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Dimensions and Determinants of India's Food Security

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ABSTRACT

India's development story is a conundrum. Recent economic developments have not matched the parallel development in the food security front of the nation. Agriculture and food security are interlinked. Without sustainable agriculture and allied sector development, zero hunger by 2030 cannot be achieved. About 21.9% of the population is recorded below the poverty line. The percentage of the undernourished population was recorded in the downward direction, but still, 14% population is facing undernourishment. The study's findings further revealed 17.5% and 34.7% wasting and stunting among children under five years of age, which were caused by the absence of the required nutritional level of food. The mortality rate of children under five declined, i.e., from 5.2% in 2012 to 3.7% in 2020. The analysis results concerning agricultural production revealed positive growth in the production of cereals, coarse cereals, pulses, fruits and vegetables, and livestock products such as milk, eggs, and meat during the period under investigation. India produced food items like cereals & millet, fruits, sugar, milk, and eggs much more than the nation's requirements except pulses, vegetables, and meat. Despite this, the problems of food insecurity and malnutrition persisted in the nation. The difference in food intake might be due to constraints in food distribution at regional and local levels and household-specific economic and non-economic factors. Over the last few years, the government has made significant efforts by launching various policies targeting food security, nutrition support, housing for all with basic amenities, education for all, universal health coverage, road connectivity, social security, employment, livelihood diversification, skill development, etc. for the overall development of the deprived and economically backward section of the society. Bridging the deprivation gap is still a challenging task for the nation. The article provides an insight into the outcomes and impacts of different food security programs and the nation's food production. The present study will help policymakers find loopholes in food security programs and policies to strengthen these programs for better results.

Keywords: Food security, Agricultural production, sustainability, nourishment, malnutrition, stunting, wasting, underweight

INTRODUCTION

The green revolution, which took place in the 1960s, increased the agricultural productivity of India and transformed the country from a food deficit to a food surplus nation. Undoubtedly, it brought tremendous changes in the agricultural sector but simultaneously confined Indian agriculture to paddy and wheat growing culture. Promoting staple crop productivity inadvertently resulted in the crowding out of micronutrient-rich traditional food crops like coarse cereals, millets, and pulses from the areas in which they were historically cultivated [33,34].

Agriculture, with its allied sectors, is India's largest source of livelihood. About 70 percent of its rural households still depend primarily on agriculture. Its overall growth is an essential prerequisite for the nation's economic development. Gross Value Addition (GVA) from Agriculture and Allied Sector at

constant (2011-12) prices during 2020-21 was Rs.2048032 crores. The Share of GVA of agriculture and allied sectors in the total economy at current prices was estimated to be 20.0% during 2020-21.

Further, the Percentage Share of the Value of Agricultural Exports to National Exports during 2020-21 was 14.30% [1]. Even during the pandemic Covid-19 lockdown across the country that brought economic activity to a near halt, the agriculture sector proved to be a silver lining for the nation's economy. Its growth was recorded to be nearly 3.4%, according to NITI Aayog. However, the role of the agricultural sector remains crucial as the share of the agricultural workforce is declining. During 2020-21, the share of the total workforce employed in agriculture was estimated to be 46.5%. It is still the prime sector for employment in the country.

In the last decades, the nation witnessed high growth due to increase in per capita income, rapid urbanization, increased literacy rates, population growth, and poverty reduction. Agricultural development provided income-generating opportunities only to some farming sectors. Marginal and small farm holders dominate the major proportion of the nation's farming community. Poor infrastructure and a lack of institutional support have kept this vast proportion away from the growth process. From a broader perspective, only a few states benefited from the growth process, and the other states remained deprived of these growth processes.

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On the other hand, poverty and poor health coexistence were observed in the country despite increased income and income-generating opportunities. This is reflected in the country's simultaneous prevalence of undernourishment, over-nutrition, and micronutrient deficiencies. The prevalence of regional disparity, rural and urban food insecurity, and the rising triple burden of malnutrition is a gloomy spot in the nation's growth story [32]. In recent times, it has also become evident that proper sanitation, hygiene facilities, and access to clean drinking water consumption are associated with food intake, regardless of satisfactory availability and accessibility to food.

The historic success of staple food like rice and wheat production alleviated hunger, but micronutrient malnutrition persists. Food policy continues to be aimed at calorie availability and has been slow to respond to the persistent problem of micronutrient-deficient malnutrition and child stunting as well as the new emerging challenges of obesity and overweight [18, 25].

Agriculture is essential in attaining adequate nutrition, as nutrition security cannot be achieved without an enhanced production level. In another way, we can say that food and nutrition security are interlinked since only a food-based approach can aid in overcoming malnutrition in terms of both social and economic viability, human right, and the environment as well as political ramifications. This has also been acknowledged and highlighted under the second goal of Sustainable Development Goals (SDG), i.e. "Zero Hunger", which focuses on achieving food security and improved nutrition through sustainable agriculture [7]. The price hike of edible commodities has remained a major issue nationwide. Hence, the price hike of food items is bound to have implications related to not only hunger and malnutrition but can also result in enhancing healthcare expenditure and a greater economic burden on the people. Price-hike creates unrest and protest, creating political and social conflict [31].

It is projected that in 2030, the nation's population will reach 1.5 billion. To feed such a huge population would be a challenging task. The country has to produce more food from shrinking per capita arable land, depleting irrigation water, and expanding environmental consequences. Since land is a shrinking resource for cultivation, the only way left is to enhance productivity per unit of arable land and irrigation water. The factor productivity will have to be boosted if production cost is reasonable and the prices of agricultural products are globally competitive. Farm holding size is reducing, and about 86.07% of farmers belong to marginal and small-size groups. Fortunately, the ownership of livestock is more egalitarian.

In the present paper, attempts have been made to focus on food production and its relation to food security by focusing on the dimensions of food security in the Indian context. Keeping this in view, analysing the characteristics and dimensions of household food security in terms of change and diversification in per capita availability, consumption, and utilization pattern will help to develop a better understanding of the status of food security in India to address the global concern associated with it and therefore suggest measures to eradicate poverty and make India a hunger free nation.

Food security

In the mid-1990s, nutrition was added to food security, considering that only food consumption is not necessary to keep the body healthy. Based on the Conceptual Framework of UNICEF, IFPRI defined nutritional security as consuming foods

with an adequate quantity of necessary health constituents like energy, protein, vitamins, and micronutrients to all household members at all times. Further, The World Bank linked it with a hygienic environment and healthcare services to ensure a healthy life for all household members. According to this definition, to ensure healthy and active life for all household members, nutritious foods, congenial hygienic conditions, and proper health care facilities are ensured. Diversity, quantity, and quality in terms of nutrient content and food safety might be ensured to scale up and achieve food security in a country and at the global level.

Dimensions of Food Security

Food security is a four-dimensional concept comprising the availability of food, access to food, utilization, and stabilization.

Food Availability: Food Availability is a physical determinant that ensures that adequate food is available at peoples' disposal. This includes the production, allocation, and transfer of food.

Food Accessibility: Food accessibility refers to the affordability and distribution of food and is said to be achieved if an individual or household has sufficient resources to obtain an appropriate diet of his preferences.

Food Utilization: Food utilization depends upon the biological and social environment that ensures proper health care through nutritious food, safe drinking water, sanitation, and hygiene facilities.

Food Stability: Food Stability reflects the temporal dimension of food security, respectively, and ensures that the household supply remains more or less constant during the year and over a long period.

Despite the tremendous increase in production, the per capita availability of food grains has remained stagnant. The per capita availability of food grains at 510.1 grams per day in 1991 was the highest achieved, and 20 years later, in 2021, we are at 507.9 grams per day. Although India contributes nearly 25 percent to total food production and 27 percent to consumption, it still records high malnutrition among children (below 5 years of age) [14]. India has the highest number of stunted and wasted children, with 46.6 million and 25.5 million worldwide and nearly a third and a half of all stunting and wasting children worldwide [10].

Food security and food grains availability have always gone hand in hand in our country. Although adequate food grains consumption guarantees that dietary energy requirements are met, a diverse diet is crucial for meeting nutrient needs [23]. With the increase in income level and availability of other food commodities, there has been a change in the pattern of food consumption. This changing consumption pattern towards a nutrient-rich diet will likely positively impact health and nutritional status [15].

METHODOLOGY

The present study is based on dimensions of food security such as the production scenario of cereals, coarse cereals, pulses, vegetables, fruits, milk, eggs, and meat, their per capita availability, monthly per capita consumption pattern, average per capita calorie, protein, fat intake in Rural and Urban India and also the allocation and distribution of food grains which indicates up to what extent our nation is secure on the food

security front. Determinants of nutritional level include the proportion of the undernourished population, nutritional status of children under five years of age, poverty rate, Hunger percentage, and percentage of the population living in households with an improved drinking-water source, sanitation facility and health care insurance. With simple tabular analysis and graphical presentation, attempts have been made to establish the relation between food production, availability status, and determinants of nutritional status in India. Time series data of above-mentioned macro indicators have been compiled from the different published reports, such as Agricultural Statistics at a Glance and National Sample Survey (NSS) reports (50th, 61st, 66th, and 68th) and has been used in the present investigation.

