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Has India Achieved Food Security Triumph in the Last Decade?

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ABSTRACT- The aspect of food security in all its form has rightly received importance globally. According to FAO's Food Security and Nutrition in the World report about 193 million people in 53 countries experienced crisis food insecurity in 2021. Food security in individual as well as societal level is crucial for human development. A nation with sustained food secured citizen can help not only to establish the societal stability but also contribute to the future growth of the nation. With respect to the above background, this paper aims to measure annual growth rate and Compound Annual Growth Rate (CAGR) of Per Capita Availability of Food Grains, Rice, Wheat, Other cereals, Cereals, Gram and Pulses for the period 2010-2022 which may represent the food security in India in the last decade. The growth rates and CAGR statistics show that food grain supply is dynamic, affected by climate, agriculture, market demand, and policy. The greater CAGR for other cereals reflects stronger cultivation and availability. Rice and gram have lower CAGRs, indicating more constant but less aggressive growth. Resilience and adaptation in agricultural and food supply systems are needed to maintain availability and manage production and demand changes over years.

KEYWORDS- Food Security, Per-capita Food Availability, Food Grains, Human development, Sustained Growth

I. INTRODUCTION

The World Food Summit (WFS) and the Food and Agricultural Organization (FAO) came to the conclusion that food security may be a factor in ensuring that an active lifestyle is maintained. This is accomplished when all people at all times have access to adequate, safe, and nutritious food that satisfies their dietary and food preferences [1] . This access is both physical and economic. In addition, the fuel that our bodies need, in the form of energy, comes from the food and sustenance that we consume. According to NABARD (2022), nutritional deficiencies have long-term consequences not just for individuals but also for society as a whole. It was at the World Food Conference in the 1970s when the idea of food security was first introduced. At that time, it was defined as the guarantee of both the availability of food and the stability of its price. Consequently, this meant that there should be adequate supplies of fundamental foodstuffs all over the globe to enable a continuous growth in food consumption, even in the face of variations in both production and prices. With regard to the issue of food security, there are three essential factors to consider: the availability of food, the accessibility of food, and the digestibility of food. On the other hand, the principles of "chronic" and "transitory" food insecurity were first presented by the World Bank in their Poverty and Hunger Report from the year 1986. The first is associated with low earnings and structural poverty, while the second is associated with natural catastrophes, economic collapse, or wars. Both of these factors are connected to poverty. The growth of agriculture is one of the most important factors in improving food security since it will immediately increase both the production and availability of food. According to Swaminathan et al. (2014) [2], for there to be a guarantee of food security, there must be more than simply the availability of food resources.

Over the last several years, the Indian economy has been rising at an astounding pace, and it continues to be one of the nations with the fastest-growing economies in the world. India continues to struggle with challenges of poverty and food insecurity, despite the great achievements that have been made. Food is an essential component for human existence, growth, and maturation—it is a basic requirement.

There were 116 countries that were included in the Global Hunger Index for 2021, and India was ranked 101st out of those countries. The Food and Agriculture Organization claims that there was a thirty percent increase in the cost of food between the years 2020 and 2021. Although the Indian government has been working for a long time to ensure that families have access to nutritious food through programs such as the Public Distribution System and the National Food Security Act 2013, there are still pressing issues surrounding food security in India. These issues are caused by a number of factors, including a growing population, shifting weather patterns, and disruptions in global supply chains brought on by the conflict between Russia and Ukraine [3].

The Indian government took both long-term and short-term measures to combat the issue of food insecurity and hunger. It devised a long-term development plan in order to ensure that sufficient food production is maintained. In addition to these factors, selective market intervention and targeted distribution of subsidized food were shown to be effective in reducing hunger and food insecurity in the short term. As a result of the fact that non-food concerns such as clean water and sanitation also have an impact on nutritional status, resolving these issues may assist in transforming food security into excellent nutrition. One of the most

significant changes is the increase in grain output. On the other hand, since the middle of the 1960s, price assistance for farmers has been an important instrument for agricultural growth and food policy. Cereal minimum support prices are important instruments for implementing pricing policy. The provision of food subsidies and essential agricultural supplies to farmers at reasonable prices or via user fees is beneficial. Twenty-five agricultural items, including cereals, pulses, oilseeds, raw cotton, raw jute, and sugarcane, are among those that have minimum support prices. After this, there is a large increase in the importation of edible oil and pulses [4].

With respect to the above background, this paper aims to measure annual growth rate and Compound Annual Growth Rate (CAGR) of Per Capita Availability of Food Grains, Rice, Wheat, Other cereals, Cereals, Gram and Pulses for the period 2010-2022 which may represent the food security in India in the last decade.

