Towards sustainable indicators of food and nutritional outcomes in India

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Abstract

Purpose – The purpose of this paper is to measure performance of India in food and nutrition security relative to other Asian countries like Bangladesh, China, Africa and also developed countries from 1991 to 2016.

Design/methodology/approach – The study is based on FAO food security indicators under four dimensions, namely, food availability, access, stability and utilization. These indicators are further categorized into determinants and outcome indicators of food security. A comprehensive fifteen indicators are examined in depth.

Findings – Food availability in terms of dietary calories and protein per capita was less in India compared to even Africa and Bangladesh. However, food access indicators like road density is better, food prices remain low and stable, which improved food access and stability. However, in utilization indicators, access to water and sanitation remained low, anaemia among pregnant women and undernourishment was relatively higher when even compared to least developed countries like Africa and Bangladesh. Depth of food deficit (an indicator of severity of food deficit) was higher in India except Africa.

Research limitations/implications – Future research should focus on policies for decreasing undernourishment and anaemia and severity in depth of food deficit with focus on India.

Practical implications – The results highlight the severity of food deficit and anaemia among women, undernourishment and provide benchmark to monitor sustainable development goals in zero hunger goal.

Originality/value – This study examined the relative performance of India in various food and nutrition security indicators in comparison to other countries.

Keywords India, Food security, Nutrition security, Sustainable development goals

Paper type Research paper

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1. Introduction

Given the importance of food and nutritional security, the sustainable development goals (SDG) adopted by United Nations clearly sets specific goal to end food insecurity under Goal 2 by 2030. The Goal 2 is "End hunger, achieve food security and adequate nutrition

for all, and promote sustainable agriculture." Under this goal, two specific targets: end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round by 2030; and, end all forms of malnutrition, and address the nutritional needs of children, pregnant women and older persons by 2030 were set to be achieved by all countries rich and poor. In this context, monitoring food insecurity at national, regional and global levels is essential for planning and policy making across countries. It is needed for three main purposes: identifying where food insecurity exists and is most severe; tracking changes in food insecurity over time; and, understanding its causes so that the most effective interventions can be chosen to alleviate it (Smith, 1998). The year 2015 marks the last year of millennium development goals (MDGs). Only 72 developing countries out of 129 countries monitored by FAO have reached the hunger target (MDG 1c) of halving the proportion of the chronically undernourished from the base line (1990/1992) by the year 2015 (FAO, 2015). In 2015, there are about 795 million people undernourished (780 million in developing countries and remaining 15 million in developed countries), which accounts for 10.9 percent of the population. It indicates just one in nine were undernourished and uneven progress in food security across developing countries. This uneven progress calls for monitoring of key indicators of food and nutrition at national and regional level including both developing and developed countries. Although progress is significant reducing undernourishment from 23.6 percent in 1991 to 12.1 percent in 2015, Asia remained as the largest continent with undernourished population with 512 million. The undernourished population in India reduced from 210 million in 1990-1992 to 195 million in 2014-2016, which indicates a reduction of 36 percent as against the target of 50 percent reduction under MDG (FAO, 2015). As India is the largest country with 195 million population undernourished (with share of undernourished is at 15.2 percent of total population) in 2015, this study focusses on changes in food security indicators in India relative to other comparable countries.

1.1 Objectives

This paper assesses the current status of the food security in India compared to other comparable developing and developed countries from 1990 to 2014. Many earlier studies had examined the food security at country and sub-national level in different countries and at global level (Carletto *et al.*, 2013; Headey and Ecker, 2013; Maxwell *et al.*, 1999; Eele, 1994). But no study compared India with other countries to understand India's comparative position. This study tries to fill this research gap in food security studies with particular focus on comparing India to similar countries including countries like Bangladesh, China in Asia and also with African continent. Developed countries were also included to know the comparative status of India compared to the world best (which can be treated as target achievable). The paper is divided into four sections. After this section, Section 2 deals with the methodology, definitions, concepts and FAO food security indicators. Section 3 deals with the analysis of the data and results. Section 4 concludes with some recommendations.

2. Methodology and definitions

Many earlier studies emphasized a uniform method of analysis of food and nutritional security across countries and at global level (Carletto *et al.*, 2013; Masset, 2011). Food security was defined by World Food Summit as "Food security exists 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" (World Food Summit, 1996). The FAO comprehensive definition encompasses the four dimensions of the food security, namely: food availability; food access; utilization; and, stability (FAO, 2006). These four concepts are defined as below.

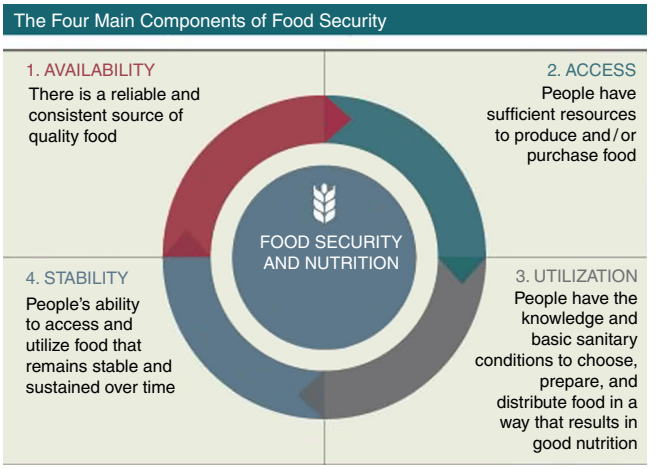
Food availability: The availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports (including food aid).