1. Food Availability

Food production scenario

Food and nutrition are interlinked, and only a food-based approach could be the right approach to eliminate malnutrition economically and socially sustainably. Food production has always been a critical determinant in monitoring food availability. India has witnessed a manifold increase in overall crop production in the past few decades. Hence, it is a prerequisite to examine the production scenario in the country, which would give an idea about demand and production and the future need to feed the ever-growing population of the nation.

Cereals

Cereals have been the principal component of the human diet and have been considered a vital survival for thousands of years.

Table 1: Area and production scenario of total cereals in India

Periods	Area (⁰⁰⁰ Hectares)	Percentage change over the previous period in the area	Production (⁰⁰⁰ Tonnes)	Percentage change over the previous period in production
TE-2003	98278.30		182955.96	-
TE-2006	98837.23	0.57	192911.57	5.44
TE-2009	100563.37	1.75	212999.30	10.41
TE-2012	99537.86	-1.02	223961.24	5.15
TE-2015	99362.95	-0.18	239817.67	7.08
TE-2018	98601.18	-0.77	265736.67	10.81
TE-2021	98546.62	-0.06	274297.11	3.22
CAGR	-0.003%	-	0.96%	-

Coarse cereals

Other than rice, wheat, and maize, cereals like sorghum (Jowar), oats (Jai), barley (Jow), pearl millet (Bajra), and other minor millets such as Finger millet (Ragi), Kodo millet, Foxtail millet (Kauni) and Barnyard millet (Sanwa) are considered as coarse cereals. These grains are warm-season cereals valued for their food, feed, and fodder uses in various parts of the world. These are cultivated mainly under rain-fed conditions with little external inputs and low grain yield (often less than 1 tonne/ha) [35]. Coarse cereals are rich in dietary energy, vitamins, several minerals (especially micronutrients such as iron and zinc), insoluble dietary and phytochemicals with antioxidant properties [8]. Finger millet is the richest source of calcium (300 to 350 mg/100 g grain). Small millets are a good source of phosphorus and iron. Being nutritionally rich, coarse cereals of late are known as nutri-cereals or nutri-grains. They are rich in compounds that help against chronic diseases like ischemic

Cereals provide more than 50% of daily caloric intake globally. Rice, wheat, maize, and to a lesser extent, sorghum and millet are important food staples. The average requirement of energy is about 2200 Kcal per capita per day. Cereals alone provide about 68 percent of the 'total energy requirements (Working Group, Ministry of Agriculture, 1994). The area and production of cereals are presented in Table 1 from 2001 to 2021. A perusal of Table 1 indicated that the area under cereals increased in the first two trienniums ending 2006 and 2009; after that, continuous decline in the area was recorded in the subsequent trienniums, and compound growth rate for the overall period also showed a decline in area under cereal crops mainly rice, wheat, and maize. The reason may be the non-agricultural uses of land for infrastructural development, urbanization, and construction of residential buildings for the country's growing population.

Production of cereal crops recorded a regular upward trend during the investigation period, and compound annual growth in cereal production was recorded at 0.96% per annum. Technological interventions and improved packages of practices might be the reason behind the enhanced production of cereal crops in India.

Annual Population growth of India is estimated to be 1%, whereas the growth rate of production of cereals crops like paddy, wheat, and maize is only 0.96%. The land is becoming a scarce resource, and expansion of cultivable land is impossible. Intensive agriculture rather than extensive growth is the only option to feed the future population. Hence, production intensification, modern technologies, and advanced inputs are the only strategies to boost production.

strokes, cardiovascular diseases, cancers, obesity, and type II diabetes [21, 20]. They are nutritionally comparable or even superior to major cereals such as wheat and rice; owing to their higher levels of protein with a more balanced amino acid profile (good source of methionine, cystine and lysine), they may prove to be a part of a nutritious diet and helpful in combating malnutrition. Considering the nutritional and health benefits, India announced 2018 as the Millets Year. The Year 2023 is celebrated as the International Year of Millets for using millets to boost the nutritional requirement for a healthy life.

The cultivation of coarse cereal was referred to as poor man's crops for a long, have remained neglected and did not get its appropriate position in the commercialized food system and investment in research and development. Because of changing climatic and environmental conditions and their adverse effect on food security and the enhancement of food demand for an ever-increasing population, shirking land and other crop

production resources, and growing health consensus, the coarse cereals got a place in the food basket. Several food products are being prepared with scientifically proven information and traditional rural knowledge on the nutritive and health aspects of coarse cereals. Research and development on potential uses of these coarse cereal grains also got attention, and the cultivation of these crops gained momentum. As evident from Table 2, the area under coarse cereals decreased during the period under investigation. After TE-2006, a gradual decrease in the area was estimated an annual compound growth rate was computed as negative (-0.58%). In the case of production, recorded decline after TE-2006 as indicated by percentage change over the previous period, and compound annual growth was estimated to be 0.99% per annum. The reasons behind positive growth in production may be the effects of research and technological interventions developed to increase the production of these grains and increased demand in the market owing to their nutritional and health-boosting properties.

Table 2: Production scenario of coarse cereals in India

Periods	Area ('000 Hectares)	Percentage change over the previous period in the area	Production ('000Tonnes)	Percentage change over the previous period in production
TE-2003	28923.97		30174.40	
TE-2006	29630.50	2.44	35045.34	16.14
TE-2009	28213.07	-4.78	38236.97	9.11
TE-2012	27478.58	-2.60	39653.41	3.70
TE-2015	25051.44	-8.83	42067.01	6.09
TE-2018	24561.11	-1.96	43088.20	2.43
TE-2021	23373.84	-4.83	47377.22	9.95
CAGR	-0.58%	-	0.99%	-

Table 3: Production Scenario of Pulses in India

Periods	Area ('000 Hectares)	Percentage change over the previous period in the area	Production ('000Tonnes)	Percentage change over the previous period in production
TE-2003	20950.90	-	11856.17	-
TE-2006	22870.80	9.16	13806.37	16.45
TE-2009	22972.97	0.45	14508.48	5.09
TE-2012	24715.41	7.58	16663.88	14.86
TE-2015	24009.74	-2.86	18250.60	9.52
TE-2018	28056.51	16.85	21623.45	18.48
TE-2021	28642.14	2.09	23521.44	8.78
CAGR	0.71%	-	1.65%	-

The production scenario of pulses in India from 2000-01 to 2020-21 is presented in Table 3. A perusal of the table revealed that both area and production of pulse crops registered positive percentage changes over previous years, except in the TE-2015 area recorded a negative percentage change over TE-2012. During the period under investigation, annual compound growth rates for area and production are estimated to be 0.71% and 1.65% per annum. After 2016 the area under pulses and the production of pulses accelerated would be the impact of different campaigns and schemes launched by the government after the declaration of 2016 as International Pulse Years. Still, as per the projected demand of pulses by Niti Ayog (2020-21) of 26.64 million tonnes country produced 23.15 million tonnes which indicated further improvement in pulses production in the nation to fulfil the nutritional security demand.

Fruits and Vegetables

During the period of the Green Revolution in the nation and after that, the main focus was to ensure food security by enhancing the production of food grains, and various schemes to boost the production of food grains were launched in different five-year plans.

Horticultural development got attention in the post-1993 period by enhancing plan allocation and knowledge-based technology. The Government of India acknowledged the need for diversification in the horticulture sector in the mid-eighties by focusing on investment. A centrally sponsored scheme named National Horticultural Mission (NHM) was launched in April 2005 to promote holistic growth of the horticultural sector through area-based, regionally differentiated strategies. The major priority areas of the NHM were horticultural research and development, improving post-harvest management, and promoting the processing and marketing of horticultural crops. Horticultural crops have a vital role in the Indian economy as they boost the income of the rural people. Though cultivating horticultural crops is labour-intensive, it can generate greater employment opportunities for rural people. The horticultural sector also can ensure income enhancement through increased productivity, providing employment, and boosting export; as a result, the sector has come out from rural confines to the

commercial front [4]. The scenario of horticulture crops in India is quite encouraging as the percentage share of horticulture in agriculture is steadily rising. The share of the horticultural sector in agricultural GDP was 30% from the 8.5% cropped area during the year 2019-20. Vegetables and fruits are the important components of the horticulture sector of the nation in particular and of agriculture in general. India ranks second in vegetable and fruit production and shares about 21% of the total vegetable production and 13% of total fruit production globally [19].

Further, vegetables and fruits account for 90% of the total horticultural production in the country. Numerous factors have catalysed the growth in the area and production of vegetable and fruit crops in the country. Some factors include urbanization, increasing per capita income, health consciousness, and shifting farmers towards high-value crops to augment their income[9,37].