II. REVIEW OF LITERATURE

In recent years, ensuring food security has become more crucial due to the high demand from India's expanding population. Over time, changes in crop production practices have given rise to several new challenges, such as crop diversification, difficulties in cultivating medicinal plants and biofuel crops, climate change, water scarcity, the state of high-yielding crop varieties, agricultural insurance and pricing, and the impact of globalization and urban expansion. The impact of globalization on agricultural growth, facilitated by Special Economic Zones (SEZs), has been both positive and negative. However, it is crucial to closely control the legislation related to globalization in order to mitigate the adverse consequences on food security in India [5]. The objectives of ensuring food security in India were first accomplished by the implementation of the existing food stocks management system, which encompasses the processes of procurement, maintenance of buffer stocks, and public distribution. Nevertheless, its deficiencies and insufficiencies have been more evident, particularly throughout the 1990s and 2000s.In order to enhance food security, the country must enhance its overall human development indices, such as literacy and education.

Since the mid-1990s, there have been many occurrences of stockpiling of 70-80 million tons. The economic expenses incurred by the country are substantial. Conversely, the main objective of China's existing grain stock programs is to assist farmers who cultivate certain cereal crops in specific areas by regulating prices. An experimental "target price" strategy is being considered as a potential replacement for these programs. The unrestricted trading system that India has implemented since the mid-1990s is also inconsistent with the current management of foodgrain inventories in the country. In order to ensure food and nutrition security, it is imperative for India to endorse trade liberalization in both cereals and non-cereal goods. India should reduce its reliance on its abundant food reserves and instead prioritize commerce for wheat and rice. Due to the significant and increasing difference in prices between the local and global markets, it is likely that China would continue to increase its imports of food, especially grain goods [6]. India has a plentiful food supply, yet, due to a shortage of protein sources, it needs to enhance its production of oilseeds, pulses, meat, and meat products. India must use agronomic and management practices, such as watershed development, in conjunction with advanced technology, such as drought-resistant cultivars, to improve agricultural and food output. In order to enhance food security, the country must enhance its overall human development indices, such as literacy and education. Analyzed by heteroskedastic linear regression, this study investigated the factors that influence the level of engagement in urban agriculture and its effects on food security in Asian and African metropolitan areas. The relationship between the extent of urban agriculture and food security was analyzed using the Seemingly Unrelated Regression. The Seemingly Unrelated Regression is an appropriate model for this analysis due to the presence of a correlation between the determinants of the food-security–access domain tools (specifically, the Household Food Insecurity Access Scale and per capita food expenditure), as indicated by the results of the Breusch-Pagan test for error independence. On average, families in India had a moderate level of food insecurity, whereas households in Ghana suffered a lighter level of food insecurity. The empirical study results revealed that several institutional, economic, and demographic elements had varying degrees of effect on the practice of urban agriculture and the level of urban food security. Moreover, the presence of urban agriculture had a beneficial effect on food security in both Ghana and India. The results also indicate that, to mitigate urban food insecurity, Asian and African countries should aggressively promote urban agriculture among urban families [7]. The accessibility of safe and nutritious food on a global scale is more challenging due to the pandemic, the Russian-Ukrainian War, and climate change. Food scarcity grew more pronounced for impoverished individuals, particularly those who rely on daily wages in some regions. Although essential goods in India were exempt from travel restrictions during the lockdown, farmers in the country had considerable difficulties in accessing markets, resulting in a surplus of food wastage. Simultaneously, the tendency of the middle class to accumulate and store resources had a detrimental effect on the value chain, exacerbating the situation [8]. The lockdown had a significant effect on India's rural populace. Individuals saw a decline in their earnings along with modifications to their dietary consumption and income-generating endeavors. In Kerala's coastal districts, a larger proportion of primary earners were engaged in paid jobs and daily wage labor, as opposed to fishing. In Phase II, there was a decline in the number of primary earners in Kerala engaged in agricultural activities, while those who remained in this sector increased their weekly working hours. An increasing number of main breadwinners started engaging in agricultural activities outside of Kerala. All other forms of labor failed. During phase II, those who had salaried occupations, engaged in farming, or were paid daily wages in agriculture had the highest number of working days per week. The findings indicate that the lockdown had an adverse effect on the food and nutritional security of rural families. As the consumption of subsidized food grains increased and the consumption of more nutritious food items decreased, diets became less varied. Kitchen gardens provide cost-effective and nourishing veggies, serving as a potential income source for rural families if they are encouraged to cultivate them [9]. The increasing climate hazards pose a significant danger to the food security and livelihoods of small-scale