Food access: Access by individuals to adequate resources (entitlements) for acquiring appropriate foods for a nutritious diet (Sen, 1981). Entitlements are defined as the set of all commodity bundles over which a person can establish command given the legal, political, economic and social arrangements of the community in which they live (including traditional rights such as access to common resources) (Figure 1).

Utilization: Utilization of food through adequate diet, clean water, sanitation and health care to reach a state of nutritional wellbeing where all physiological needs are met. This brings out the importance of non-food inputs in food security.

Stability: To be food secure, a population, household or individual must have access to adequate food at all times. They should not risk losing access to food as a consequence of sudden shocks (e.g. an economic or climatic crisis) or cyclical events (e.g. seasonal food insecurity). The concept of stability can therefore refer to both the availability and access dimensions of food security.

It should be noted that there is some discursive debate around the use of the term "security." It has been criticized as a concept that largely relates to developed, advanced capitalist economies, which are consumers of food, and reflects their preoccupations around feeding mass populations. This is to be contrasted with less developed producer nations, a number of whom refer to the need for food sovereignty, and is exemplified by such ant-free market initiatives, such as La Via Campesina (Rose, 2014). This critique follows the analysis that use of the term food security implies the market logic of "accumulation by dispossession" (Rose, 2014, citing Harvey, 2003). For this reason, some global food-related forums, such as the Committee on World Food Security (CFS) preface use of the term with normative concepts such as "the right to adequate food" (Rose, 2014, citing CFS, 2009).



Source: USAID (2010)

Figure 1.
Four main components of food security

2.1 Indicators for measuring food security

Following the recommendation of experts gathered in the CFS Round Table on hunger measurement, hosted at FAO headquarters in September 2011, an initial set of indicators aiming to capture above four dimensions of the food security is presented here. Further, the indicators are also categorized as determinants and outcomes of food security.

Food availability is first pillar of food security. Supplying enough food to a country's population is necessary but not sufficient condition for food security. It has both quantitative and qualitative aspects to it. We have selected four indicators under food availability which are: average per capita dietary energy supply adequacy; average per capita protein supply; average per capita supply of protein of animal origin; and, average per capita fat supply. All these indicators are determinants of food security, not the outcomes (Table 1).

Physical access to food depends on availability and quality of infrastructure (like road density). Economic access to food depends on level of food prices, which can be captured through domestic food price index. The above indicators are determinants of food access. The outcome indicators for food access are prevalence of undernourishment, share of food expenditure of the poor in per capita gross domestic product (GDP) and depth of the food deficit.

Food stability indicators are: domestic food price volatility; and, per capita food production variability. Both determine the stability and vulnerability of food security of a country. Both are determinants of food stability.

Utilization indicators are: access to improved water sources; access to improved sanitation facilities; and, prevalence of anaemia among pregnant women. First two indicators are determinants and the later was the outcome indicator of food utilization.

3. Results

The results are grouped into two sections. Section 1 concerns with determinants of food security, which covers entire determinants in four dimensions (availability, access, stability and utilization). Section 2 deals with outcome indicators for two dimensions of access and utilization, as availability and stability are determinants of food security and they are not outcome indicators.

Food security indicators	Dimension	Determinant/outcome
Average per capita dietary energy supply adequacy	Availability	Determinant
Average per capita protein supply		
Average per capita supply of protein of animal origin		
Average per capita fat supply		
Road density	Physical access	
Domestic food price index	Economic access	
Domestic food price volatility	Stability	
Per capita food production variability		
Access to improved water sources	Utilization	
Access to improved sanitation facilities		
Prevalence of undernourishment	Access	Outcome
Share of food expenditure of the poor		
Depth of the food deficit		
Prevalence of anaemia among pregnant women	Utilization	

Table I.
Indicators selected for analysis

3.1 Determinants of food security

Under determinants of food security, the paper covered four indicators for food availability dimension: average dietary energy supply; average protein supply; average supply of protein of animal origin; and, average fat supply. For food access dimension, one indicator for physical access (road density) and another for economic access (domestic food price index) were covered. For food stability dimension, two indicators: domestic food price volatility; and, per capita food production variability were covered. Under food utilization dimension two indicators: access to improved water sources; and, access to improved sanitation facilities were covered.

