IDS WORKING PAPER
Volume **2013** No **430**

The Great Indian Calorie Debate: Explaining Rising Undernourishment during India's Rapid Economic Growth

Lisa C. Smith
August 2013

TANGO INTERNATIONAL
TECHNICAL ASSISTANCE to NGOS

IDS Institute of Development Studies

The Great Indian Calorie Debate: Explaining Rising Undernourishment during India's Rapid Economic Growth
Lisa C. Smith
IDS Working Paper 430
First published by the Institute of Development Studies in August 2013

ISSN: 2040-0209 ISBN: 978-1-78118-129-4

A catalogue record for this publication is available from the British Library.

Available from:
Central Communications, Institute of Development Studies, Brighton BN1 9RE, UK
Tel: +44 (0) 1273 915637 Fax: +44 (0) 1273 621202
E-mail: bookshop@ids.ac.uk
Web: www.ids.ac.uk/publications

IDS is a charitable company limited by guarantee and registered in England (No. 877338)

The Great Indian Calorie Debate: Explaining Rising Undernourishment during India's Rapid Economic Growth

Lisa C. Smith

Summary

The prevalence of undernourishment in India – the percent of people consuming insufficient calories to meet their energy requirements – has been rising steadily since the mid-1980s. Paradoxically, this period has been one of robust poverty reduction and rapid economic growth. The reasons for the apparent reductions in calorie consumption underlying increased undernourishment have been the subject of intense debate both within India and internationally. This paper critically reviews this debate, finding that is has taken place outside of the context of India's recent nutrition and epidemiological transitions, which appear to have brought with them increased, not decreased, food consumption. The debate has also taken place under the unchallenged assumption that the data on which the conflicting trends are based, collected as part of the country's Household Consumption and Expenditure Surveys (HCESs), are reliable. The paper provides supporting literature and empirical evidence that one key factor driving the measured calorie decline is incomplete collection of data on food consumed away from peoples' homes, which is widespread and rapidly increasing. The India example shows that complete measurement of this food source in the HCESs of all countries is vital for accurate measurement of undernourishment and, indeed, poverty at national, regional and global levels.

Keywords: undernourishment; India; Household Consumption and Expenditure Surveys; food consumed away from home

Lisa C. Smith is a senior economist at TANGO, International in Tucson, Arizona. She was formerly a Research Fellow at the International Food Policy Research Institute and Visiting Faculty at the University of Arizona and Emory University. She served as a food security advisor in USAID's policy bureau while an American Association for the Advancement of Science Post-Doctoral Fellow. Smith is currently partnering with IDS on a research project to understand the causes of and identify policy options for reducing child malnutrition in the coming decades. She holds a Ph.D. in Agricultural and Applied Economics from the University of Wisconsin-Madison. Her areas of expertise are development economics, food and nutrition security, gender and impact evaluation.

Contents

Acknowledgements

Previous versions of this paper have benefitted from comments and feedback of FAO Statistics Division staff Carlo Cafiero, Seeva Ramasawmy, Ana Moltedo and Nathalie Troubat, with additional input from Loganaden Naiken. FAO also generously provided data used for the cross-country regression analysis. Additional helpful comments on the paper were provided by Derek Heady, Jean Drèze, Lawrence Haddad and participants at an FAO Statistics Division seminar (March 2011), and participants at a presentation given at the International Scientific Symposium on Food and Nutrition Security Information (January 2012). Discussions with Timothy Frankenberger have helped to formulate the ideas presented. Monica Mueller, Laurie Starr and Beth Phillips of TANGO, International are thanked for their intellectual contributions and editorial assistance. Finally, financial support from FAO, and from the International Household Survey Network through a grant from OECD/PARIS21, is gratefully acknowledged.

1. Introduction

India is the home of over 1.2 billion people, now making up more than a sixth of the world's population. By 2025, it is expected to be the most populous country in the world, surpassing China (U.S. Census Bureau 2012). Given its large population, the food and nutrition situation in India has a major influence over developing-world statistics on food insecurity, including the indicators used to gauge progress towards the Millennium Development Goals. For instance, reflecting its high prevalence of malnutrition among preschool children and sheer size, a full 42 percent of the world's underweight children live in India (von Grebmer *et al.* 2010). According to United Nations Food and Agriculture Organization (FAO) estimates, it is also the home of the largest number of undernourished people – that is, the number consuming insufficient calories to meet their energy requirements – representing one-fourth of the developing-world total (FAO 2012a).[1]

By virtue of India's prominence in influencing the achievement of global goals – but more importantly, for the sake of the millions of Indian people facing food insecurity and hunger – it is of primary importance that statistics on its food and nutrition situation give accurate guidance to policy makers working to improve that situation.