Table 4: Production scenario of vegetables in India

Periods	Area ('000 Hectares)	Percentage change over the previous period in the area	Production ('000Tonnes)	Percentage change over the previous period in production
TE-2003	6166.00	-	89095.33	-
TE-2006	6679.67	8.33	100326.33	12.61
TE-2009	7789.33	16.61	123325.00	22.92
TE-2012	8489.67	8.99	145539.33	18.01
TE-2015	9381.10	10.50	164854.05	13.27
TE-2018	10218.43	8.93	176155.31	6.86
TE-2021	10416.00	1.93	191026.33	8.44
CAGR	1.36%	-	1.94%	-

Table 5: Production scenario of fruits in India

Periods	Area ('000 Hectares)	Percentage change over the previous period in the area	Production ('000Tonnes)	Percentage change over the previous period in production
TE-2003	3885.64	-	44034.96	-
TE-2006	5046.67	29.88	50762.00	15.28
TE-2009	5810.00	15.13	63844.00	25.77
TE-2012	6472.06	11.40	74272.74	16.33
TE-2015	6769.33	4.59	85621.38	15.28
TE-2018	6428.89	-5.03	93462.35	9.16
TE-2021	6743.00	4.89	100298.67	7.31
CAGR	1.18%	-	2.08%	-

Vegetables and fruits are essential items in everyday meals as they contain all the required nutrients for a balanced diet; in addition, fruits also have medicinal and aesthetic value. The production scenario of fruits and vegetables in India from 2000-01 to 2020-21 is presented in Table 4& Table 5. Results revealed that the area and production of both crops recorded increasing trends. Compound annual growth rates for area and production of vegetables were estimated to be 1.36% and 1.94% per annum during the period of investigation, whereas in the case of fruits, area and production recorded annual growth of 1.18% and 2.08% per annum, except negative percentage change in TE-2018 over TE-2015 was recorded for fruit crops. The reasons may be the high demands due to health consciousness and boost in per capita income and on account of technological interventions through the National Horticulture Mission launched in the country.

Production of milk, eggs, and meat in India

The livestock sector offers great opportunities for increasing farm income and employment and provides subsidiary occupation.

This sector is one of the fastest-growing sectors of the agricultural economy. India has emerged as the largest milk producer, with a 20.17% share in total milk production globally, accounting for about 5.65% of global egg production and 3% of global meat production. India also has the world's largest population of milch animals (APEDA, 2018). Livestock contributed 4.90% of total GVA to national GVA and 28.4% to agricultural GVA in 2020-21. Livestock is an important constituent of the livelihoods of people with low incomes. It serves as a major capital reserve for farming households and enhances the economic viability and sustainability of the farming system. In addition to income and employment, livestock provides manure, draught power, and, more importantly, quality food – milk, egg, and meat. Meat and eggs are rich in protein and other constituents of a healthy diet, and milk is traditionally considered a complete diet as it contains all the required elements for boosting health.

India's development story is considered a conundrum. Recent

economic developments have not matched the parallel development in the food security front of the nation. The Second Sustainable Development Goal agenda, zero hunger by 2030, was set in 2015 by United Nations. Food security is measured based on caloric intake in the country. The average daily energy requirement recommended for an individual is 2269 kcal per day to lead a healthy and active life in India. The World Health Organization (WHO) defines a 'safe' (recommended) intake in adults as 0.83 grams per kilogram per day (g/kg/d) of body mass for proteins with a digestibility score of 1.0 [13]. The protein consumption is 47gm/person/day, comparatively low as global consumption is 68gm/person/day.

Productions of meat, eggs, and milk are presented in Table 6. Annual compound growth rates of meat 3.92%, eggs 2.60% and milk 2.10% per annum were recorded during the period of investigation from 2000-01 to 2020-21. A positive increase was recorded in meat, eggs, and milk production over the previous years.

Table 6: Production scenario of milk, eggs, and meat in India

Periods	Milk (Million tonnes)	Percentage change over the previous period in the area	Eggs (Million Nos.)	Percentage change over the previous period in production	Meat (Million tonnes)	Percentage change over the previous period in production
TE-2003	83.73	-	38394.67	-	1.97	-
TE-2006	92.57	10.55	43946.33	14.46	2.20	11.86
TE-2009	107.57	16.20	53269.33	21.21	3.50	59.09
TE-2012	122.00	13.42	63246.67	18.73	4.97	41.90
TE-2015	138.80	13.77	73884.33	16.82	6.27	26.17
TE-2018	165.73	19.40	88761.00	20.14	7.37	17.55
TE-2021	198.67	19.87	113250.03	27.59	8.50	15.43
CAGR	2.10%	-	2.60%	-	3.92%	-

Per Capita Availability of Food grains

With the success of the Green Revolution, India has been able to transform from a nation dependent on food imports in the early 1960s to one now self-sufficient and a significant global exporter of agricultural commodities. Despite this significant progress in production level, India still falls into the severe hunger category. As per the Global Hunger Index 2022, India stands 107th out of 121 countries, well behind its neighbouring countries like Pakistan, Bangladesh, and Nepal. Per capita availability of food grains is worked out by dividing the net availability of food grains by the population estimates for a particular year. The net availability of food grains is estimated to be Gross Production (-) seed, feed & wastage, (-) exports, (+) imports, and (+/-) change in stocks. Table 7 represents the Per capita net availability of food grains in India in terms of grams per day (Table 7). In 1950-51, the per capita availability of food grains was 394.9 grams, which improved to 468.8 grams in 1970-71. However, the same dipped to 454.8 grams in 1980-81. In terms of per capita availability, 1990-91 marked an unprecedented height by reaching the milestone of 510.1 grams with an increase in net availability by more than 12 percent. However, this increase was temporary and reversed to the previous levels the following year. In 2020-21 and 2021-22 (P), we reached the level observed in 1990-91. While we are limiting our approach to food grain security as identical to food security, there is a shifting trend in per capita food availability towards high-value horticultural crops and animal-based products from food grain products, particularly coarse cereals, as people realize the need for a nutritive and diversified diet.

Table 7: Per capita net availability of food grains (per day) in India

(Grams per day)

Year	Rice	Wheat	Other Cereals	Total Cereals	Pulses	Food grains
1950-51	158.9	65.7	109.6	334.2	60.7	394.9
1960-61	201.1	79.1	119.5	399.7	69.0	468.7
1970-71	192.6	103.6	121.4	417.6	51.2	468.8
1980-81	197.8	129.6	89.9	417.3	37.5	454.8

1990-91	221.7	166.8	80.0	468.5	41.6	510.1
2000-01	190.5	135.8	56.2	386.2	30.0	416.2
2010-11	181.6	163.6	65.5	410.7	43.0	468.2
2020-21	200.9	183.5	82.8	467.2	44.5	511.7
2021-22 (P)	190.5	188.6	81.6	460.8	53.8	514.6

P: Figures are based on 4th Advance Estimates of production for 2021-22 (as on 17.08.2022)

Total Cereals include rice, wheat, and other cereals.

Pulses include all Kharif and Rabi Pulses

Food grains include rice, wheat, other cereals, and pulses.

Monthly per capita consumption of food of rural and urban population in India

Table 8: Change in monthly per capita consumption of food commodities in India over NSS Rounds

(per capita/month)										
Year/ NSSO Rounds	Rice	Wheat	Total Cereals	Total Pulses	Total Edible oils	Vegetables	Milk (litre)	Egg (No.)	Fish (kg)	Chicken (Kg)
Rural										
1993-1994(50 th)	6.79	4.32	13.40	0.76	0.37	2.71	3.94	0.64	0.18	0.02
2004-2005(61 st)	6.38	4.19	12.12	0.71	0.48	2.92	3.87	1.01	0.20	0.05
2009-2010(66 th)	6.00	4.24	11.35	0.65	0.64	4.04	4.12	1.73	0.27	0.12
2011-2012(68 th)	5.98	4.29	11.22	0.78	0.67	6.76	4.33	1.94	0.27	0.18
Urban										
1993-1994(50 th)	5.13	4.44	10.60	0.86	0.56	2.91	4.89	1.48	0.20	0.09
2004-2005(61 st)	4.71	4.36	9.94	0.82	0.66	3.17	5.11	1.72	0.20	0.09
2009-2010(66 th)	4.52	4.08	9.37	0.79	0.82	4.12	5.36	2.67	0.24	0.18
2011-2012(68 th)	4.49	4.01	9.28	0.90	0.85	6.84	5.42	3.18	0.25	0.24

Table 8 depicts the change in monthly per capita consumption of food consumption by rural and urban populations in India in India during the period 1993-94 to 2011-12 based on the National Sample Survey Report. Rice accounts for a major share of the per capita monthly consumption of all cereal crops. The data suggests that there has been a decline in the monthly consumption of cereals over the period. The monthly per-capita consumption of cereals declined from 13.40 kg to about 11.22 kg in the rural population. At the same time, there was a steady and marginal decline in the urban population, i.e., from 10.6 to 9.28 kg per month during the same period. Monthly consumption of pulses reported a very stagnant proportion, with around 0.8 kg per month and 0.9 kg per month in the rural and urban populations, respectively.

There has been a notable change in the monthly consumption of edible oils, vegetables, milk, eggs, and chicken. Monthly consumption of edible oils increased from 0.37 to 0.67 kg per month in the rural population, and 0.56 to 0.85 kg in the urban population, and vegetable consumption increased from 2.71 to 6.76 kg and 2.91 to 6.84 kg in rural and urban populations, respectively), eggs monthly consumption (0.64 to 1.94 numbers per month and 1.48 to 3.18 numbers per month in rural and urban population, respectively), monthly fish consumption (0.18 to 0.27 kg and 0.20 to 0.25 kg in rural and urban

population, respectively) and chicken (0.02 to 0.18 kg per month and 0.09 to 0.24 kg per month in rural and urban population, respectively) during the period from 1993-94 and 2011-12. It was observed that monthly per-capita consumption of all the food commodities was comparatively higher in urban than in the rural population, except cereal crops. This clearly portrays the change in dietary preferences of the Indian population over the past few decades.