3.1.1 Food availability. Based on food balance sheets data of FAO, national average per capita food energy supply is calculated on three-year averages, to reduce the influence of errors in recording of annual stock variations. The units for measurement are cal/capita/day. Major sources of dietary energy in India are rice and wheat. Supply of dietary calories was less and stagnant in India (2,469 kcal/capita/day) compared to the China (3,156) and even compared to African countries (2,581). Bangladesh (2,486) overtook India in the early 2000s (Figure 2). The stagnant calories availability was due to the reduction in the cereal share in overall agricultural production in the country. It might be also due to the reduction in area under cereals *vis-à-vis* other commercial crops like cotton, chili, fruit, vegetables and other commercial crops in India.

Protein supply. Major sources of protein for human consumption are pulses, meat, fish and milk products, even cereals also contain about 8 percent protein in grains. Protein supply per capita was stagnant in India since 1990s (59 gm/capita/day), whereas it was steadily increased for Bangladesh (55 gm/capita/day) (Figure 3). However, still, India was ahead of Bangladesh in protein supply. Protein supply per capita in China (94 gm/capita/day) was steeply increased during this period. Developed countries average protein supply was 103 gm/capita/day. African countries average protein supply was also higher (65 gm/capita/day).

Although, in India, some sections of the population are vegetarian, with the increase in income levels, most of them are increasingly consuming meat and meat products (Kumar *et al.*, 2014). Internationally, the quality of protein intake was assessed by the share of the protein sourced from animal origin. Hence, we have also presented average

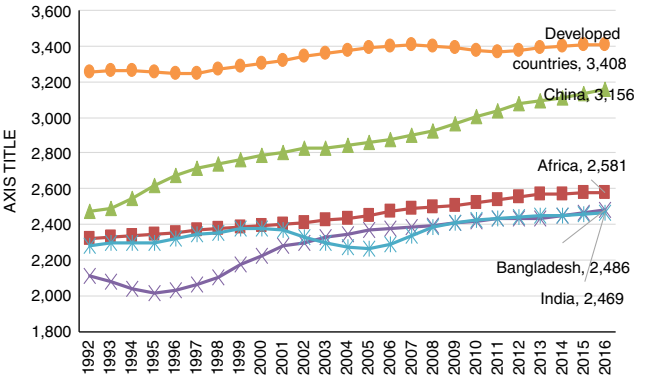


Figure 2.
Average national energy supply (kcal/capita/day)

protein supply from animal origin in Figure 4. National average protein supply of animal origin (expressed in gm/capita/day) includes the following groups: meat; animal fats and products; milk and products; eggs, fish, seafood and products; and aquatic products and other. Across the world, there was growing availability for protein from animal sources for food. In India, availability of animal protein per capita was (12 gm/capita/day) less even compared to China (37 gm/capita/day) and also Africa (14 gm/capita/day), but more than Bangladesh (10 gm/capita/day). In developed countries per capita consumption was 60 gm/capita/day.

Fat supply (expressed in gm/capita/day). The fat supply per capita in India is less (52 gm/capita/day) than many comparable countries (China 93 gm; Africa 52 gm) except Bangladesh (only 29 gm). In the recent years, most of the developing countries improved their position, even China surpassed world average, but dietary fat availability in India is less and almost equivalent to Africa (Figure 5).

3.1.2 Food access. 3.1.2.1 Road density. In India road density was much higher (143 km/100 km^2) than many other countries except Bangladesh (179 km/100 km^2) (Figure 6). The road density was slowly improving after 1992, but after 1998 there was steep increase. However, in terms of share of paved roads to total roads, India's (54 percent of the roads are paved) position was above Bangladesh (25 percent) below China (80 percent) and Africa (79 percent) (Figure 7). After 1990s, there was a huge investment in construction of roads in India, which was having positive impact on the road density.

3.1.2.2 Domestic food price index. The domestic food price-level index is an indicator of the relative price of food in a country. The indicator is calculated from the 2011 International Comparison Program (ICP) data from the World Bank as well as general and food consumer price indices from the International Labour Organization available

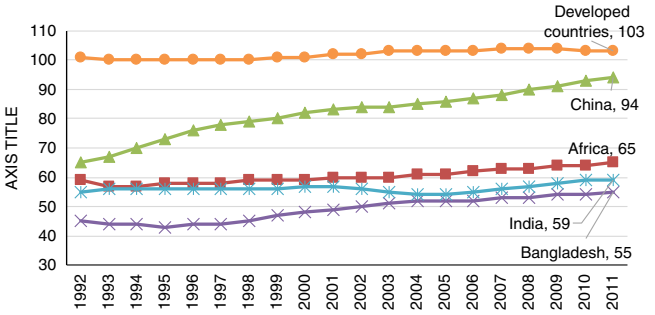


Figure 3.
Average protein supply (gm/capita/day)

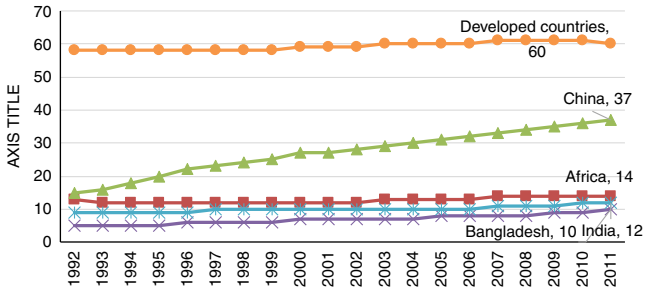


Figure 4.
Average supply of protein of animal origin (gm/capita/day)