An important source of data on which estimates of undernourishment in India are based is the country's Household Consumption and Expenditure Surveys (HCESs) conducted by the National Sample Survey Organization (NSSO). Figure 1 reports undernourishment prevalences derived from HCESs conducted between 1988 and 2005. For comparison, World Bank estimates of poverty, that is, the percent of people living on less than $1.25 per day, derived from the same surveys are also reported. Undernourishment shows a steadily increasing trend over the period, rising from 25 percent in 1988 to 34 in 2005, a nine percentage-point increase. By contrast, poverty shows a robust declining trend, falling 12 percentage points. Underlying rising undernourishment estimates is a steady decline in estimated calorie consumption per capita found in both rural and urban areas.[2]

What explains these anomalous trends? The decline in poverty over the 17-year period, which was one of rapid economic growth, is to be expected. But why would calorie consumption fall and, most worrisome, undernourishment go up when incomes are rising? Further puzzling is that measured calorie consumption has fallen the most for the wealthiest segment of the population, whose incomes are increasing the fastest (Deaton and Drèze 2009) and for whom overweight and diet-related non-communicable disease prevalences are the highest (Gaiha, Jha and Kulkarni 2010).

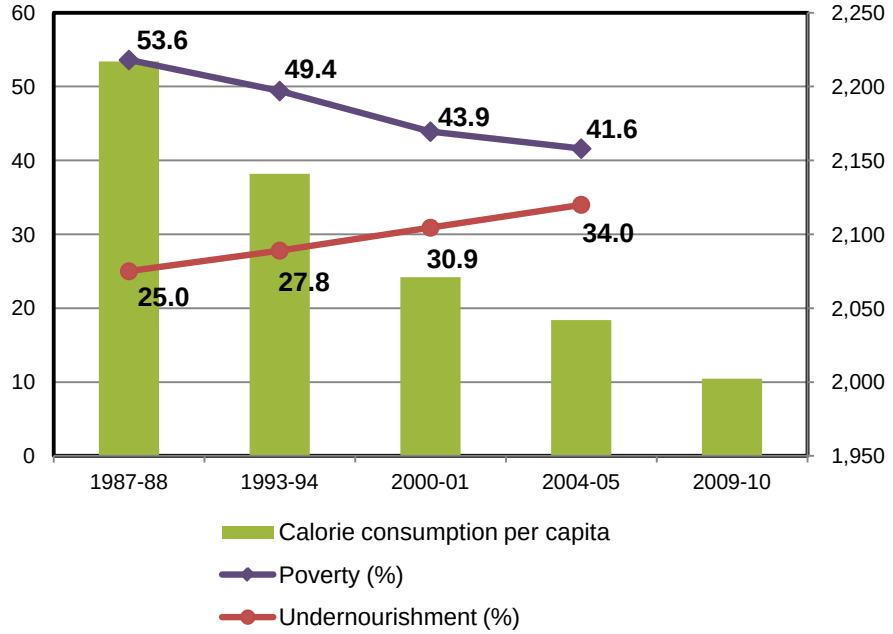
Partly due to the magnitude of food insecurity problems in India and partly to the degree of their incongruity, trends in poverty and calorie consumption in the country have been the subject of intense discussion and debate for a long time. The participants in the debate include government officials, private and non-profit think tanks, journalists, and academics within India, with more involvement internationally since the 1990s when the NSSO data became accessible to non-government analysts (see Deaton and Kozel 2005 on the Great Indian Poverty Debate). In 2009 Deaton and Drèze (2009) provided an extensive review of the available evidence in their widely-cited article 'Food and nutrition in India: Facts and interpretations'. In the wake of this paper's publication the crossfire heated up, with the latest round published in India's

[1] FAO estimates of undernourishment published in its annual *State of Food Insecurity in the World* (FAO 2012a) are currently based on food supply data from Food Balance Sheets as well as supplementary information on distribution obtained from countries' Household Consumption and Expenditure Surveys. Thus they are not comparable to those presented in this paper.

[2] Between 1987/88 and 2009/10 measured calorie consumption per capita fell by 10.3 percent (from 2,252 to 2,020 kcals) in rural India and by 7.2 percent (from 2,098 to 2,026) in urban India (see Figure 1 for data sources).

Economic and Political Weekly including accusations of 'calorie fundamentalism' and 'fatal fallacies' (Patnaik 2010 a,b; Deaton and Drèze 2010 a,b).

Figure 1. Trends in estimates of poverty, undernourishment, and calorie consumption from India's household consumption and expenditure surveys, 1988–2010



Note: Estimates of poverty and undernourishment for 2009-10 are not yet available.
Sources: Poverty estimates: World Bank (2010). Undernourishment estimates for 1993-94, 2000-01 and 2004-05: NSSO survey rounds 50, 56 and 61 and reported in Chattapadhyay and Chowdhury (2010); Estimate for 1987-88: from NSSO survey round 43, author's calculation. Calorie consumption: FAO (2010a) for years prior to 2009-10; NSSO (2012) for 2009-10.

This paper brings a new perspective by placing the debate into the wider context of India's recent economic, nutrition and epidemiological transitions and appraising the underlying HCES data used to measure calorie consumption. It starts with a review of previous explanations given for the anomalous trends in poverty and calorie consumption. It then describes the highly dynamic context in which the food and nutrition situation in India has evolved in recent years. Examination of this context in turn leads to exploration of a key HCES measurement issue, first highlighted by Bouis, Haddad and Kennedy (1992): the quality of data collected on food consumed away from home. Data from India's HCES's are used to analyze how this source of food has changed over time and whether it is included in estimates of calorie consumption. Before concluding, a cross-country analysis of the importance of the quality of data collected on food consumed away from home for estimates of calorie consumption is undertaken.