Change in average per capita intake of calories, protein, and fats.

The change in average per capita intake of calories, protein, and fat per day for both the rural and urban population based on the published reports of different NSSO rounds (27th, 38th, 50th, 55th, 61st, 66th (Schedule 1 & 2) and 68th (Schedule 1 & 2)) are presented in Table 9. The data suggests that there has been a decreasing trend in the average per capita intake of calories and protein per day. In contrast, the per capita fat intake for rural and urban populations witnessed an increasing trend. The data shows that from 1972-73 (27th NSSO Round) to 2011-12 (68th Round Schedule 2), the per-capita intake of calories had decreased from 2266 to 2233 kcal per day in rural areas and from 2107 to 2206 kcal per day in urban areas of the nation. Protein intake, considered a vital component in the Indian diet

for catalysing body nutrients, has witnessed a marginal fall in rural areas from 62 to 60.7 grams per day. At the same time, it was comparatively stagnant in the case of urban areas (i.e. 56 grams per day in 1972-73 to 55.7 grams per day in Schedule 1 of 68th Round with a slight increment recorded in Schedule 2 with an intake of 60.3 gm per day. The fat intake shows an increasing trend (24 to 46 gm per day in rural and 36 to 58 gm per day in urban areas) from 1972-73 to 2011-12 (Schedule 2). The table concludes that India's average per capita calorie and protein intake has recorded moderate growth in rural areas compared to urban areas, while the per capita fat intake has recorded an increment in both rural and urban areas taken into consideration. There has also been a decline in the proportionate share of household expenditure on cereals from 18 percent and 10.1 percent in 2004-05 to 10.7 percent and 6.6 percent in 2011-12 in rural and urban India, respectively [24].

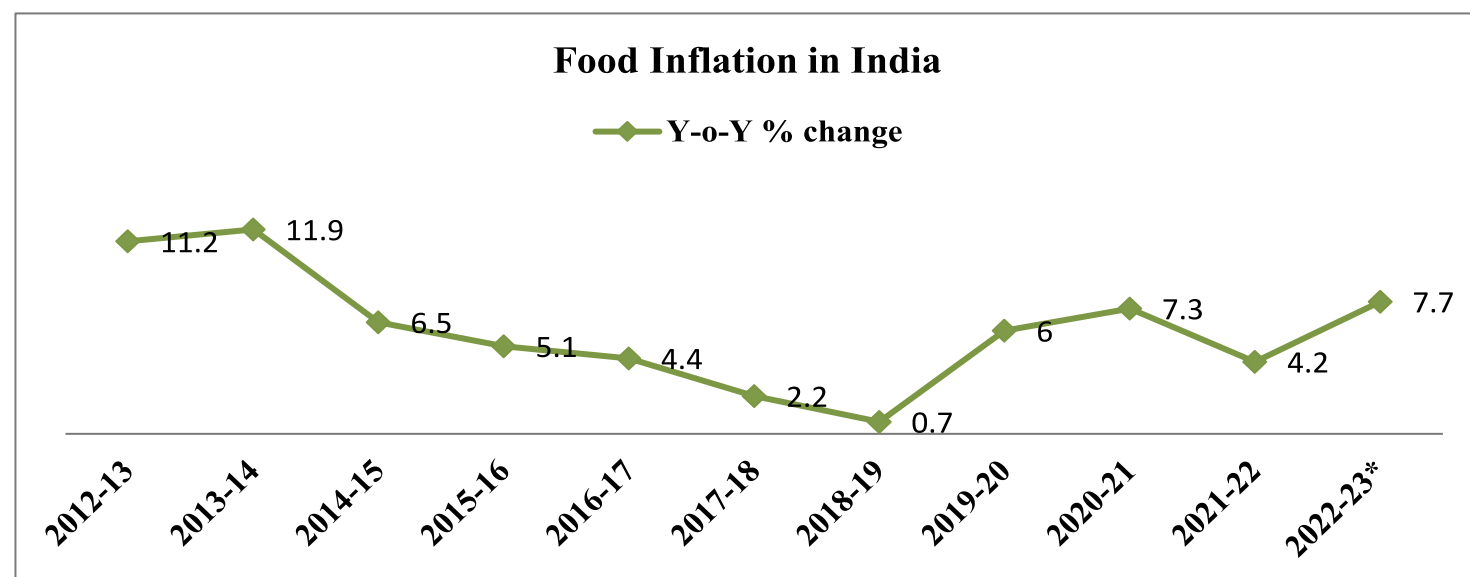
Table 9: Change in average per capita intake of calories, protein, and fats per day over NSS rounds

NSSO Rounds	Calorie Intake (Kcal)		Protein Intake (gm)		Fats (gm)	
	Rural	Urban	Rural	Urban	Rural	Urban
1972-1973 (27 th)	2266	2107	62.0	56.0	24.0	36.0
1983-1984 (38 th)	2221	2089	62.0	57.0	27.0	37.0
1993-1994 (50 th)	2153	2071	60.2	57.2	31.4	42.0
1999-2000 (55 th)	2149	2156	59.1	58.5	36.1	49.6
2004-2005 (61 st)	2047	2020	57.0	57.0	35.5	47.5
2009-2010 (66 th Round) Schedule 1	2020	1946	55.0	53.5	38.3	47.9
2009-2010 (66 th Round) Schedule 2	2147	2123	59.3	58.8	43.1	53.0
2011-2012 (68 th Round) Schedule 1	2099	2058	56.5	55.7	41.6	52.5
2011-2012 (68 th Round) Schedule 2	2233	2206	60.7	60.3	46.1	58.0

2. Food Accessibility

Food Inflation

Achieving self-sufficiency in food production and the mere availability of food in the nation does not determine universal access to food. It is the purchasing power of a household that determines its economic access to sufficient food. In this regard, food inflation is an important indicator of economic access to food from the perspective of nutrition and food security. With the increase in the price level of food commodities, it becomes unaffordable and inaccessible for the vulnerable section of society to have easy food access, pushing them below the average standard of living. In September 2022, double-digit inflation was recorded in cereals, vegetables, and spices with the percentage share of 11.53 percent, 18.05 percent, and 16.88 percent, respectively, which indicates hindrance in food accessibility by the vulnerable. It has been reported that a one percent increase in food inflation leads to an increase of 0.3 percent in infant and child mortalities and 0.5 percent in undernourishment [26].



(2022-23*: April to September 2022)

Fig. 1: Percentage change in Year to Year (Y-o-Y) Food inflation in India over the past ten years (2012-13 to 2022-23*)

Table 10 represents the average annual food inflation based on Consumer Price Index-Combined (CPI-C). During FY2022, India witnessed comparatively lower CPI-C-based food inflation during the study period. While in FY 2023, food inflation ranged from 4.2 percent to 8.6 percent between April and December 2022, with an overall food inflation rate of 7.0 percent. The data shows that although food inflation is a broad spectrum, the major contributor in this spectrum during the study period includes cereals and their products, vegetables, milk and its products and spices. Because of the supply disruption and crop damage due to erratic rainfall in major vegetable-producing states, there was a spike in the price level of vegetables. Inflation in edible oils surged due to the global production shortfall, leading to an increase in global price stress. However, the rise in the price of edible oil was subdued due to the rationalization of

tariffs and the imposition of stock limits. Regarding the global competition in the spice export basket, annual inflation has remarkably increased from FY 2020 to FY 2023.

The government has also been taking regulatory measures to control inflation. For instance, to control the soaring prices of wheat and rice, exporting wheat products with Harmonised System (HS) Code 1101 was prohibited, and export duty was imposed on rice. In order to insulate vulnerable sections of society against inflation, a new integrated food security scheme, "Pradhan Mantri Garib Kalyan Ann Yojana", was launched this year on 1st January 2023. This scheme aims to provide 5 kg of free food grains per month to the poor in addition to the subsidized (₹ 2-3 per kg) ration provided under the National Food Security Act (NFSA) to families covered under the Public Distribution System (PDS).

Table 10: Average annual food inflation based on CPI-Combined (per cent) (base year: 2011-12=100)

Groups/Subgroups	FY2020	FY2021	FY2022	FY2023*
Cereals and products	2.8	3.8	0.5	9.3
Pulses and products	9.9	16.4	6.0	1.8
Fruits	0.7	2.6	6.2	4.4
Vegetables	21.3	5.8	-7.2	7.6
Spices	4.4	10.9	5.3	14.9
Oil and Fats	2.9	5.4	2.8	6.8
Milk and Products	2.9	5.4	2.8	6.8
Egg	4.5	12.9	7.6	-1.0
Meat and Fish	9.3	15.4	7.9	4.7
Sugar and confectionery	0.8	2.5	2.3	2.7
Food Inflation	6.7	7.7	3.8	7.0

A study carried out by the RBI reports that a "One percent increase in prices across all the countries and sectors due to global inflation shock could increase inflation in India by around 63 basis points through second-round effects comprising domestic indirect effects (46 basis points) and global spill overs (17 basis points), in addition to the direct impact of 100 basis points".