farmers in susceptible regions. These farmers often experience complete crop failures, leading to their economic downfall and pushing them into severe poverty. This significantly increases the feminization of agriculture and compels male farmers to relocate to other areas. The primary drivers of rural out-migration in South Asia are gender and socioeconomic inequality, together with the overall poor economic growth in rural areas. Rural towns must expedite their economic development in order to find a resolution. Prioritize strategic activities in the short, medium, and long term for business models that promote gender equality in employment, improved education, and comprehensive training programs. To enhance women's decision-making and reduce the migration of low-paid workers, a portfolio of socioeconomic-environmental advantages should include specific measures to improve women's access to and control over resources. The implementation of Climate-smart Agricultural Practices (CSAPs) significantly reduces the financial burden on the government by minimizing the need for substantial compensation payments to farmers during periods of climatic risks. This not only promotes gender equality but also effectively mitigates the adverse effects of climatic risks [10]. Regarding food security, women in both rural and peri-urban families fulfill diverse responsibilities. Adult women not only face food poverty, but their female offspring are also affected by uneven gender relations. Mothers not only consume smaller quantities of food, but they also eat less often and are the last ones to eat. Additionally, their daughters also share this obligation. Malnutrition throughout successive generations and related diseases are the consequences of this. While women are more inclined to make significant contributions to food security within both the household and community, they are also more susceptible to its negative impacts. During the epidemic, these weaknesses were exacerbated [11].

Enhancing nutrition-focused parts of increased food security is facilitated by raising earnings, which also empower families to purchase safer, higher-quality, and more diverse food. While it is necessary to implement health and nutrition programs directly, it has been anticipated that improving income levels within households and across nations would significantly decrease malnutrition [12]. The food security of individuals and nations relies on several demand elements such as salaries, hazards, health, social protection measures, and domestic caregiving, as well as supply side issues related to agricultural productivity. Enhanced agricultural output releases labor and financial resources for allocation in alternative sectors of the economy. Agriculture also contributes to the process of industrialization. It provides markets for industrial products, supplies raw resources for the industrial sector to consume, and exports to produce the foreign currency necessary to purchase capital goods [13].

The task of guaranteeing food security mostly affects developing countries with low GDP per capita, inadequate infrastructure, and unfavorable agricultural conditions. Food security difficulties are particularly severe in developing countries, where agriculture plays a significant role in the gross domestic product (GDP), harsh environmental conditions hinder agricultural production, and insufficient infrastructure adds to food security challenges. Countries may enhance agricultural output and secure funds for importing food to compensate for local production deficits by implementing farming technology, enhancing farmer training programs and extension services, and implementing an open trade policy. The following stages outline a potential approach that might use oil or natural resources to address the nutrition issue. In nations grappling with the task of boosting agricultural productivity, particularly those with large populations, it is crucial for food security policies to prioritize the advancement of eco-friendly technologies, the augmentation of investments in agricultural research and extension systems, and the enhancement of farmers' education through the transfer of technology from developed nations [14].

III. METHODOLOGY AND DATA SOURCE

In this study Per Capita food availability of Food Grains, Rice, Wheat, Other cereals, Cereals, Gram and Pulses for the period 2010-2022 measured in Kilograms (Kg). All the data has been collected for the period 2010-2022 from Directorate of Economics and Statistics (DES), an attached office of the Department of Agriculture, Cooperation and Farmers Welfare (DAC & FW), Government of India. This article employed descriptive statistics to analyze the change in Food Grains, Rice, Wheat, Other cereals, Cereals, Gram and Pulses.

IV. ANALYSIS OF RESULT

The descriptive statistics (Table 1) for per capita availability of food grains from 2010 to 2022 reveal several insights into the consumption patterns and supply stability of various types of grains. The overall availability of food grains shows a range between 159.50 and 187.80 kg per year, with a mean value of 177.42 kg and a coefficient of variation (CV) of 0.05, indicating low variability and a relatively stable supply over the period. Rice, with a minimum of 66.30 kg and a maximum of 73.30 kg, has a mean of 69.27 kg and a CV of 0.04, reflecting even lower variability and consistency in its availability. Wheat shows slightly higher variability (CV of 0.06) with a range of 57.80 to 72.90 kg and a mean of 64.59 kg, suggesting more fluctuation in supply compared to rice. Other cereals, including those less commonly consumed, have the highest variability (CV of 0.17), ranging from 18.80 to 30.90 kg with a mean of 26.09 kg, indicating less stability in their supply. Overall cereal availability, combining rice, wheat, and other cereals, ranges from 146.60 to 170.50 kg, with a mean of 159.02 kg and a CV of 0.05, again showing stability. Pulses, with a range of 12.90 to 20.00 kg and a mean of 16.26 kg, have a CV of 0.10, indicating moderate variability. The availability of gram is relatively stable (CV of 0.06) with a narrow range of 4.90 to 6.00 kg and a mean of 5.17 kg. These statistics suggest that the overall food grain availability has been stable, with rice and wheat showing lower variability compared to other cereals and pulses, reflecting effective agricultural practices and supply chain management for these staple grains.