The paper's analysis follows on an extensive joint FAO-NSSO review of calorie consumption and undernourishment computations from recent HCESs (FAO 2010a). The resulting estimates, reported in Chattapadhyay and Chowdhury (2010), and the underlying processed data from surveys conducted in 1987/88, 1993/94, 1999/2000, 2000/01 and 2004/05[3] are the main data base employed. Supplementary information from the 2009/10 HCES and *2005 India Human Development Survey* is also relied on.

[3] The NSSO survey data are collected using multi-stage stratified random sampling, with the strata being urban and rural areas within each of India's States or Union Territories (Chattapadhyay & Chowdhury 2010). The data are collected over a year's time. Those data from all survey rounds except 2000/01 are the 'thick' rounds conducted more or less quinquennially in which a larger sample size (approximately 120,000 households) is taken to enhance the ability to compute statistics sub-nationally. The 56th round survey undertaken in 2000/01 is a 'thin' round survey with a smaller sample size (81,488 households). The data in this latter survey were employed by Chattapadhyay & Chowdhury (2010) because the 1999/2000 thick round survey used an unusual two-period reference period rendering poverty and calorie consumption estimates non-comparable with the other rounds without complicated compensatory data manipulation (Deaton and Kozel 2005).

2. The debate over the causes of declining calorie consumption in India: a critical review

A number of explanations have been proposed for the measured declines in calorie consumption in India in the face of rising incomes. One explanation, mentioned earlier in Rao (2000) and Palmer-Jones (2005) and given recent prominence in Deaton and Drèze (2009), is that they are rooted in falling calorie requirements. The hypothesis is that increased mechanization of agricultural and domestic technologies and of transport have reduced physical activity, leading to a reduction in the energy required by the average Indian.[4] The reasoning is that people have voluntarily reduced their calorie consumption even as their incomes have increased because they need less food. The calorie requirements hypothesis is used to explain the pattern of downward shifting calorie Engle curves[5] over time using data from successive HCESs (Deaton and Drèze 2009).

It is intuitively plausible and well-accepted among nutritionists that calorie consumption is positively correlated with calorie requirements (Institute of Medicine 2000; Mason 2002). Further, there is no doubt that there have been declines in physical activity over time in India, although current evidence suggests that this decline is slow in comparison with the experience of other countries undergoing strong economic growth.[6] However, calorie requirements depend not only on energy expenditure, but also on age, sex, body composition and body size (UNU, WHO and FAO 2004). While actual energy requirements of individuals based on *all* these factors have not been estimated for the Indian population, FAO reports national per-capita requirements derived from age, sex and height data and assuming a constant 'light' physical activity level (FAO 2012b). Over the 20-year period from 1992 to 2012, this requirement increased by close to 100 kcals, from 2,163 to 2,258.[7] The increase is associated with the aging of the population (an increased proportion of adults, who are taller and heavier) and increasing heights in all age groups.[8] Thus, when additional determining factors are taken into account, it is not self-evident that calorie requirements have actually in fact been declining.

Consider also that, contrary to the abnormal trends over time and consistent with the general tendency worldwide,[9] cross-sectional data from India's HCESs and other surveys show a sharp increase in calorie consumption per capita as incomes rise. The increase tends to be steeper for poorer households (Deaton and Drèze 2009; Gaiha, Jha and Kulkarni 2009), who are at most risk of undernourishment.

As pointed out by Patnaik (2010b), the decline in calorie consumption from an already low point in conjunction with increased incomes is also abnormal in relation to international experience as well as India's own earlier trends. Stagnant or declining calorie consumption during periods of economic growth are a rare phenomenon, possibly occurring in only two other known instances: China between 1985 and 1992 and England during the Industrial Revolution (Du *et al.* 2001 and

---

4 Another possible factor cited for the reduction of energy requirements is health environment improvements that reduce the need for calories to recover from illness (Deaton and Drèze 2009).

5 The Engle curves show the (cross-sectional) relationship between income and calorie consumption.

6 Evidence is presented in Ng and Popkin (2012) who, using data collected from 2000 to 2005, document slight declines in occupational, domestic, and travel-related physical activity, accompanied by no change in being sedentary.

7 These requirements are referred to as 'average' requirements for light activity recommended by UNU, WHO and FAO (2004). 'Minimum' requirements are used for FAO's calculations of undernourishment and for the estimates reported in Figure 1.

8 Data on the latter trend are reported in Deaton and Drèze (2009) and Ramachandran (2008). The increase in the estimated requirement attributable to height changes came with an update using height data from the 2005/06 Family Health Survey, which collected data for both women and men for the first time. Estimates for earlier years were based on heights reported in James and Schofield (1990) (Cinzia Cerri, FAO Statistics Division, Personal Communication, November 13, 2012).

9 A positive relationship between income and calorie consumption has been found in virtually all analyses using HCES data but with varying strength in that relationship depending on the location, data source, and methodology (Bouis and Haddad 2002; Salois, Tiffin and Balcombe 2010).