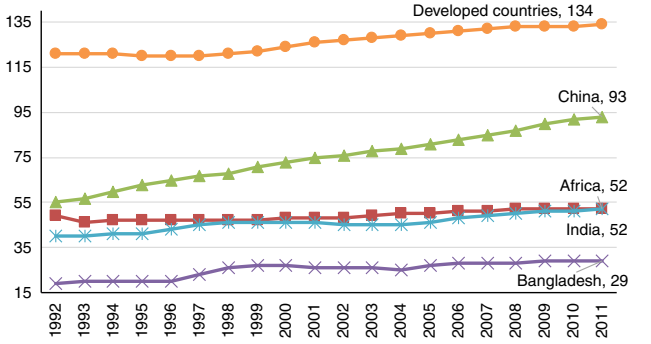


Figure 5.
Average fat supply (gm/capita/day)

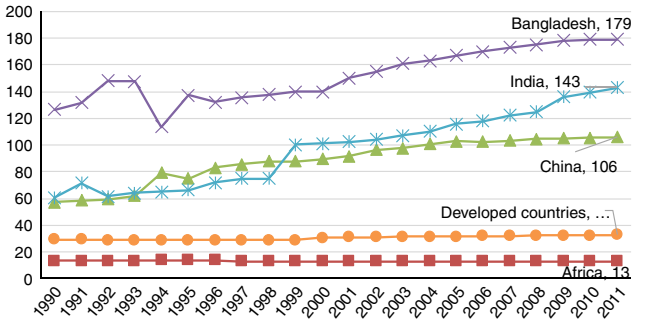


Figure 6.
Road density (per 100 km^2 of land area)

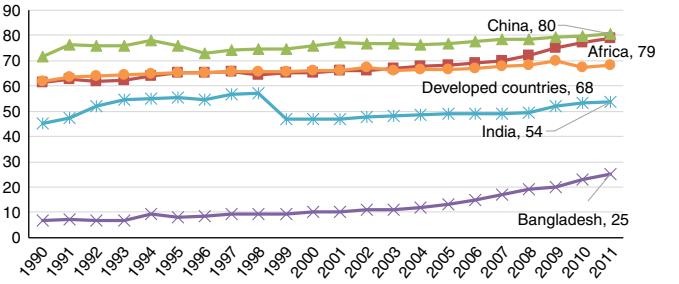


Figure 7.
Percent of paved roads over total roads

on FAOSTAT. Specifically, the ratio of food and non-alcoholic beverages expenditure to actual individual consumption is calculated in purchasing power parity (PPP) terms relative to the USA. To control for inflation, this ratio is forecasted and backcasted using the ratio of a country's food consumer price index (FPI) and general consumer price index (CPI) using a 2011 base year, relative to the USA. The indicator is computed for countries for which ICP data as well as general and food consumer price indices are available (FAO, 2015). Domestic food price-level index is an important indicator for global monitoring of food security because it compares the relative price of food across countries and over time. In India domestic food price index was higher than developed countries and China, but lower than Africa and Bangladesh (Figure 8). The lower increase in food price index is an indicator of increase in competitiveness of

food products and also increased access to food by poor in India compared to world. However, the increase in prices of protein rich food like pulses and animal sources of protein is a cause of concern, given the increase in the demand for protein foods.

3.1.3 Stability indicators. According to various reports on climate change, the country is expected to face more frequent floods and droughts in the future. This will increase the occurrence of supply shocks which increase volatility of food production and price fluctuations. Hence need for stability indicators in food security analysis.

3.1.3.1 Domestic food price volatility. The domestic food price volatility index measures the variability in the relative price of food in a country. The indicator is calculated from the monthly domestic food price-level index using monthly consumer and general food price indices and PPP data from the ICP conducted by the World Bank (see the Relative Price of Food Indicator for more information). Month-to-month growth rates are calculated, and the standard deviation of these growth rates is calculated over the previous eight months (eight months rolling standard deviation). The average of these standard deviations is then computed to obtain an annual volatility indicator. The domestic food price volatility index (8) is less compared to Africa (9), but almost equivalent to China and more than Bangladesh (5) and developed countries (5) (Figure 9). As India is implementing nationwide food procurement system at minimum support price and distributing through ration shops in almost all the villages (600,000 in number) across India, the price volatility is less even though production fluctuates widely due to recurrent monsoon failures.