Table 11: Average Annual Wholesale Food Inflation based on WPI (percent) (Base: 2011-12=100)

Groups/ Subgroups	FY 2020	FY 2021	FY 2022	FY 2023*
Food Articles	8.4	3.1	4.1	8.3
Cereals	7.5	-2.6	1.6	10.7
Pulses	15.9	11.6	6.9	0.0
Fruits	3.2	1.4	11.3	10.4
Vegetables	31.2	3.4	0.4	13.2
Food Products	4.1	5.6	11.7	6.0
Edible Oils	1.4	20.3	30.5	1.4
Food Inflation (Food articles + Food products)	6.9	3.9	6.8	7.5

Wholesale Price Index (WPI)-based on annual food inflation, was also worked to get a broad picture of food inflation in India. The average annual Wholesale Food Inflation based on WPI is presented in Table 11. The result shows that WPI remained low during the Covid-19 pandemic phase, and as the economy revived post-pandemic, it started to gain momentum. The Russia-Ukraine conflict further exacerbated the inflation rate as the global supply chains were disturbed due to a lack of free movement. Prices of food commodities with maximum exposure to global price levels led to an increment in the domestic WPI food inflation, which stayed at 7.5 percent against 6.9 percent in FY20. Cereals and vegetables were the major contributors to food inflation owing to erratic climatic conditions. The rising global price of edible oils and import dependency increased the domestic price of these products leading to inflation.

Government Initiatives in food accessibility

The government of India has also been proactive in ensuring access to food for its citizen. The current budget (2022-23) allocated about 5.2 percent of its total budget to the country's food subsidy programme. The Public Distribution System (PDS), one of the country's crucial welfare programs, aims to provide affordable food grains and protect farmers against low market prices. National Food Security Act, 2013 (NFSA) covers about 75 percent of the rural population and 50 percent of the urban population, marking a paradigm shift in the approach to food security from welfare to a rights-based approach through different schemes.

Antyodaya Anna Yojana (AAY): AAY comprises of the poorest of-the-poor, and the beneficiaries are entitled to receive 35 kg of food grains per household per month.

Priority Households (PHH): Beneficiaries under PPH are entitled to receive 5 kg of food grains per person per month.

Anganwadi system under the Integrated Child Development Scheme (ICDS): This aims to provide rations to pregnant and lactating women.

Pradhan Mantri Garib Kalyan Anna Yojana (PMGKAY): Under this scheme, registered families are entitled to 5 kg of free food grains per month in addition to the subsidized ration provided under the Public Distribution System (PDS).

Pradhan Mantri Poshan Shakti Nirman Yojana (PM-POSHAN Scheme): Under this, one hot cooked meal in Government and Government - aided Schools will be provided with a broad vision to provide free food for 5 years to crores of children of government schools across the nation to eradicate malnutrition and also encourage school attendance.

Table 12 represents the category-wise rice and wheat allocated under NFSA/TPDS for FY 2022-23 up to 07.03.2023. Under different schemes of NFSA/TPDS, 595.49 lakh tonnes of rice and wheat have been allocated with a major share of rice, i.e., 67 percent of the total allocation. However, these food distribution programs mainly focus on providing adequate calories rather than nutrition. As a result, many people in India suffer from the problem of hidden hunger (chronic micronutrient deficiency), where a person may have access to sufficient calories but lacks adequate micronutrients (George and McKay, 2019).

Table 12: Category-wise Rice and Wheat under NFSA/TPDS (2022-2023*)

(Quantity in Lakh Tonne)			
NFSA/TPDS Allocation	Rice	Wheat	Total
Antyodaya Anna Yojana (AAY)	71.05	28.67	99.72
Priority Household (PHH)	272.94	146.06	419.0
TPDS (Tide Over)	20.87	5.53	26.40
PM Poshan (MDM)	23.05	4.36	27.41
WBNP (ICDS)	11.66	11.30	22.96
Total	399.57	195.92	595.49

(2022-23*: Up to 07.03.2023)

3. Food Utilization

Food utilization refers to "the proper biological use of food requiring a diet providing sufficient energy and essential nutrients, potable water, and adequate sanitation". This is coupled with proper knowledge of basic nutrition principles, food storage, and childcare. Optimal nutrition and improvement of nutritional deficiencies during the early years are of particular significance as beyond 2 years of age; a reversal may become very difficult. Malnutrition is one of the important themes of SDG 2 concentrates on ending all forms of malnutrition (i.e., "deficiencies or excesses in nutrient intake, imbalance of essential nutrients or impaired nutrient utilization") by 2030. It addresses the agricultural productivity and income of small-scale farmers. Three major nutrition indicators, viz. stunting, wasting, and underweight among children on the NFHS data, are analyzed to understand the utilization dimension. Changes in the state-wise pattern of these indicators between 2005-2006 and 2019-21 have been presented in Table 13, Table 14, and Table 15.

Stunting

Stunting is "the impaired growth and development children experience from poor nutrition, repeated infection, and inadequate psychosocial stimulation". Children are stunted if the "height-for-age" is more than two standard deviations below the WHO Child Growth Standards median. Stunting results in major consequences such as poor perception, low productivity and educational performance, and low adult wages and sometimes leads to an increased risk of chronic diseases in adulthood. The data presented in Table 13 shows that India has witnessed a declining trend in child stunting from 48 percent in 2006 to 35.5 percent in 2019-20, i.e., relative decrease in stunting by around 15 percent. However, on a global scale, India accounts for nearly a third of the global burden of childhood stunting, with the majority lying in rural areas (37.3 percent) compared to urban areas (30.1 percent). During 2019-20, in terms of geographical distribution, Meghalaya (46.5 percent), Bihar (42.9 per cent), Uttar Pradesh (39.7 percent), and Jharkhand (39.6 percent) have extremely high rates of stunting, while Sikkim and Pondicherry showed least stunting rate with 22.3 per cent and 20 per cent, respectively.

Table 13: Change in Nutritional Indicators of children (Stunted) (< 5 years) of India by state-wise.

(In percent)

Sl. No.	State/UT	Stunted		
		NFHS-3	NFHS-4	NFHS-5
1	A & N Islands	N/A	23.00	22.50
2	Andhra Pradesh	42.70	31.00	31.20
3	Arunachal Pradesh	43.30	29.00	N/A
4	Assam	46.50	36.00	35.30
5	Bihar	55.60	48.00	42.90
6	Chandigarh	N/A	29.00	N/A
7	Chhattisgarh	52.90	38.00	N/A
8	Dadra and Nagar Haveli	N/A	42.00	39.40
9	Daman & Diu	N/A	23.00	N/A
10	Delhi	42.20	32.00	N/A
11	Goa	25.60	20.00	25.80
12	Gujarat	51.70	39.00	39.00
13	Haryana	45.70	34.00	N/A
14	Himachal Pradesh	38.60	26.00	30.80
15	Jammu & Kashmir	35.00	27.00	26.90
16	Jharkhand	49.80	45.00	39.60
17	Karnataka	43.70	36.00	35.40
18	Kerala	24.50	20.00	23.40
19	Lakshadweep	N/A	27.00	32.00
20	Madhya Pradesh	50.00	42.00	N/A
21	Maharashtra	46.30	34.00	35.20
22	Manipur	35.60	29.00	23.40
23	Meghalaya	55.10	44.00	46.50
24	Mizoram	39.80	28.00	28.90
25	Nagaland	38.80	29.00	32.70
26	Odisha	45.00	34.00	N/A
27	Pondicherry	N/A	24.00	20.00
28	Punjab	36.70	26.00	N/A
29	Rajasthan	43.70	39.00	N/A
30	Sikkim	38.30	30.00	22.30
31	Tamil Nadu	30.90	27.00	N/A
32	Telangana	N/A	28.00	33.10
33	Tripura	35.70	24.00	32.30
34	Uttar Pradesh	56.80	46.00	39.70
35	Uttarakhand	44.40	34.00	N/A
36	West Bengal	44.60	32.50	33.80
	India	48.00	38.40	35.50

(N/A: Not applicable or not assorted or not available)

Table 13 shows that states like Madhya Pradesh, Uttar Pradesh, and Uttarakhand have reported a decline in stunting by at least six percentage points. Rajasthan has recorded a decline of 7.3 percent. Besides, the reversal in progress was observed in West Bengal, with a rise in stunting from 32.5 in 2015-16 to 33.8 in 2019-20. In order to overcome the challenges associated with stunting, it is imperative to push for the convergence of health and nutrition programs right from pregnancy until the child reaches five years of age.

Wasting

The next important nutrition indicator, wasting, is "low weight for height". It usually occurs when an individual has food of inadequate quality and quantity characterized by a monotonous diet with low nutrient density, inadequate caring and feeding practices, lack of sanitary facilities, and exposure to frequent or prolonged illnesses. In 2012, the World Health Assembly endorsed a

Comprehensive implementation plan to reduce and maintain childhood waste to less than 5 percent in India by 2025. Table 14 shows that Maharashtra has the highest proportion of wasted children (25.6 percent). At the same time, Nagaland has witnessed the maximum increment (i.e., from 11.3 percent to 19.1 percent) during the study period. At all India levels, wasting has decreased from 19.80 percent in 2005-06 to 19.30 in 2019-20. The percentage share of children affected with severe wasting at the all-India level ranges from 7.6 to 7.7 per cent.