Clark *et al.* 1995, cited in Eli and Li 2012). If a pattern of declining calorie requirements were strong and persistent enough to completely reverse the income-induced upward course of calorie consumption, we would expect it to have occurred in the many other countries experiencing similar technological and economic transformations. And the anomaly would eventually begin to appear in aggregate income and calorie consumption statistics. However, there are only a handful of countries in the world for which there is a negative correlation over time between GDP per capita and calories available for human consumption as measured by per-capita dietary energy supply.[10] India is not one of these countries (see also Section 3 below). Note that Eli and Li (2012) formally test the declining calorie requirements hypothesis using India's HCES data and only taking into account the physical activity component of requirements. They find it to be only a partial explanation at best, concluding that other factors explain the majority of the decline.

A second explanation commonly put forth for declining calorie consumption in India is that people have been forced to reduce their food consumption due to an increase in the price of food over time (e.g., Gaiha, Jha and Kilkarni 2009, 2010; Patnaik 2010a). Indeed, nominal food prices have been rising in India, but the important trend of interest when income is increasing is the price of food relative to non-foods. According to Deaton and Drèze (2009), there has been no increase in the ratio of food to non-food prices over the period of the decline in calorie consumption per capita; there has in fact been a decline. Still, some sort of 'budget squeeze' that forces households to reduce their food consumption to meet other basic needs may be at work (Basu and Basole 2012).

A third explanation focuses on increasing poverty. There is substantial literature on the proposition that poverty is being incorrectly measured in India because a money-metric poverty line delinked from calorie requirements is employed. Proponents of this view state that if poverty were measured using a calorie-based poverty line, it would become clear that the population of India has become increasingly impoverished (Patnaik 2010; InfoChange India 2009; Ray 2007).[11] Yet the NSSO surveys from 1983-on confirm that along with the growth of the Indian economy there has been an increase in the average Indian household's income as measured by real total expenditures per capita, including households in the lowest income quintiles (Deaton and Drèze 2009). Thus this argument still begs the question of why the average household's calorie consumption would be declining when its real income is increasing.

In a fourth explanation, Landy (2010) proposes that calorie consumption is declining in India because of its high 'cultural density', which acts as a buffer against the adoption of high calorie Western-world food habits. The typical pattern of countries with rapid economic growth is for calorie intake to increase to a point where sufficiency is reached, followed by a diversification of diets away from cereals and towards more expensive sources of calories. However, according to this hypothesis, in India's own unique nutrition transition model, lowered cereal consumption is not compensated for by increases in consumption of more costly calories. This theory is undermined by the ample evidence that high-calorie, Western-world food habits are being adopted en force in India (see next section).

Finally, a fifth explanation has been offered by Banerjee and Duflo (2011) in their article 'More than 1 billion people are hungry in the world. But what if the experts are wrong?' The authors question whether poor Indians are truly hungry in the first place and hypothesize that, in keeping with the basic human need for a pleasant life, they do not increase their consumption of food when their incomes rise because they prioritize luxuries, such as televisions and celebrations, over food.

---

[10] Among the 134 countries for which data are available for both GDP per capita and per-capita dietary energy supply for over 20 years between 1980 and 2009, a statistically significant ($p<0.01$), negative correlation can only be detected for Brunei Darussalem and Gabon. Source: Author's calculations based on data from World Bank (2012) and FAO (2012c).

[11] Palmer-Jones and Dubey (2010), Palmer-Jones (2005), and Deaton and Drèze (2009) discuss the empirical issues related to poverty measurement.

The declining calorie requirements hypothesis and those of Landy (2010) and Banerjee and Duflo (2011) have in common an underlying assumption that reductions in food and calorie consumption are based on willful choices by people. However, not only has estimated calorie consumption declined in India, measured undernourishment – a deficiency of calories – has risen as well (see Figure 1), implying that some people have willingly entered into a state of hunger. To comprehend the implausibility of such behavior, it is important to understand how undernourishment is estimated.

Formally, energy requirements are 'the amount of food energy needed to balance energy expenditure in order to maintain body size, body composition, and a level of necessary and desirable physical activity consistent with long-term good health,' which varies by physical activity level (UNU, WHO and FAO 2004, p. 4). Although humans can adapt to situations of energy intake below such a requirement, this may entail 'biological and behavioral penalties,' including reduced growth velocity (for children), loss of lean body mass, increased risk of disease, forced rest periods, and physical or social limitations in performing certain activities and tasks. When choosing which energy requirements to employ, analysts have a choice of both activity level and, since requirements vary across individuals according to their individual metabolism, which percentile of the requirements distribution to use. The prevalences of undernourishment reported in this paper are estimated using the 'minimum energy requirement' employed by FAO. The requirement assumes the lowest possible activity level (light) and the energy requirement for the *bottom fifth* percentile of the requirement distribution (Sibrián, Seevalingum and Mernies 2008). It is the most conservative requirement in use. People consuming calories below it are highly likely to be in a state of calorie deficiency (especially those with a high physical activity level), to be subjected to some of the penalties mentioned above, and to experience the physical sensation of hunger. Obtaining more food is certainly a top priority for them.

The fact that declining measured calorie consumption in India is mirrored by increased measured undernourishment calls into question any explanation founded on voluntary reductions in food consumption. It is simply not plausible that segments of the population who formerly had enough to eat would begin to eat less than they need for basic human functioning when their income starts to increase.

