subsistence agriculture as well as commercial horticulture, hence compromising the overall food system stability of the region.

Apart from environmental and infrastructural limitations, socio-economic vulnerabilities add complexity to the food security situation in these states. Marginalized groups such as Scheduled Castes (SCs), Scheduled Tribes (STs), women-headed families, and economically weaker sections tend to experience structural exclusion in accessing entitlements and public services. Low levels of education, lack of access to care, and social gender roles have negative impacts on dietary variety, maternal and child nutrition, and general use of available food. All these inequities are frequently exacerbated in distant and interior areas where state extension and civil society efforts are inadequate or geographically lopsided.⁴

In this backdrop, it becomes necessary to study the current body of literature pertaining to the food security dynamics of Himachal Pradesh and Uttarakhand. While a number of studies at the national level have discussed the food security of India in general terms-considering the progression of policy, performance of PDS, agricultural growth, and nutritional levels-there is a comparative lack of academic literature that engages with the regional peculiarities of hilly regions in depth. Most notably missing is a rigorous, comparative study that considers the various ecological,

administrative, and socio-economic environments of these two Himalayan states.^{5,6}

This chapter attempts to plug this gap by providing a holistic review of literature on food security in India, focusing particularly on Himachal Pradesh and Uttarakhand. The review follows a thematic structure and is divided into separate sections on agricultural production and land use dynamics; food distribution systems such as the PDS; public health and nutritional status; infrastructure and climatic vulnerability; gender and social equity; and institutional and governance structures. By combining evidence from academic writings and policy reports, the chapter attempts to capture patterns, challenges, and innovations in food security as faced by these hilly states.

In addition, the review identifies current gaps in research, including under-representation of rural high-altitude populations, absence of dis-aggregated data, and need for terrain-sensitive implementation designs. It also emphasizes the imperative for an inter-state comparative perspective that not only reflects the complexity of realities in every area but also informs more targeted, local-level policy interventions. Ultimately, this chapter adds to a more nuanced understanding of food security as an everyday experience within India's mountain areas—one that is beyond aggregate figures to capture the intricacy of hunger, nutrition, and well-being in geographically peripherized places.

2. The Discourse on Food Security in India

India's transition from scarcity of food in the initial decades after independence to comparative food surpluses today is well documented. Early research, for example, Devi (1966) had examined the Madras State (now Tamil Nadu) and presented one of the first sub-national critiques of India's food policy. She came to the conclusion that the lack of a coherent and efficient food policy had resulted in a reduction of both the extent under food grain cultivation and actual output levels. Her results showed a strong correspondence between food price volatility and variations in the size of cultivation, which meant that farmers' choice of production was extremely sensitive to market conditions when they did not have policy support. The research actively promoted the formulation of a stable, long-term food policy, advocating that only such stability could provide agricultural stability and food security for the state.⁷

Gupta (1970) approached the problem from a more general, national stance, claiming that India's national food policy needed to reconcile two fundamental objectives: Increasing food production, and enhancing the distribution network to accommodate large-scale, equitable access to all regions. He condemned the absence of an integrated national plan, which he claimed had resulted in regional resentment and inefficiency, famously termed a food muddle. Gupta reiterated that the fair distribution of foodstuffs between states, irrespective of their local production, should be a cornerstone of India's food security strategy. His research also highlighted the need for voluntary discipline and collective responsibility on the part of producers, consumers, and the government if the system were to work well.⁸

Ensminger (1977) proceeded and put greater emphasis on the fact that India's food security issue is just as much an issue of farm output as it is one of coping with population pressures and guaranteeing equal access to all the states.⁹

Subsequent researches, including Gopalan (1995) and Radhakrishna (1996), came to appreciate how structural transformation and urbanization were resulting in new risks to consumption and nutrition patterns, especially for the weaker sections. The Green Revolution period was both a success story and a school of failure-while cereal output increased, regional and crop-specific imbalances ensued.^{10,11}