Table 1: Descriptive Statistics of Per Capita Availability of Foodgrains (Kgs. per year) for the period 2010-2022

	Minimum	Maximum	Mean	CV
Food Grains	159.50	187.80	177.42	0.05
Rice	66.30	73.30	69.27	0.04
Wheat	57.80	72.90	64.59	0.06
Other cereals	18.80	30.90	26.09	0.17
Cereals	146.60	170.50	159.02	0.05
Gram	4.90	6.00	5.17	0.06
Pulses	12.90	20.00	16.26	0.10

Source: Authors Own Calculation

The table 2 presents the annual growth rates and compound annual growth rate (CAGR) for per capita availability of various food grains from 2010 to 2022. The data reveals the fluctuations and overall trends in the availability of food grains, rice, wheat, other cereals, cereals, gram, and pulses over this period. The growth rates for food grains show significant variability, with notable positive growth in years like 2011 (7.147%) and 2013 (6.025%), and declines in years like 2015 (-4.927%) and 2018 (-3.895%). The CAGR for food grains is 0.013, indicating a modest annual growth over the period. The availability of rice also fluctuates, with some years experiencing declines, such as 2015 (-6.086%) and 2022 (-5.048%), while others see positive growth, such as 2012 (4.676%) and 2020 (5.882%). The CAGR for rice is relatively low at 0.004, suggesting very minimal long-term growth. Wheat shows significant year-to-year variation, with sharp declines in 2015 (-8.234%) and 2017 (-8.505%), but also strong growth in years like 2013 (15.571%) and 2016 (18.923%). The CAGR for wheat is 0.009, indicating moderate long-term growth. This category exhibits the highest variability in growth rates, with extreme values such as 27.128% in 2011 and -12.329% in 2013. The CAGR for other cereals is 0.036, the highest among all categories, indicating substantial long-term growth despite annual fluctuations. Combining rice, wheat, and other cereals, the growth rates show moderate variability with positive growth in 2011 (2.251%) and 2020 (4.174%) and declines in 2015 (-4.827%) and 2022 (-1.349%). The CAGR for cereals is 0.011, suggesting steady but modest growth. The availability of gram has relatively consistent growth rates, with notable positive years like 2011 (8.163%) and 2013 (14.286%), and declines in 2015 (-15.000%) and 2016 (-2.961%). The CAGR for gram is 0.004, indicating minimal growth over the period. Pulses show substantial annual variation, with high growth in years like 2011 (21.705%) and 2017 (27.389%), and significant declines in 2019 (-17.112%) and 2015 (-5.325%). The CAGR for pulses is 0.020, reflecting moderate long-term growth. These growth rates and CAGR values indicate the dynamic nature of food grain availability, influenced by factors such as climatic conditions, agricultural practices, market demand, and policy interventions. The higher CAGR for other cereals suggests increased emphasis or improvements in the cultivation and availability of these grains. Conversely, the lower CAGRs for rice and gram reflect more stable but less aggressive growth trends. The variability across years underscores the importance of resilience and adaptability in agricultural and food supply systems to ensure consistent availability and address the fluctuations in production and demand.

Table 2: Growth rate and CAGR of Per Capita Availability of Food grains (Kgs. per year) for the period 2010-2022