In sum, previous explanations given for the declining trend in calorie consumption in India are implausible given the available evidence, although some may serve as partial explanations. It is noticeable that the entire Indian calorie debate has taken place under the assumption that the data from which trends in calorie consumption and undernourishment have been identified are correctly collected from households. Further, it has taken place largely outside of context of the nutrition and epidemiological transitions that have accompanied rapid economic growth, an understanding of which is important for appraising trends in calorie consumption in India. Before looking into the issue of measurement, the next two sections give an overview of this context.

3. India's economic, nutrition, and epidemiological transitions

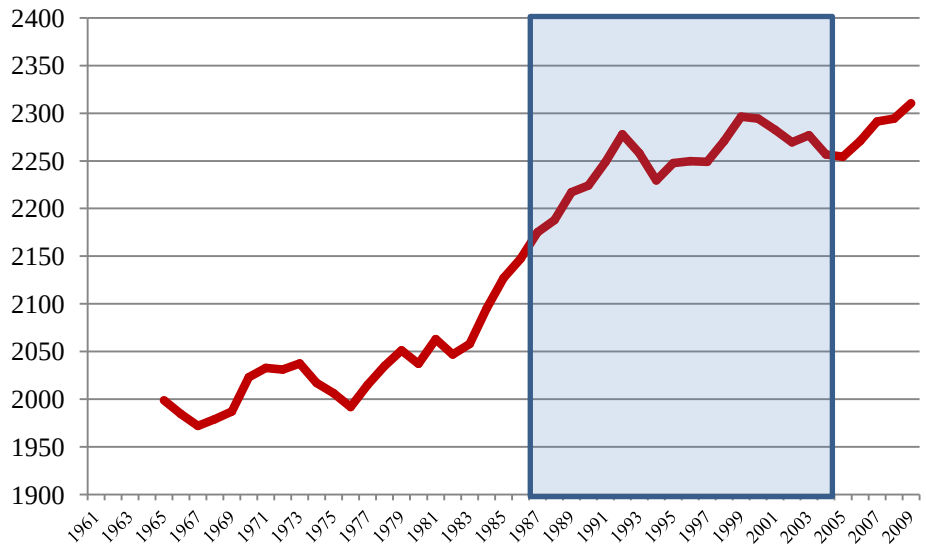
India has undergone wide-ranging transformation over the last few decades marked by economic, nutrition, and epidemiological transitions that have changed the lifestyles, living conditions, and well-being of its people in many ways.

The economic transition has been manifested in steady and strong increases in national income per capita that accelerated after liberalization of the economy in the 1990s in what has been referred to as a 'spectacular take-off'. Between 1990 and 2010, real Gross Domestic Product (GDP) per capita grew at close to five percent a year, with more recent rates being close to eight percent (Drèze and Sen 2011). The rate for 2011, at 8.5 percent, was the second-highest in the world after China (Economic Times, 2011).

Economic transformation has been accompanied by steady urbanization. The percent of the population that lived in urban areas was 17.3 percent in 1950. It had risen to 30 percent by 2008 and is expected to rise to 40 percent as early as 2030 (McKinsey & Company 2010).

With respect to food availability, over the last six decades India has gone from a situation of chronic food shortages to food self-sufficiency. It now has a food surplus and is a net exporter of many foods (Ramachandran 2008). Figure 2 shows that the amount of calories in the food available for human consumption measured on a per capita basis has been increasing more or less steadily since the mid-1960s. Notably, it rose by nearly 90 calories between 1987 and 2005, the period of measured increases in undernourishment.