3.1.3.2 Per capita food production variability. Per capita food production variability corresponds to the variability of the net food production value in constant 2004-2006

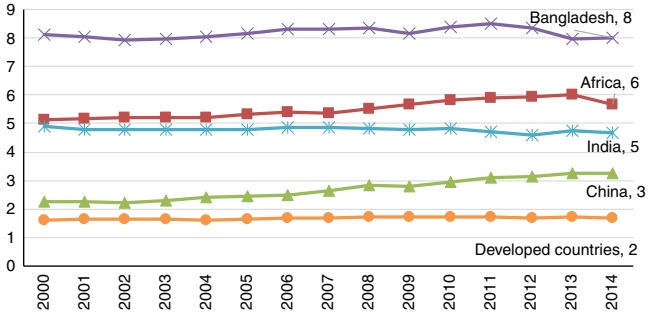


Figure 8.
Domestic food price index

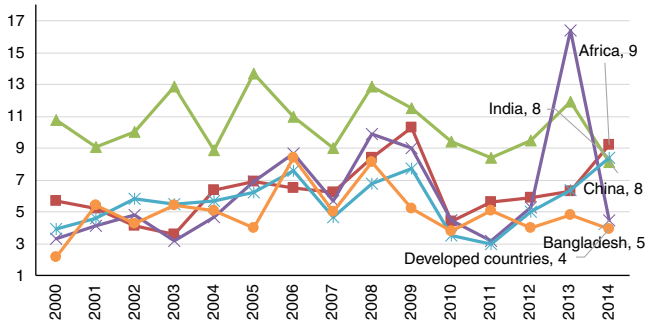


Figure 9.
Domestic food price volatility index

International dollar (net food production index number) divided by the population number as from UN 2010 estimates. Variability is based on the trend of the net food production index number per capita over the period 1990-2012 and corresponds to the standard deviation of the deviation from the trend over a period of five years.

Per capita food production variability index is much higher in India (4.1) compared to China (1.8), Africa (2.8), Bangladesh (4.0) except developed countries (7.2). This is mainly due to the dependence of Indian food grain production on rain fed agriculture. Still, about 60 percent of the cropped area is unirrigated and depends on the annual monsoon (Figure 10). In the recent years, Indian monsoon is erratic, more frequent drought and floods are common (Prasad *et al.*, 2015).

3.1.4 Utilization indicators. Percentage of population with improved water access and access to sanitation facilities was determinant of utilization of food. In access to improved water, India (93 percent have access to improved water) is better than Bangladesh (85 percent) and Africa (69 percent), but worse than China (98 percent) and developed countries (99 percent). Developed countries reached 100 percent access to improved water (Figure 11). In case of access to sanitation facilities, India was at the bottom (only 36 percent access to sanitation) when compared to all comparable countries like Africa (39 percent) and Bangladesh (57 percent). China and developed countries reached 100 percent level (Figure 12).

3.2 Outcome indicators

Food access and utilization dimension were having outcome indicators. Under access dimension three indicators, namely: percent share of food expenditure of the poor; prevalence of undernourishment; and, depth of the food deficit were covered. For the utilization dimension, only one indicator prevalence of anaemia among pregnant women was covered.

3.2.1 Access indicators. 3.2.1.1 Share of food expenditure of the poor. The share of food expenditure in total expenditure was an outcome indicator in food access

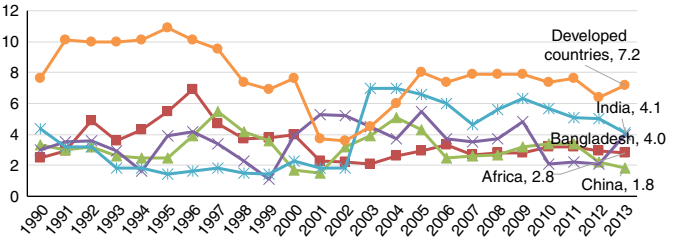


Figure 10.
Per capita food production variability (constant 2004-2006 int$1,000 per capita)

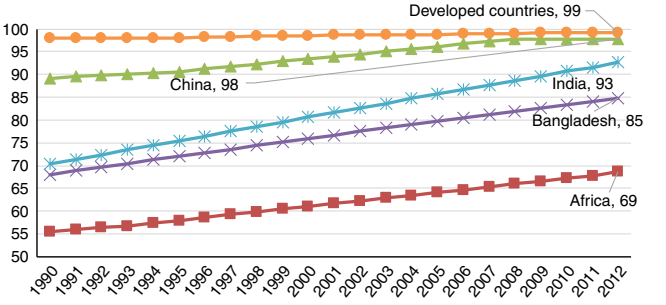


Figure 11.
Percentage of population with access to improved water sources

dimension. According to the Engel's law, the higher the income of a household, the lower the proportion of income spent on food. When applied at the national level, this indicator reflects the living standard of a country, as well as the vulnerability of a country to food price increases. Due to the lack/unreliability of income data, this indicator has been built as the ratio between food consumption of the poor and total expenditure. Finally, given the higher vulnerability of the poorer households to food price increase, this indicator only encompasses the share of food consumption of the poorest income quintile of a country population.

The ratio of food expenditure to total expenditure is calculated in PPP terms relative to the USA. To control for inflation, this ratio is forecasted and backcasted using the ratio of a country's FPI and CPI using a 2005 base year, relative to the USA. The indicator is computed for countries for which ICP data as well as general and food consumer price indices are available.