3. Agricultural Production in Hilly Lands

Agriculture constitutes the backbone of the social and economic existence of Himachal Pradesh and Uttarakhand. In these rural, hill states, most of the populace depends directly or indirectly on agriculture for livelihood, employment, and generation of income. However, hill farm production is fundamentally distinct from plains farm production, not only in scale and crop choice but also in systemic limitations, environmental exposure, and livelihoods. The complex hill agriculture dynamics are examined in this section by examining the key constraints, traditional practices, diversification trends, and food security policy environments that shape food security in Himachal Pradesh and Uttarakhand.^{12,13}

Sharma *et. al* (1996) provide significant insights into the organization, productivity, and adaptive capacity of conventional

farming systems in the Western Himalayan states of Himachal Pradesh and Uttarakhand. These systems, while frequently classified as low-yielding by mainstream agronomic criteria, are extremely resilient and ecologically integrated, especially if measured against the backdrop of local agro-climatic conditions, topographical limitations, and resource scarcity. It noted, along with these practices, the delicate mountain ecosystems, in which steep slopes, shallow soil, and restricted irrigation render intensive monoculture-based agriculture unfeasible. Crops are not chosen merely for their market value but also their resilience to climatic fluctuation, poor soils, and labor shortages.¹⁴ Also Sharma *et.al* (2022) also highlights the multi-functional character of such traditional systems. In addition to food production, they support ecosystem services such as the maintenance of soil fertility, the conservation of biodiversity, and water regulation. Though less productive on a yield per hectare basis than high-yielding varieties (HYVs), their stability, sustainability, and adaptability translate into long-term food security, particularly under climatic disturbances.¹⁵

Purohit *et al.* (1996) carried out a seminal study of integrated and diversified farming systems in India's dryland and desert regions with the aim of identifying ways in which ecologically suited, resource-conserving models of agriculture can be employed to enhance the livelihood of small and marginal farmers in adverse environments. Though the research was conducted in the dry tracts of western India, its conclusion has implications in general, particularly for mountainous areas such as Himachal Pradesh and Uttarakhand, which have similar constraints-limited cultivated land, delicate soils, erratic rainfall, and exposure to environment.¹⁶

4. Public Distribution System and State-Level Performance

The Public Distribution System (PDS) has traditionally been one of India's main institutions for supporting food access and smoothing consumption, particularly among poor and geographically isolated groups. As part of India's overall food security system, the PDS is intended to provide staple commodities like rice, wheat, sugar, and kerosene at subsidized rates through a system of Fair Price Shops (FPSs).¹⁷

Himachal Pradesh is often cited as a relatively successful example of PDS functioning, especially among hill states. With over 90% rural

population, the state government has historically maintained a universal approach to food distribution, even after the introduction of TPDS. Swaminathan (1996)¹⁸ admired Himachal for its effective distribution system, which made coverage possible in high-altitude and snow-covered regions by well-coordinated pre-positioning of stocks and PDS performance in Uttarakhand, however, is a more varied case. While the state has endeavored to computerize ration cards and organize supply chains, field-based studies and social audits in the countryside and hill districts such as Pauri Garhwal, Tehri, and Almora, demonstrate continued gaps at the implementation level. As cited by Swaminathan (1996a) and subsequent observations by civil society groups, the PDS in Uttarakhand is afflicted by poor road infrastructure, Low levels of awareness amongst beneficiaries regarding their entitlements, Irregular operations of Fair Price Shops, especially in thinly populated villages and state capacity weakness for monitoring and grievance redressal.

Additionally, Uttarakhand has had persistent underutilization of PDS entitlements, partly because of variable grain quality and irregular supply.