Figure 2. Trends in per-capita dietary energy supply, 1961–2005

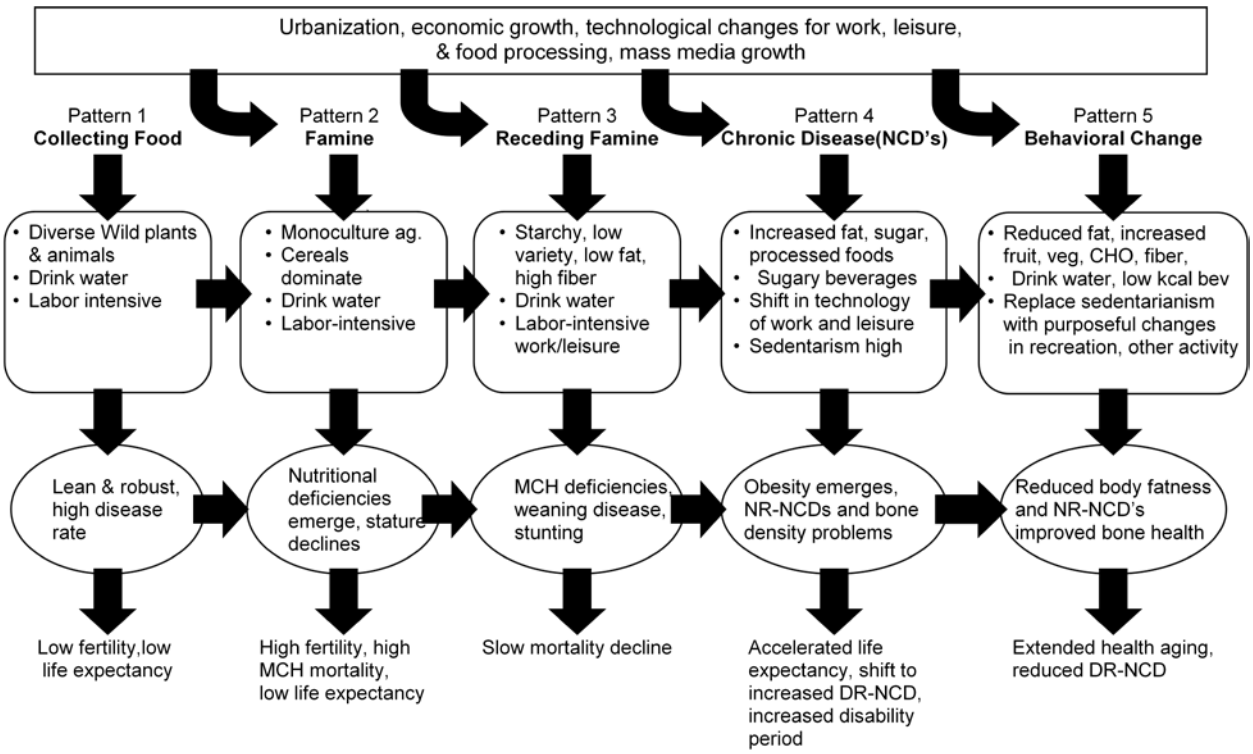


Note: Trend line based on a five-period moving average.
Data source: FAOSTAT (FAO 2012c).

Meanwhile, the country has fully embarked on its 'nutrition transition,' that is, changes in diet composition and physical activity that appear with increased incomes, urbanization, and globalization. Countries undergoing the nutrition transition typically do so in phases, with a typology given in Figure 3. The transition starts with a 'hunter-gatherers' phase. It then

progresses through three stages where the composition of the diet shifts from being cereal-focused (Pattern 2) to being characterized as low-variety, low-fat and high fiber (Pattern 3), and then to a diet containing increased fat, sugar, and processed foods along with caloric beverages instead of water (Pattern 4). In the last stage, fitting some populations in Western countries, people take on a healthier, lower calorie diet with reduced fat and increased fiber. Concurrent with these stages, populations generally move from a situation of famine and nutritional deficiencies, through receding famine, increased obesity and diet-related non-communicable diseases (NCDs), and finally to extended healthy aging.

Figure 3: Stages of the nutrition transition



Source: Popkin (2006).

As the information presented in this section demonstrates, India appears to have transitioned from being situated somewhere between Pattern 2 and Pattern 3 in the 1950s to its current Pattern 4 diet. Along with fast-paced economic growth and the increased economic integration and communication of globalization have come 'tectonic shifts' in the Indian diet (Gulati 2004). In the 1980s, consumption of animal products, spices, and oil crops rose, signaling the start of dietary diversification, but rice and pulses, the traditional staples, saw increases as well. The pattern of food consumption changed more dramatically in the 1990s, with rising consumption of more energy-dense foods. There were marked increases in the consumption of animal products, especially animal fats, in vegetable oils, sugar and sweeteners, fruits and wheat (a non-traditional cereal in India), with declining consumption of rice and pulses. There were also significant increases in the consumption of starchy roots in the form of potatoes, often associated with the consumption of french fries and potato chips (Pingali and Khwaja 2004; Ramachandran 2006, 2008).

Economic and nutrition transition has been accompanied by dramatic reductions in undernutrition as measured using anthropometric techniques (that is, measuring peoples'

heights and weights). Data from nine of India's 25 states and Union Territories collected by the National Nutrition Monitoring Bureau (NNMB), while not nationally representative, give the longest-term perspective. In the late 1970s, over 50 percent of women were underweight, suffering from chronic energy deficiency (CED) (see Table 1). The prevalence had fallen to 36 percent by 2005. The reduction for men was even greater. Continued improvements in nutritional status among Indian women nationally are confirmed by data from India's National Family Health Surveys (NFHS), which document a decline in CED from 36 to 33 percent between 1999 and 2006 (IIPS and Macro International 2007).

Table 1. Prevalences of undernutrition and overnutrition among adults and preschool children in rural areas of nine Indian states, 1975–2005

	1975–79	1988–90	1996–97	2000–01	2004–05
Undernutrition (chronic energy deficiency) among adults					
Women	51.8	49.3	47.7	39.3	36.0
Men	55.6	49.0	45.5	37.4	33.0
Overweight among adults					
Women	3.4	4.1	6.0	8.2	12.7
Men	2.3	2.6	4.1	5.7	8.5
Malnutrition among preschool children					
Underweight	77.0	69.0	62.0	60.0	55.0
Stunting	79.0	65.0	58.0	49.0	51.5

Notes: Adults are classified as chronically energy deficient if their body mass index (BMI) is < 18.5.

They are classified as overweight if their BMI is > 25.0. Preschool children are classified as underweight (stunted) if their weight-for-age (height-for-age) z-score is less than -2 standard deviations below the median of the NCHS reference population.