GDP per capita was based on PPP. PPP-GDP is GDP converted to international dollars using PPP rates. An international dollar has the same purchasing power over GDP as the US dollar has in the USA. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2011 international dollars.

Proportion of food consumption over total consumption (food and non-food) for the lowest income quintile of the population and per capita GDP for the year 2011was given in Figure 13. The graph depicts the share of expenditure on food decreased by 9.5 percent if per capita income increased by USD100 in terms of PPP. This indicates that, in the low-income countries, the share of expenditure going to food is far higher; hence poor will be exposed to fluctuations in prices, if we do not have food security provisions at WTO. In India share of food expenses were 64 percent of total consumption. And hence they are more vulnerable to the price fluctuations (Figure 13).

3.2.1.2 Prevalence of Undernourishment. It is also an outcome indicator in food access. The prevalence of undernourishment indicator shows that the probability that a randomly selected individual from the population consumes an amount of calories that is insufficient to cover her/his energy requirement for an active and healthy life. The indicator is computed by comparing a probability distribution of habitual daily dietary energy consumption with a threshold level called the minimum dietary energy requirement. Both are based on the notion of an average individual in the reference population. This is the traditional FAO hunger indicator, adopted as official MDG indicator for Goal 1, Target 1.9. More details on the methodology for computing the

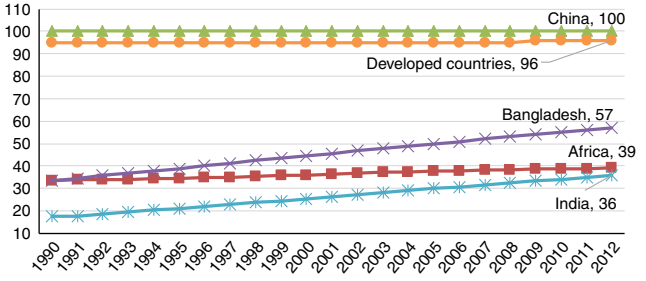


Figure 12. Percentage of population with access to sanitation facilities

prevalence of undernourishment are in Annex 2 of the State of Food Insecurity in the World 2013 Report (FAO, 2013).

Undernourishment is much higher in India compared in 1992, but decreased steeply. Still, in year 2016, undernourishment was higher in India (15 percent) compared to China (9 percent), and Bangladesh (16 percent) except Africa (20 percent). In developed countries it is below 5 percent. However, there was wide fluctuation year-on-year mainly due to the high fluctuations in food production and availability for human consumption (Figure 14).

3.2.1.3 Depth of food deficit. The depth of food deficit was an outcome indicator in food access dimension. The depth of the food deficit indicates how many calories would be needed to lift the undernourished from their status, everything else being constant. It is the average intensity of food deprivation of the undernourished, estimated as the difference between the average dietary energy requirement and the average dietary energy consumption of the undernourished population (food-deprived), is multiplied by the number of undernourished to provide an estimate of the total food deficit in the country, which is then normalized by the total population. Depth of food deficit is an indicator of severity of food deficit among different countries. In this indicator also India (109 kcal/capita/day) is falling most of the developing countries, except Africa (151 kcal/capita/day) and Bangladesh (116 kcal/capita/day) (Figure 15). It means, an average undernourished Indian consumer is consuming 109 kcal less than the recommended for healthy life.

3.2.2 Utilization indicators. 3.2.2.1 Anaemia among pregnant women. This is an outcome indicator in food utilization dimension. Anaemia is a condition in which the

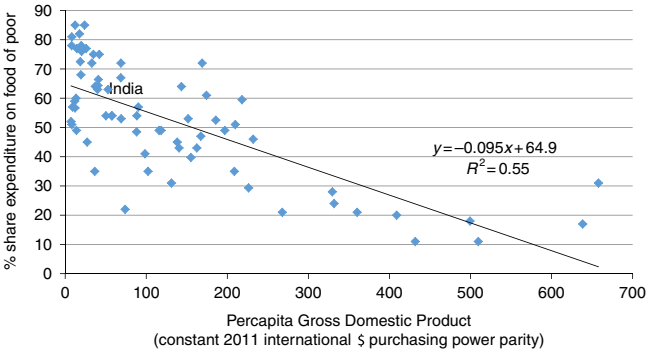


Figure 13.
Percent food expenditure of the poor and per capita GDP across countries

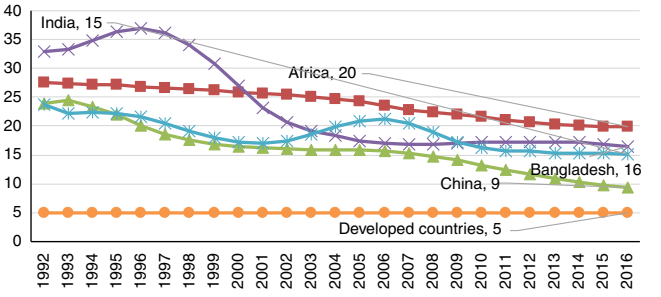


Figure 14.
Prevalence of undernourishment (percent)

number of red blood cells (and consequently their oxygen-carrying capacity) is insufficient to meet the body's physiologic needs. Specific physiologic needs vary with a person's age, gender and different stages of pregnancy. This indicator measures nutritional imbalance and malnutrition resulting in under nutrition assessed by prevalence of anaemia. Iron deficiency is thought to be the most common cause of anaemia globally. The prevalence of anaemia is an important health indicator. When used with other measurements of iron status, the haemoglobin concentration can provide information about the severity of iron deficiency. The cut-off values for public health significance is 40 percent. A prevalence of anaemia equal or higher than this level signals a severe public health problem.