In areas with robust subsistence farming culture, individuals will resort to home-bred cereals instead of relying on poor state delivery. With both states further refining their welfare delivery mechanism, terrain-sensitive, locally adaptive approaches are necessary to make sure that the aims of the PDS-availability, accessibility, and equity of food-are adequately met. Swaminathan (1996) and Radhakrishna (1996) research continues to hold value today, citing the conflict between general food policy models and calls for place-specific implementation models. An in-depth review by Sasi *et al.* (2024) indicates that India's PDS, being theoretically sound, requires contemporary updates and terrain-sensitive modifications in implementation-especially for areas such as Uttarakhand.^{19,20}

5. Nutrition Security and Public Health Implications

The theory of food security in India has increasingly developed from a constricted concentration on grain food production and calorie availability to a widening, more complex definition that encompasses nutritional adequacy and public health impact. This development has become increasingly significant as it came to acknowledge that sufficiency of calories does not necessarily translate into nutrition security, particularly among vulnerable

populations like women, children, and the elderly. The Uttarakhand and Himachal Pradesh states, although they have moderately succeeded in enhancing food supply and distribution by means of schemes such as the Public Distribution System (PDS), still struggle with ongoing issues in attaining overall nutritional security.^{21,22}

Swaminathan & Bhavani (2013)²³ point out that nutritional security is more than maintaining a sufficient caloric intake. It is access to varied, balanced, and micronutrient-dense diets, along with sanitation, health care, and education, among pregnant women, lactating women, and children. Their study contends that looking only at grain-based caloric consumption could conceal underlying protein, vitamin, iron, and other nutrient deficiencies.

Here, both Uttarakhand and Himachal Pradesh show a paradoxical nutritional profile. While indicators of basic food security like calorie consumption and availability of subsidized staples have shown improvement, malnutrition in large areas remains unabated. Both states report very high rates of stunting (low height-for-age), wasting (low weight-for-height), and anemia, particularly among the under-five and reproductive-aged women, as per the National Family Health Survey (NFHS-5).

Radhakrishna et al. (2004) and Mishra & Rampal (2020) focus on the role of programs such as ICDS and mid-day meal scheme in nutritional outcomes, but quality, coverage, and delivery are still issues. Terrain-induced remoteness decreases the effectiveness of these programs in Uttarakhand. In Himachal Pradesh, an improved healthcare system has helped moderate some nutritional issues to some extent, but regional differences continue to exist.^{24,25}

Prajapat & Ranawat (2024) observed that while ICDS has improved service uptake in some rural areas, infrastructure limitations and declining child participation pose serious challenges.²⁶

6. Climate Change and Environmental Vulnerability

Climate variability poses a major threat to food systems in hill areas. High frequency of landslides, floods, and irregular rainfall interfere with agriculture cycles and lower domestic food security. Vyankatrao (2017) and Jangir & Goswami (2025) chronicled the negative impacts of climate change on rice and wheat crops, advocating for increased investment in climate-resilient agriculture.

In spite of various policy interventions, such as crop insurance and drought relief schemes, climate-smart agriculture adoption is low in Himachal Pradesh and Uttarakhand. Research points towards inadequate institutional capacity and farmer awareness about adaptive measures, such as water harvesting, agroforestry, and climate-resilient crops.^{27,28}

7. Socio-Economic Inequality and Food Access

Mehta & Jha (2015) and Gupta (2020) establish that Scheduled Castes, Scheduled Tribes, and women bear a disproportionate brunt of food insecurity. These populations tend to live in the most inaccessible and resource-deficient areas of the hill states. Restricted access to land, financial credit, and public services adds to their risk.

Agarwal (2018) identified effective models of women's collectives improving food access and economic empowerment. Systemic issues such as patriarchal land tenure, bureaucratic latency, and weak outreach, however, impede scaling.^{29,30,31}

8. Institutional and Governance Mechanisms

Decentralized institutional mechanisms, including Gram Sabhas and Panchayati Raj Institutions (PRIs), can play a major role in enhancing food delivery systems. Awanish (2011) illustrated that Gram Sabhas, when empowered, could serve as instruments of local monitoring of food schemes. Institutional capacity continues to be weak in high-altitude districts, where administrative extension is thin.³²

Basu (2011) and Chand (2005) emphasized that structural change in the food grain market, such as effective procurement and distribution, had the potential to sustain local economies and de-link dependency on markets far away.^{33,34}

9. Comparative Evaluation: Himachal Pradesh and Uttarakhand

While both the states fall within the same agro-climatic regions, they vary considerable in economic organization and administrative effectiveness. Himachal has improved infrastructure, greater per capita income, and relatively better institutions. Uttarakhand, on the other hand, is plagued with greater out-migration, lack of investment in agriculture, and poor enforcement of central schemes.