Year	Food Grains	Rice	Wheat	Other cereals	Cereals	Gram	Pulses
2010	-	-	-	-	-	-	-
2011	7.147	-0.151	-2.769	27.128	2.251	8.163	21.705
2012	-0.936	4.676	-3.183	-8.368	-0.534	-7.547	-3.185
2013	6.025	3.890	15.571	-12.329	6.036	14.286	3.947
2014	-0.501	0.277	0.000	17.708	2.214	7.143	6.962
2015	-4.927	-6.086	-8.234	25.664	-4.827	-15.000	-5.325
2016	4.653	-1.031	18.923	-8.099	5.332	-2.961	-1.875
2017	5.459	-0.595	-8.505	12.644	-2.222	0.766	27.389
2018	-3.895	3.593	-7.796	4.082	1.831	0.760	-6.500
2019	-2.277	-1.734	5.691	-10.458	-0.496	0.755	-17.112
2020	4.034	5.882	-1.538	12.774	4.174	0.749	3.226
2021	2.021	1.806	4.688	-2.265	1.974	0.743	1.875
2022	0.535	-5.048	2.687	-1.325	-1.349	0.738	2.537
CAGR	0.013	0.004	0.009	0.036	0.011	0.004	0.020

Source: Authors Own Calculation

Based on the 1996 World Food Summit, food security is defined when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (Food and Agriculture Organization (FAO). Organizations such as the Food and Agriculture Organization (FAO) of the United Nations and the World Food Programme (WFP) often use the metric of "caloric intake per capita" as one of the indicators of food security. So, the "caloric intake per capita" and economic access to sufficient safe and nutritious food can be represented by agricultural production and per capita availability of the food (Swaminathan & Bhavani, 2013). So, India has

managed Food Security in India successfully in the last decade.

V. CONCLUSION

The descriptive data (Table 1) for per capita food grain availability from 2010 to 2022 demonstrate grain consumption trends and supply stability. The annual availability of food grains ranges from 159.50 to 187.80 kg, with a mean of 177.42 kg and a CV of 0.05, suggesting minimal fluctuation and a very consistent supply. Rice has a mean of 69.27 kg and a CV of 0.04, indicating considerably reduced variability and consistency in availability. Wheat has a range of 57.80 to 72.90 kg and a mean of 64.59 kg, demonstrating larger supply variation than rice (CV = 0.06). Other grains, including less popular ones, had the largest variability (CV of 0.17), ranging from 18.80 to 30.90 kg with a mean of 26.09 kg, suggesting poorer supply consistency. Overall cereal availability, including rice, wheat, and other cereals, is 146.60 to 170.50 kg, with a mean of 159.02 kg and a CV of 0.05, indicating stability. Pulses had a CV of 0.10, suggesting moderate variability, with a range of 12.90 to 20.00 kg and a mean of 16.26 kg. Gram availability is quite steady (CV of 0.06) with a limited range of 4.90 to 6.00 kg and a mean of 5.17 kg. Rice and wheat have lower variability than other cereals and pulses, indicating excellent farming techniques and supply chain management for these key grains. Table 2 shows food grain per capita availability growth rates and CAGR from 2010 to 2022. Data shows changes and trends in food grain, rice, wheat, other cereals, gram, and pulse availability throughout this time. Food grain growth rates vary, with 2011 (7.147%) and 2013 (6.025%) showing positive growth and 2015 (-4.927%) and 2018 (-3.895%) showing negative growth. Food grains have a 0.013 CAGR, showing low yearly increase. Rice availability changes, with 2015 (-6.086%) and 2022 (-5.048%) declining and 2012 (4.676%) and 2020 (5.882%) increasing. Rice has a 0.004 CAGR, indicating limited long-term growth. Wheat fluctuates across years, with substantial reductions in 2015 (-8.234%) and 2017 (-8.505%) and considerable gains in 2013 (15.571%) and 2016 (18.923%). Wheat has modest long-term growth of 0.009. This category has the most growth rate variations, with 27.128% in 2011 and -12.329% in 2013. Other cereals had the greatest CAGR, 0.036, demonstrating long-term development despite yearly changes. Combining rice, wheat, and other cereals, growth rates are positive in 2011 (2.251%) and 2020 (4.174%) and negative in 2015 (-4.827%) and 2022 (-1.349%). A 0.011 CAGR indicates continuous but moderate crop growth. Gram availability tends to rise in 2011 (8.163%) and 2013 (14.286%) and fall in 2015 (-15.000%) and 2016 (-2.961%). Gram's CAGR is 0.004, showing little growth. Pulses expand rapidly in 2011 (21.705%) and 2017 (27.389%) and fall significantly in 2019 (-17.112%) and 2015 (-5.325%). Pulses have modest long-term increase at 0.020. These growth rates and CAGR statistics show that food grain supply is dynamic, affected by climate, agriculture, market demand, and policy. The greater CAGR for other cereals reflects stronger cultivation and availability. Rice and gram have lower CAGRs, indicating more constant but less aggressive growth. Resilience and adaptation in agricultural and food supply systems are needed to maintain availability and manage production and demand changes over years.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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