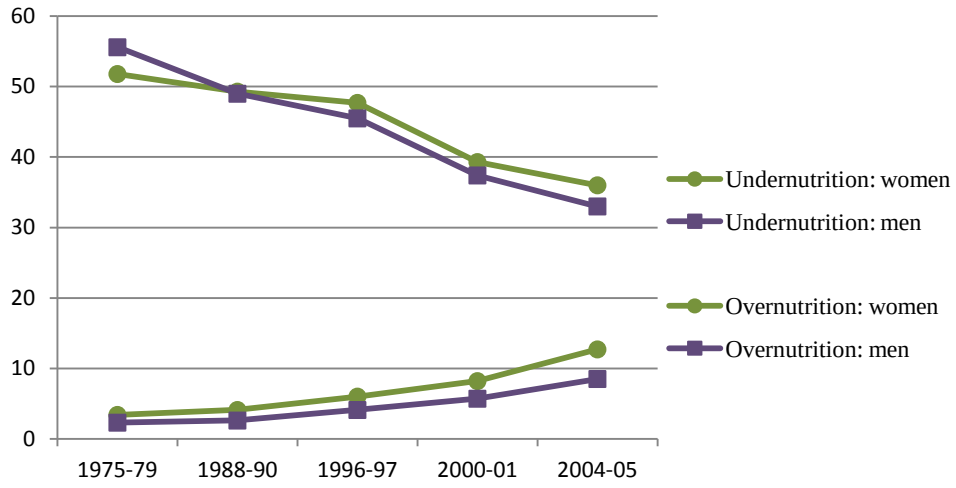
Sources: National Nutrition Monitoring Bureau (NNMB) surveys and reported in Ramachandran 2006, 2008 and NNMB 2006.

Long-term trends in malnutrition among children indicate the same. Data from the NNMB surveys show a decline in the prevalence of stunting among children one to five years old from a widespread 79 percent in the late 1970s to a much lower (although still unacceptably high) 52 percent by 2005. The NFHS data confirm that stunting continues to decline nationally, with the prevalence among children under three falling from 51.0 to 44.9 from 1999 to 2006 (IIPS and Macro International 2007).[12] Note that the declines in child malnutrition have nevertheless been slow compared to other countries undergoing rapid economic growth, with contributing factors including a weak public health system, poor access to clean water and sanitation, inefficiencies in national nutrition and food security programs, poor governance, and continued discrimination based on gender and caste (Haddad 2011).

Meanwhile, overweight and obesity rates are on the rise, inducing a classic 'double burden of malnutrition.' Figure 4 depicts India's double burden for adults, showing a consistent pattern of simultaneous high, though falling, undernutrition and rising overnutrition. The prevalence of overweight among women in the rural NNMB sample nearly quadrupled between 1975 and 2005, rising from 3.4 to 12.7 percent. Data from the NFHS surveys confirm growing obesity. As of 2006, over 30 percent of women from the highest wealth quintile were overweight (IIPS and Macro International 2007).

[12] These estimates were calculated using the WHO 2006 reference (de Onis *et al.* 2004) Note that some reported estimates use the old NCHS reference for 1998-99 and the WHO 2006 reference for 2005-06, which compromises the comparability of the estimates.

Figure 4: The 'double burden' of malnutrition in India: Prevalences of undernutrition and overnutrition among adults in rural areas of nine Indian states, 1975–2005



Source: See Table 1.

India's concurrent epidemiological transition has brought with it a major increase in life expectancy at birth, from 37 years in 1950 to 65 in 2000 (Ramachandran 2008). Infectious and parasitic diseases are declining as causes of mortality (Popkin *et al.* 2001). However, as elsewhere, the increase in overweight and obesity has been paralleled by a rise in NCDs, including diabetes, hypertension, and cardiovascular disease (Ramachandran 2006, 2008). Self-reports of NCDs indicate that, as of 2005, the prevalence of high blood pressure was 26 percent, that of heart disease 9.2, and that of diabetes 15.7 (Gaiha, Jha and Kulkarni 2010). India now has the largest number of people with diabetes of any country in the world, with an estimated 50.8 million in 2009 (The Hindu 2012) and projected 219.3 million by 2025 (Reddy 2009).

Overweight and NCD prevalences are strongly and positively related to income and urban residence in India (Gaiha, Jha and Kulkarni 2010; Subramanian and Smith 2006). Thus, if the pattern of increased incomes and urbanization continue without drastic changes in lifestyles, we can expect their prevalences to continue increasing rapidly. Popkin *et al.* (2001) estimate that given current trends the overweight prevalence will increase to 24 percent by 2025, nearly a quarter of all people. However, overweight and NCDs are not confined to high-income, urban households. As evidence in point, the prevalences of high blood pressure and heart disease are higher than the national prevalence in urban slums, at 35.6 and 12.6 percent, respectively (Gaiha, Jha and Kulkarni 2010). Surveys conducted in a low-income urban area of the Western region and in rural Tamil Nadu found that over 35 percent of adults were overweight (Wang *et al.* 2009; Kaur *et al.* 2011).