Table 14: Change in Nutritional Indicators of children (Wasted) (< 5 years) of India by state-wise.

(In percent)

Sl. No.	State/UT	Wasted		
		NFHS-3	NFHS-4	NFHS-5
1	A & N Islands	N/A	18.90	16.00
2	Andhra Pradesh	12.20	17.20	16.10
3	Arunachal Pradesh	15.30	17.30	N/A
4	Assam	13.70	17.00	21.70
5	Bihar	27.10	20.80	22.90
6	Chandigarh	N/A	10.90	N/A
7	Chhattisgarh	19.50	23.10	N/A
8	Dadra and Nagar Haveli	N/A	27.60	21.20
9	Daman & Diu	N/A	24.10	N/A
10	Delhi	15.40	15.90	N/A
11	Goa	14.10	21.90	19.10
12	Gujarat	18.70	26.40	25.10
13	Haryana	19.10	21.20	N/A
14	Himachal Pradesh	19.30	13.70	17.40
15	Jammu & Kashmir	14.80	12.10	19.00
16	Jharkhand	32.30	29.00	N/A
17	Karnataka	17.60	26.10	19.50
18	Kerala	15.90	15.70	15.80
19	Lakshadweep	N/A	13.70	17.40
20	Madhya Pradesh	35.00	25.80	N/A
21	Maharashtra	16.50	25.60	25.60
22	Manipur	9.00	6.80	9.90
23	Meghalaya	30.70	15.30	12.10
24	Mizoram	9.00	6.10	9.80
25	Nagaland	13.30	11.30	19.10
26	Odisha	19.50	20.40	N/A
27	Pondicherry	N/A	23.60	N/A
28	Punjab	9.20	15.60	N/A
29	Rajasthan	20.40	23.00	N/A
30	Sikkim	9.70	14.20	13.70
31	Tamil Nadu	22.20	19.7	N/A
32	Telangana	N/A	18.00	21.70
33	Tripura	24.60	16.80	18.20
34	Uttar Pradesh	14.80	17.90	N/A
35	Uttarakhand	18.80	19.50	N/A
36	West Bengal	16.90	20.30	20.30
	India	19.80	21.00	19.30

(N/A: Not applicable or not assorted or not available)

Underweight

The third nutrition indicator selected for the study is underweight. As weight is easy to measure, it is considered a widely practiced instrument. The prevalence of underweight children in India is the highest among lower or middle-income countries worldwide. At an all-India level, there has been an improvement as the underweight proportion has reduced from 35.8 percent to 32.1 percent, with

the highest levels observed in Bihar (41 per cent) followed by Gujarat (39.70 percent), Jharkhand (39.40 percent), Dadra & Nagar Haveli (38.7 per cent) and Maharashtra (36.1 per cent) (Table 15). Altogether, the major drivers of food insecurity and malnutrition can be intensified by transforming the Agri-food systems, aiming at the most cost-effective and efficient use of limited resources in ways that contribute to making healthy diets more affordable for all.

Table 15: Change in Nutritional Indicators of children (Underweight) (< 5 years) of India by state-wise.

(In percent)

Sl. No.	State/UT	Underweight		
		NFHS-3	NFHS-4	NFHS-5
1	A & N Islands	N/A	21.50	23.70
2	Andhra Pradesh	32.50	31.90	29.60
3	Arunachal Pradesh	32.50	19.40	N/A
4	Assam	36.40	29.80	32.80
5	Bihar	55.90	43.90	41.00
6	Chandigarh	N/A	24.50	N/A
7	Chhattisgarh	47.10	37.70	N/A
8	Dadra and Nagar Haveli	N/A	38.80	38.70
9	Daman & Diu	N/A	26.70	N/A
10	Delhi	26.10	27.00	N/A
11	Goa	25.00	23.80	24.00
12	Gujarat	44.60	39.30	39.70
13	Haryana	39.60	29.40	N/A
14	Himachal Pradesh	36.50	21.20	25.50
15	Jammu & Kashmir	25.60	16.60	21.00
16	Jharkhand	56.50	47.80	39.40
17	Karnataka	37.60	35.20	32.90
18	Kerala	22.90	16.10	19.70
19	Lakshadweep	N/A	23.60	25.80
20	Madhya Pradesh	60.00	42.80	N/A
21	Maharashtra	37.00	36.00	36.10
22	Manipur	22.10	13.80	13.30
23	Meghalaya	48.80	28.90	26.60
24	Mizoram	19.90	12.00	12.70
25	Nagaland	25.20	16.70	26.90
26	Odisha	40.70	34.40	N/A
27	Pondicherry	N/A	22.00	N/A
28	Punjab	24.90	21.60	N/A
29	Rajasthan	39.90	36.70	N/A
30	Sikkim	19.70	14.20	13.10
31	Tamil Nadu	29.80	23.80	N/A
32	Telangana	N/A	28.30	31.80
33	Tripura	39.60	24.10	25.60
34	Uttar Pradesh	42.40	39.50	N/A
35	Uttarakhand	38.00	26.60	N/A
36	West Bengal	38.70	31.50	32.20
	India	42.50	35.80	32.10

(N/A: Not applicable or not assorted or not available)

Nutritional Status of Adults

In the case of adults, two major causes of concern regarding nutrition include being overweight and obesity and anaemia. The study reflected that only few states/UTs like A & N Island, Andhra Pradesh, Dadra Nagar Haveli, Himachal Pradesh, Lakshadweep, and Meghalaya registered a decrease in anaemic condition of women of the productive age group (15-49 years) in NFHS-5 over NFHS-4. Overweight and obesity are noticed accelerating in almost all states, both in the case of men and women, during the period under investigation.

4. Food Stability

Food Stability describes the "temporal dimension of food security and ensures that the food supply at household level remains more or less constant during the year and in the long-term". In order to ensure food stability, there is an urgent need to develop a coping mechanism and timely interventions to minimize external risks such as climate change, natural disasters, price volatility, and conflicts. Taking into consideration all the past events that disrupted the stability aspect of food security, two major events in the present time are COVID-19 and the Russia-Ukraine War. The unequal pattern of economic recovery post-pandemic has worsened the food security situation for the populations already struggling the most to feed their families. All these disruptions have also resulted in increased food prices due to bottlenecks in supply chains, soaring transport costs, and other factors. Furthermore, the war in Ukraine, involving two of the biggest agricultural producers, affected the global food grain, fertilizer, and energy prices, leading to shortages and even higher inflation. On top of this, the growing frequency and intensity of extreme climate events are proving to be a major disrupter of supply chains, especially in low-income countries (LICs).

COVID-19

There have been major disruptions to food supply chains in the wake of lockdown measures, which have affected the availability, accessibility, and utilization of food [5]. The closure of restaurants and other food service facilities led to a sharp decline in demand for various perishable commodities such as dairy products, potatoes, fresh fruits, and specially goods such as chocolate and high-value meat [36]. With the onset of lockdown in different parts of the nation, due to a fall in demand and challenges in delivering these supplies to markets, several food commodities were being abandoned or ploughed back into the fields. Farmers who lacked proper cold storage facilities found themselves with excess produce that they could not sell. Due to the pandemic, vulnerable sections of society switched their expenditure from fresh produce with high micronutrient content to less nutrient-rich staple foods. Also, at this time, various

community-based nutrition programs and hands-on training for pregnant and breastfeeding mothers were disturbed, which worsened the food security dimensions of the nation. The only measure of assistance proposed as part of the "stimulus package" was the provision of free food grains to the approximately 8 crore migrants stuck by the lockdown for two months. Nevertheless, none of these relief efforts is considered adequate to lessen the pandemic's detrimental effects on food availability.

Russia-Ukraine War

War results in significant economic upheaval and food shortages, endangering the ability of entire people to survive. The ongoing turmoil brought on by the current Russia-Ukraine conflict, with all the potential effects, created pressure on prices and supply chains. Around 30 percent of the globally traded wheat and 12 percent of its calories are produced in Russia and Ukraine [38], and also Russia supplies a large proportion of fertilizer globally [11]. As a result of this conflict, the export of wheat, maize, and barley from these nations has been severely hampered, and ultimately, the cost of food and fertilizer has dramatically skyrocketed [12]. Due to the sharp increase in global food prices, maintaining food stability will become increasingly challenging.

Determinants of nutrition

The proportion of undernourished in the total population.

India ranked 101st in the Global hunger index among 116 countries in 2021. In 2020 with a GHI score of 27.5, the rank was 94th out of 107 countries with a GHI score of 27.2. The percentage of the undernourished population was in the downward direction and was estimated to be about 14% in 2020; to it went up in 2021 to 15.3% population, resulting in a lower rank. The reason may be faulty implementation of nutritional programs, improper monitoring systems, and poor performance of larger states in tackling the nutritional program may be the other reason behind the lower ranking in GHI. The percentage prevalence of undernourishment is depicted in Fig. 2.