The comparative literature indicates that these factors account for a broader food security shortfall in Uttarakhand. In spite of similar policies, they have different outcomes as a result of differences in political will, administrative capability, and civil society mobilization.^{35,36}

10. Literature Gaps and Future Research Directions

While there is a large amount of national and sectoral research on food security in India, region-specific studies that address the specific difficulties of mountain states like Uttarakhand and Himachal Pradesh are comparatively limited. These two Himalayan states, given their unique topographical, climatic, and socio-economic conditions, need focused scholarly inquiry to enhance comprehension of the specificity of food access, nutritional realities, and program delivery within mountain contexts.³⁷

Perhaps the most significant gap in the literature is the paucity of disaggregated data, especially by gender, caste, tribal status, and geographic location. This deficiency significantly constrains policymakers' and researchers' capacities to formulate inclusive and equity-oriented interventions. For instance, although aggregate nutrition data indicate moderate improvements, latent differences among women, SCs, STs, and geographically hard-to-reach rural communities are usually hidden.

Another significant deficiency is in the scarceness of empirical work on hill agriculture's climate adaptation and resilience. Given the fact that both Himachal Pradesh and Uttarakhand are extremely sensitive to climate-related disasters like landslides, irregular rainfall, and glacier retreat, there is a strong need for field-level evidence on how small and marginal farmers are adapting to environmental stresses.³⁸ Research on adaptive cropping systems, water harvesting, and local knowledge systems might provide useful lessons for the development of climate-resilient food systems.³⁹

Economic studies can also reveal the significant gap in systematic assessment of public programs such as the Public Distribution System (PDS), National Food Security Act (NFSA), and Poshan Abhiyan, in hilly regions. Although these schemes constitute the framework of India's food and nutrition security systems, their efficacy in inaccessible, remote, and scattered areas has not been properly evaluated. Problems of implementation in such areas like

seasonal inaccessibility, lack of personnel, weak monitoring, and community apathy need special investigation.

Aside from that, there is scarce literature focusing on the application of technological innovations to improve food security in the mountainous zones. The role of agri-tech solutions like drone-based input delivery, GIS-based crop monitoring, digital grain tracking, and mobile-based extension services play a role in bringing improvement to the food supply chains in far-flung regions has not received enough attention. As these technologies have the potential to fill terrain-related gaps, it is essential that future research assesses their feasibility, affordability, and scalability in hilly settings.

In view of these gaps, future studies need to follow a multidisciplinary, participatory, and localized research framework. Blending quantitative analysis of data with qualitative inputs from communities, and situating research within the region's socio-political and cultural context, will be critical for producing meaningful, policy-relevant results. In addition, longitudinal studies that follow the effects of interventions over time, especially in the context of climate change, migration, and changing agricultural practices, are essential. A robust policy focus that connects research to outcomes of action will be vital to further food and nutritional security in India's hill states.^{40,41}

11. Conclusion

Literature evidently demonstrates that food security in mountainous states such as Himachal Pradesh and Uttarakhand is a result of interrelated challenges, climatic, geographical, institutional, and economic. Although national food policies set the structural context, their effectiveness in hill areas relies on localized adaptation, more governance, and increased community involvement.

An inter-state comparative approach that identifies terrain-specific opportunities and needs can allow for more effective food security intervention design and implementation. If India is to achieve its Sustainable Development Goals (SDGs), removal of the structural bottlenecks in its mountain states will be critical to inclusive and resilient development.

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