Low haemoglobin concentrations and anaemia are important risk factors for the health and development of women and children. Therefore, the World Bank estimated trends in the distributions of haemoglobin concentration and in the prevalence of anaemia and severe anaemia in young children and pregnant and non-pregnant women between 1995 and 2011.

The prevalence of anaemia among pregnant women is higher (54 percent of the pregnant women) in India even compared to Bangladesh (48 percent) and Africa (43 percent) (Figure 16). The figures for China (25 percent) and developed countries (17 percent) are very low. This high level of under nutrition, malnutrition are the urgent problems India needs to solve. To tackle this there is a need for widening of the food security basket to include pulses, animal-based products to make the food security program truly nutrition security program.

4. Policy suggestions

Above analysis shows that although food availability is a problem in India (although in most of the availability indicators, India is better than Africa and Bangladesh, but

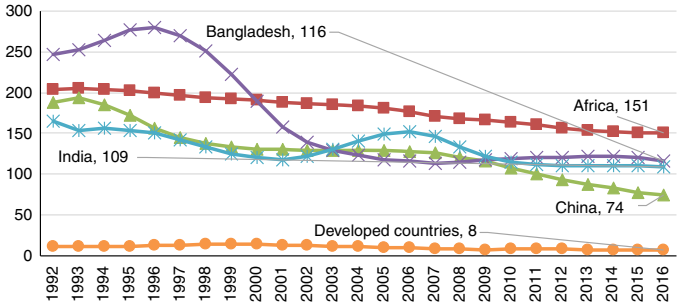


Figure 15.
Depth of the food deficit (kcal/capita/day)

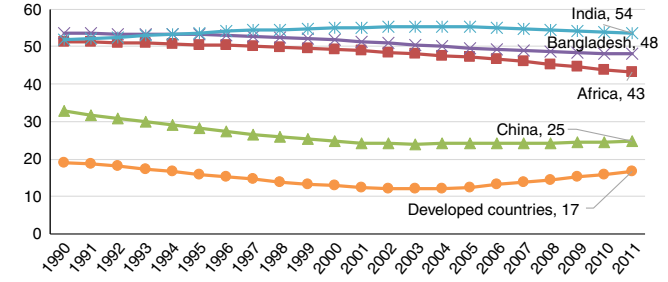


Figure 16.
Prevalence of anaemia among pregnant women

worse than China and developed countries), in food access and utilization indicators. India performed poorly even compared to Africa and Bangladesh. To increase food access and utilization, India needs to invest heavily in food access indicators like pavement of rural roads, sanitation and market infrastructure such as national agricultural markets. National agricultural markets will pave the way for free movement of food from surplus areas to deficit areas and also reduce the price gap between different markets. India is one of the worst performer in food access outcomes like prevalence of undernourishment and food utilization indicators like prevalence of anaemia among pregnant women. To reduce undernourishment and anaemia and other malnutrition, Indian food security basket should also include not only rice and wheat, but also needs to be diversified into pulses, oilseeds and animal-based products. SDGs of food and nutrition security are admirable, but the achievement of SDG food security priorities, wider dissemination of information to gain active public participation (Ratiu and Anderson, 2014). The state and central governments should incorporate nutrition as one of the components in all developmental activities like public works programs, mid-day meal programs for school children, women and child development programs. It requires collaborating with many stakeholders and government, private and public agencies and multiple departments. Assessment of the availability of local seasonal foods like forest produce for their nutritional content and measures to increase their production, availability, access and utilization needs to be considered by identifying the poorest of the poor through participatory approaches through putting the last first (Chambers, 1997). There should be specific role for ministry of agriculture to increase production of nutrient rich crops like pulses in India which are known as poor man's meat.