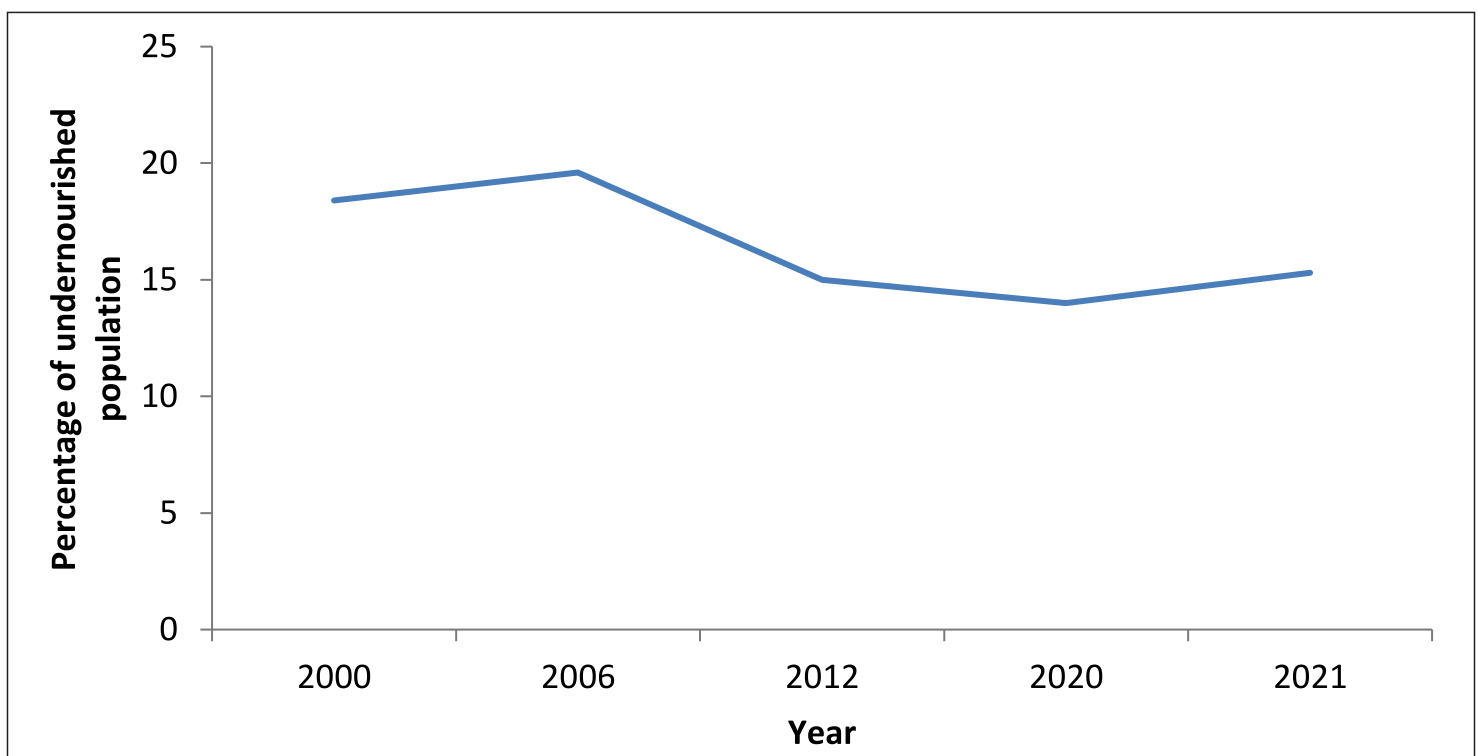


Fig. 2. Proportion of under-nourished population in the Total population of India

Table 16: Trend in the nutrition status of children under five years of age in India

(Percent)			
Year	Wasting	Stunting	Mortality rate
2000	17.1	54.2	9.2
2006	20.0	47.8	7.1
2012	15.1	38.7	5.2
2020	17.3	34.7	3.7
2021	17.3	34.7	3.4

A perusal of Fig.2 indicated that despite having self-sufficiency in food production, 153% of the total population still could not get minimum level dietary consumption, i.e., intake of food was found insufficient to meet dietary energy requirements at the national level. It was further revealed from Table 16 that wasting and stunting were estimated to be 17.5% and 34.7%, caused by the absence of the required nutritional level of food. The mortality rate of children under five registered a declining trend, i.e., 3.4% in 2021, indicating the development of healthcare facilities provided by the government and different health awareness programs launched by UNICEF in the country. The other reason may be that Swachha Bharat Abhiyan was launched in the nation, which uplifted the hygienic condition, particularly in rural areas.

Poverty rate

Right from independence, poverty eradication has remained the main focal point in the nation's development agenda. Poverty is related to food security as poverty is defined as the condition a household or an individual cannot afford his basic living needs due to financial resource scarcity. Food security may not be ensured without overcoming poverty and creating a just and equitable society. The conventional method used to measure poverty is the poverty line, specified as the minimum expenditure or income required to purchase a basket of goods and services necessary to fulfil basic human needs.

Table 17: Percentage population below the poverty line

2004-05			2009-10			2011-12		
Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
42.0	25.5	37.2	33.8	20.9	29.8	25.7	13.7	21.9

Source: NITI Aayog (erstwhile Planning Commission)

The last estimate available is for 2011-12 (Table 17), which was estimated using the Tendulkar Committee approach. The Sustainable Development Goal (SDG-2) report of NITI Aayog referred to the poverty line of 21.9 % estimated in 2011-12 as the official poverty line. Interestingly, Global MPI Reports 2019 and 2020 show India's poverty line for 2011-12 as 21.2% (2011-12), based on World Bank's 1.90\$ poverty line for extreme poverty, which is quite close to the Tendulkar Committee-based Poverty line.

A perusal of the table indicated a gradual decline in the percentage population below the poverty line. It was estimated at 37.2% in 2004-05, down to 29.8% in 2009-10, and further reduced to 21.2% in 2011-12. Rural and urban proportions of poverty revealed that in rural population prevalence of poverty is comparatively more than that of urban areas indicating rural people are more deprived of basic amenities like food, sanitary, and health care facilities. In 2015 a Task Force set up by NITI Aayog on poverty recommended the need for a poverty line or poverty ratio for three potential reasons: identification of the poor, allocation of expenditure on anti-poverty programs across states, and tracking poverty over time in different states and Union territories. Allocation of expenditure is made for a universal programs like poverty alleviation programs, Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) and Sarva Shiksha Abhiyan (SSA) for combating poverty and uplifting the living standard of the people.

It is a well-accepted fact that multi-dimensional approaches are needed to tackle poverty not only in India but across the global

level. Many international institutions have advocated transformational changes in reducing poverty in India on the front income and the reduction of chronic malnutrition and poverty. This performance of organizations in the recent year has attracted global attention. Among the 17 agendas set by World Bank for Sustainable Development, India has put two "ending poverty in all forms and hunger" in its main policy frame and moving towards reducing at least half the proportion of men, women, and children of all ages living in poverty in all its dimensions by 2030. India has taken many reformative steps to eliminate poverty by facilitating income growth for the economically disadvantaged by developing agriculture infrastructure and support services, creating productive assets, and developing skills and entrepreneurship. Various Social protection policies and interventions such as food security, housing for all with basic amenities, education for all, universal health coverage, road connectivity, livelihood diversification, skill development, etc., are taken up nationwide. Pradhan Mantri Jan Dhan Yojana was launched to ensure financial inclusion by providing universal access to banking facilities and credit and insurance coverage. On the health care front Pradhan Mantri Jan Arogya Yojana (PMJAY), popularly known as Ayushman Bharat Yojana Scheme, aims to provide universal health protection to poor and vulnerable populations, provision of subsidized LPG, electricity, drinking water, toilet, etc. are some of the mega developmental programs for narrowing deprivation gap (Gaur and Rao,2020).

Conclusion

From the ongoing discussion, it can be concluded that India's development story is considered a conundrum. Recent economic developments have not matched the parallel development in the food security front of the nation. The Second Sustainable Development Goal agenda, 'zero hunger by 2030', was set in 2015 by United Nations. India ranked 101st in the Global hunger index among 116 countries in 2021. It was ranked 94th in the Global hunger index among 107 countries in 2020 and 2019, 102nd out of 117 countries. The percentage of the undernourished population was recorded in the downward direction, but still, 14% population is facing undernourishment, resulting in a lower rank in the hunger index. The findings of the study further revealed 17.5% and 34.7% wasting and stunting among children under five years of age, which were caused by the absence of the required nutritional level of food. The mortality rate of children under five registered a declining trend, i.e. from 5.2% in 2012 to 3.7% in 2020. Sustainable Development Goal (SDG-2) report of NITI Aayog referred to the poverty line of 21.9 % estimated in 2011-12 as the official poverty line.

Interestingly, Global MPI Reports 2019 and 2020 also showed India's poverty line for 2011-12 as 21.2% (2011- 12), based on World Bank's 1.90\$ poverty line for extreme poverty. The study indicated a gradual decline in the percentage population below the poverty line, from 37.2% in 2004-05 to 29.8% in 2009-10 and further reduced to 21.2% in 2011-12. Rural and urban proportions of poverty revealed that in the rural population prevalence of poverty was recorded comparatively more than that of urban, indicating rural people are more deprived of basic amenities like food, sanitary, and health care facilities in India.