5. Conclusions

Food security was given highest priority by the global community by putting it in SDG to achieve hunger free and food secure world by 2030. The FAO food security indicators are good indicators for the year-to-year cross-comparison of countries position in food and nutrition security. This study examined FAO food security indicators under four dimensions, namely: food availability; access; stability; and, utilization. Dietary calories availability was less (only 2,469 kcal/capita/day) in India compared to China (3156 kcal) and even compared to African countries (2,581 kcal). Bangladesh overtook India in the early 2000s. Availability of animal proteins was less in India even compared to developing countries within Asia and also Africa. Average protein supply was also less in India (59 gm/capita/day) compared to China (94 gm/capita/day) and Africa (65 gm/capita/day), but more than Bangladesh (55 gm/capita/day). The dietary fat availability in India was less than China, equivalent to Africa, but more than Bangladesh. In food access indicators, availability of roads and road density was better than many countries, but quality of roads (paved roads) was less even compared to some developing countries. Domestic food price index is less than Bangladesh and Africa but more than China. The lower level in domestic food price index in India is an indicator of increased access of food for the poor in India compared to other countries. However, the increase in prices of protein rich food like pulses and animal sources of protein is a cause of concern, given the increase in the demand for protein foods. Among food stability indicators, domestic food price volatility index was higher in India compared to Bangladesh, but lower than Africa and equivalent to China. However, food production variability was much higher in India compared to China, Bangladesh and Africa due to predominant monsoon dependent rainfed agriculture. Even though, per capita food production variability index is much higher

in India, domestic food grain prices volatility is low compared to China and other developing countries mainly due to the stable minimum support price policy and wide spread public distribution system of food grains at subsidized rates. In food utilization indicators, about 93 percent of population in India were having access to improved water sources, while the same figure was 98 percent for China and 69 percent for the Africa. However, access to sanitation was dismally low in India with only 36 percent, while it was 39 percent in Africa, 57 percent in Bangladesh and 100 percent in China. In case of outcome indicators, in India undernourishment was steeply declined to 15 percent, but still it was higher than China (9 percent). There was a wide fluctuation in year-on-year undernourishment mainly due to the high fluctuations in food production and availability of food due to abnormal rainfall. Depth of food deficit is an indicator of severity of food deficit among different countries. In this indicator position was better in India (109 kcal/capita/day) compared to Africa (151 kcal/capita/day) and Bangladesh (116 kcal/capita/day), but worse than China. The prevalence of anaemia among pregnant women was higher in India (54 percent of pregnant women) even compared to most underdeveloped countries like Bangladesh (48 percent) and Africa (43 percent).

References

Carletto, C., Zezza, A. and Banerjee, R. (2013), "Towards better measurement of household food security: harmonizing indicators and the role of household surveys", *Global Food Security*, Vol. 2 No. 1, pp. 30-40.

Chambers, R. (1997), *Whose Reality Counts?: Putting the First Last*, Intermediate Technology Publications Ltd (ITP), London.

Eele, G. (1994), "Indicators for food security and nutrition monitoring: a review of experience from Southern Africa", *Food Policy*, Vol. 19 No. 3, pp. 314-328.

FAO (2006), "Food security", Policy Brief, Issue 2, Rome, available at: www.fao.org/forestry/13128-0e6f36f27e0091055bec28ebe830f46b3.pdf (accessed February 27, 2006).

FAO (2013), "WFP: the state of food insecurity in the World 2015: the multiple dimensions of food security", FAO, Rome.

FAO (2015), "WFP: the state of food insecurity in the World 2015", FAO, Rome.

Headey, D. and Ecker, O. (2013), "Rethinking the measurement of food security: from first principles to best practice", *Food Security*, Vol. 5 No. 3, pp. 327-343.

Kumar, P., Joshi, P.K. and Aggarwal, P. (2014), "Projected effect of droughts on supply, demand, and prices of crops in India", *Economic & Political Weekly*, Vol. 49 No. 52 p. 55.

Masset, E. (2011), "A review of hunger indices and methods to monitor country commitment to fighting hunger", *Food Policy*, Vol. 36 No. S1, pp. S102-S108.

Maxwell, D., Ahiadeke, C., Levin, C., Armar-Klemesu, M., Zakariah, S. and Lamptey, G.M. (1999), "Alternative food-security indicators: revisiting the frequency and severity of coping strategies", *Food Policy*, Vol. 24 No. 4, pp. 411-429.

Prasad, Y.G., Srinivasarao, C., Dixit, S., Maheswari, M., Prasad, J.V.N.S., Venkateswarlu, B. and Sikka, A.K. (2015), "Evidences from farmer participatory technology demonstrations to combat increasing climate uncertainty in rainfed agriculture in India", *Procedia Environmental Sciences*, Vol. 29 No. 1, pp. 291-292.

Ratiu, C. and Anderson, B.B. (2014), "The identity crisis of sustainable development", *World Journal of Science, Technology and Sustainable Development*, Vol. 11 No. 1, pp. 4-15.

Rose, N. (2014), "Food security, food sovereignty and global governance regimes", in Cadman, T. (Ed.), *Climate Change and Global Policy Regimes: Towards Institutional Legitimacy*, Palgrave Macmillan, London, pp. 157-172.

Sen, A. (1981), *Poverty and Famines: An Essay on Entitlement and Deprivation*, Clarendon Press, Oxford.

Smith, L.C. (1998), "Can FAO's measure of chronic undernourishment be strengthened?", *Food Policy*, Vol. 23 No. 5, pp. 425-445.

USAID (2010), *Feed The Future Guide*, U.S. Agency for International Development, Washington.

World Food Summit (1996), "Rome declaration on world food security and World Food Summit Plan of Action", FAO, Rome.

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