Agriculture and food and nutrition security are interlinked. Without sustainable agriculture and allied sector development, zero hunger by 2030 cannot be achieved. The arable land, water resources, and soil fertility are continuously declining with the increase in population and on account of climatic changes. Despite this, India recorded positive growth in agricultural and allied sectors even during the pandemic when all other sectors of the economy registered decline; the agriculture and allied sector registered a boost of 3.4% during 2020 when the lockdown was imposed not only at the national level but on a global level to prevent the spread of the pandemic.

The results of the analysis with respect to agricultural production revealed positive growth in the production of cereals, coarse cereals, pulses, fruits and vegetables, and livestock products such as milk, eggs, and meat during the period under investigation. India produced food items like cereals & millet, fruits, sugar, milk, and eggs much more than the nation's requirements except pulses, vegetables, and meat.

In India, the food-based safety nets favour staples like rice and wheat over maybe more nutrient-dense foods like coarse grains, pulses, fruits, and vegetables. If foods high in protein are not included in the household's food consumption basket, calorie adequacy cannot address the household's nutritional security. Food-based safety nets like PDS should offer a more varied food selection that includes staples that have been bio-fortified. This will allow recipients more freedom to choose their diet programs and encourage them to spend the cash award in accordance with their consumption needs. Moreover, shifting some of the wheat and rice subsidies to nutrient-dense foods can aid in lowering food poverty.

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References

1. Agricultural Statistics at a Glance (2021). Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, Govt. Of India, New Delhi.
2. Ahmad, N, Sinha DK and Singh KM. (2018). Growth and instability in pulses: A spatiotemporal analysis in eastern India. *Journal of AgriSearch* 5(1):67-76
3. Ahmad, N., Sinha, D.K. and Singh, K.M. (2018). Economic analysis of production and instability of lentil in major lentil growing states of India, *Int. J. Pure App. Biosci.* 6(1): 593-598. doi: <http://dx.doi.org/10.18782/2320-7051.6213>
4. Ahmad, Nasim, Sinha DK, Singh KM and Mishra R.R. (2018). Comparative production performance of vegetable crops in the country vis-à-vis Eastern India. *Vegetable Science.* 45(2): 238-243.
5. Barrett, Christopher B. (2020). Actions now can curb food systems fallout from COVID-19. *Nature Food.* 1:319-320
6. Ben Hassen, T.; El Bilali, H. (2022) Impacts of the Russia-Ukraine War on Global Food Security: Towards More Sustainable and Resilient Food Systems? *Foods*, 11, 2301. <https://doi.org/10.3390/foods11152301>.
7. Bhavani, RV and Rampal, Priya. (2018). Review of agriculture – nutrition linkages in South Asia. *CAB Reviews Perspective in Agriculture, Veterinary Science, Nutrition and Natural Resources.* 13(046): 1:19
8. Bouis HE (2000) Enrichment of food staples through plant breeding: a new strategy for fighting micronutrient malnutrition. *Nutrition* 16: 701–704
9. Choudhary K and Kundal R (2015) A study in the area, production, and productivity of tomatoes in India from 2002-2011. *Intl J Advance Res Comp Sci Manage Studies* 3(7): 90-94.
10. Claydon, Jen (2018). Global Nutrition Report 2018. Development Initiatives Poverty Research Limited, United Kingdom.
11. Elliot Smith, "Fertilizer prices are at record highs. Here's what that means for the global economy", CNBC, March 22, 2022. Available at: <https://www.cnbc.com/2022/03/22/fertilizer-prices-are-at-record-highs-heres-what-that-means.html>
12. F. Lin et al., (2023). The impact of Russia-Ukraine conflict on global food security, *Global Food Security* 36 (2023) 100661.
13. FAO (2007). Expert Consultation on Protein and Amino Acid Requirements in Human Nutrition (2002): Geneva, Switzerland), Food and Agriculture Organization of the United Nations, World Health Organization & United Nations University. (2007). Protein and amino acid requirements in human nutrition : report of a joint FAO/WHO/UNU expert consultation. World Health Organization.

14. FAO, (2019). India at a glance. Food and Agriculture Organization of the United Nations (FAO), Rome. Retrieved from: <https://www.fao.org/india/fao-in-india/india-ata-glance/en/>
15. Fears R, Cananles, C., Ter Meulen, V and Von Braun J. (2019). Transforming food systems to deliver healthy, sustainable diets – the view from the world's science academies. *Lancet Planet Health*. 3(4):163-165.
16. Gaur, Seema and Rao N Srinivasa (2020): Poverty measurement in India: A status update, Working Paper No. 1/2020, Ministry of Rural Development, Govt. Of India.
17. George, N. A., & McKay, F. H. (2019). The Public Distribution System and Food Security in India. *International journal of environmental research and public health*, 16(17): 3221-3235.
18. Gómez, Miguel I, Barrett, Christopher B., Raney, Terri, Pinstrup-Andersen, Per, Meerman, Janice, Croppenstedt, André, Carisma, Brian, and Thompson, Brian. (2013). "Post-green revolution food systems and the triple burden of malnutrition," *Food Policy*, Elsevier, vol. 42(C): 129-138.
19. Horticultural Statistics at a Glance (2017). Horticulture Statistics Division, Department of Agriculture Co-operation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. Of India, New Delhi.
20. Jones JM (2006) Grain-based foods and health cereals. *Cereal Foods World* 51:108–113
21. Jones PJH, Raeini-Sarjaz M, Ntanios FY, Vanstone CA, Feng JY, Parsons WE (2000) Modulation of plasma lipid levels and cholesterol kinetics by phytosterol versus phytosterol esters. *J Lipid Res* 41:697–705.
22. Kaur Kiran Deep, Jha Alok, Sabikhi Latha and Singh, A. K. (2014). Significance of coarse cereals in health and nutrition: a review, *J. Food Sci. Technol.* (August 2014) 51(8):1429–1441
23. Kumar, P, Mruthyunjaya and Dey, M. M. (2007). Long-term Changes in Indian Food Basket and Nutrition. *Economic & Political Weekly*. 42(35): 3567-72.
24. Kumari, Venna and Prasad, Rakesh Kumar. (2018). An analysis of Production and Consumption Pattern in India. *International Journal of Current Microbiology and Applied Sciences*. Special Issue-7: 3923-3931.
25. Meenakshi, J.V., (2016). Trends and Patterns in the Triple Burden of Malnutrition in India (Working Paper No. 256). New Delhi.
26. NABARD. (2022). Food and Nutritional Security in India: Changing the way to a robust Agri-food system, *NABARD Research Study -35*. Department of Economic Analysis and Research, National Bank for Agriculture and Rural Development, Mumbai.
27. NIN (2011). Dietary guidelines for Indians. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad. Oxfam (2020). Dignity Not Destitution. <https://www.oxfam.org.nz/wp-content/uploads/2020/04/Oxfam-Report-Dignity-not-Destitution.pdf>
28. NSSO (National Sample Survey Office). (2014). *Nutrition Intake Report 2011-12*, 68th Round. Ministry of Statistics and Program Implementation, Government of India, New Delhi.
29. NSSO (National Sample Survey Office). (2007). *Nutrition Intake Report 2004-05*. 61st Round. Ministry of Statistics and Program Implementation, Government of India, New Delhi.
30. NSSO (National Sample Survey Office). (2012). *Nutrition Intake Report 2011-12*, 66th Round. Ministry of Statistics and Program Implementation, Government of India, New Delhi.
31. Pillay, D.P.K. and Kumar Manoj T.K. (2018). Food Security in India: Evolution, efforts and Problems, Strategic Analysis, 4 2 : 6 , 5 9 5 - 6 1 1 . <https://doi.org/10.1080/09700161.2018.1560916>
32. Pingali, P, Aiyar, A., Abraham, M and Rahman, A (2019). Transforming Food Systems for a Rising India. Palgrave Studies in Agricultural Economics and Food Policy, ISBN 978-3-030-14408-1 ISBN 978-3-030-14409-8 (eBook). <https://doi.org/10.1007/978-3-030-14409-8>
33. Pingali, P. (2012). Green Revolution: impacts, limits, and the path ahead. *Proc. Natl. Acad. Sci.* 109(31):12302-12208. <http://dx.doi.org/10.1073/pnas.0912953109>.
34. Pingali, P. Sunder, N. (2017). Transitioning towards nutrition sensitive food system in developing countries: a review. *Annu. Rev. Resour. Econ.* 1-28. <http://dx.doi.org/10.1146/annurev-resource-100516-053552fothcoming>.
35. Rai KN, Gowda CLL, Reddy BVS, Sehgal S (2008) Adaptation and potential uses of sorghum and pearl millet in alternative and health foods. *Compr Rev Food Sci Food Saf* 7:340–352
36. Terazono, E., and Munshi, N. (2020). Choc waves: How coronavirus shook the cocoa market. *Financial Times*, July 30, 2020
37. Verma VK, Jha AK, Chaudhuri P, Singh BK and Roy A (2016) Comparative analysis of production and profitability of seasonal vegetable, tuber and spice crops under the mid-hills of Meghalaya. *Vegetable Science* 43(1): 87-90.
38. World Food Program, (2022) "Food security implications of the Ukraine conflict", March 2022, p. 8.