Undoubtedly, one cause of increasing overweight and NCDs in India is the reduced physical activity levels referred to in the last section. However, becoming overweight is a consequence of energy intake exceeding energy expenditure, and increases in overweight are typically associated with changes in dietary patterns and increased calorie consumption as well (Pourhassan and Najafabadi 2009; Stubbs and Lee 2004; Shetty 2002).[13] As shown empirically

[13] An exploratory study by Bleich, *et al.* (2008) indicates that rising obesity in the developed world has been primarily the result of consuming more calories rather than reduced physical activity.

by Gaiha, Jha and Kulkarni (2010), in India calorie consumption is a strong determinant of diet-related NCDs. Their study suggests that increased incidences of overweight and NCDs can be partly attributed to the fact that people are eating more food or more energy-dense foods, that is, consuming more calories.

Further confirmation that people are eating more comes from self-assessments of hunger and food insecurity. As part of India's HCESs, respondents are asked whether they got 'two square meals a day' (1983 and 1993–94 surveys) or 'enough food every day' (starting with the 1999–2000 survey). The percent of respondents reporting lack of sufficient food fell precipitously from 17.3 in 1983 to 2.5 in 2005 (Deaton and Drèze 2009). An ample drop is corroborated by Gallup World Poll data collected on self-assessments of food insecurity (Heady 2013). Here the question asked is 'Have there been times in the past 12 months when you did not have enough money to buy the food that you or your family needed?' The percent of respondents answering 'yes' fell from 22 to 13 in the short period between 2008 and 2012.[14]

To summarize, in recent decades India has experienced:

- Rapid and sustained economic growth along with rising calorie availability;
- An increasingly diversified diet, with decreased consumption of food grains and increased consumption of energy-dense foods containing more fats and sugar;
- The emergence of a 'double burden of malnutrition,' with continued high, though falling, prevalences of undernutrition accompanied by increases in overweight and obesity;
- Increasing prevalences of diet-related NCDs, of which calorie consumption is a central determinant; and
- Greatly reduced self-reported hunger and food insecurity.

These trends are a strong indication that the average Indian's food consumption and, in particular, calorie consumption has been increasing rather than decreasing over time. They are consistent with the experience of other countries undergoing the nutrition transition that has accompanied increased incomes, globalization and urbanization.

4. The rising importance of food consumed away from home

A key shift that typically occurs during countries' nutrition transitions is an increase in the consumption of food prepared and consumed outside of the home (Maxwell and Slater 2003; FAO 2006a; Popkin 2008). As shown in this section, India is no exception. Eating outside of the home traditionally centered on 'in kind' sources, whether in the form of free meals from employers of the many landless laborers in rural India or eating at the homes of neighbors, friends, and relatives. While there has been an increase in free school meals, recent increases are fueled by purchases in commercial establishments.

In India as elsewhere, rising incomes have been a major force leading to increased consumption of food away from home (Gaiha, Jha and Kulkarni 2009; Pingali and Kwaja 2004),[15] which in other settings has tended to increase faster with incomes than food consumed at home (Senauer 2006; Gale and Huang 2007). Additional factors driving the trend are: new

[14] Data provided by Derek Heady (IFPRI), November 26, 2012.

[15] For studies on the relationship between food consumed away and income from other developing countries see Gale and Huang 2007 and Ma *et al.* 2006 (China); Senauer 2006 (Peru); and Islam *et al.* 2009 (Malaysia). Smith, Dupriez and Troubat (2013) present evidence on increases in food consumed away from home from Egypt, Mauritius, urban China, and the United States, the latter for which the longest time series is available.

sources of transportation, which increase the ease with which people can travel farther away from their homes; urbanization, which brings increasingly larger concentrations of people together in one location; globalization, with its advertising and messages that urge people to eat in restaurants with new foods; and the fact that as people, especially women, begin to take on paid jobs, the time for shopping and preparing foods is more limited, making it more cost-effective to purchase cooked foods (Pingali and Kwaja 2004).

Another major driver reinforcing consumption of food away is increases in the supply of prepared foods for purchase in commercial establishments (Pingali and Kwaja 2004). In recent years India has witnessed a steady and strong expansion of restaurants and fast-food outlets. As manifested in a long list of U.S.-based restaurants and fast food chains,[16] global retail and restaurant chains have aggressively expanded into India, proactively targeting the 60 percent of its large and receptive population under the age of 30 (Chatterjee and Singh 2011). While globalization has made fast food more easily accessible, and Indians have 'taken Western junk food to heart,' India has its own array of high-calorie fried snacks and indeed has sprouted its own modern-style, fast-food chains, such as Jumbo King, whose owner was inspired by McDonald's (India Knowledge@Wharton 2008; Sukhdev 2008). In a global on-line consumer survey conducted by ACNielsen in 2004 to assess the market in the 'out-of home, fast food, and impulse sector,' 37 percent of respondents in India claimed to eat take-away at least once a week, compared to only 35 percent in the United States (Ng 2005). While being from an on-line survey this result is not representative of the population of India, it is indicative of the degree to which fast food consumption has taken hold among some population sub-groups.

Retail establishments selling prepared and packaged foods are another growing source of food for consumption away from home in India. India's vibrant food retail economy has long been dominated by traditional 'kirana' shops, hawkers, and wet market stall operators. However, the first decade of this century witnessed a 'roaring supermarket revolution'. Modern supermarkets are quickly becoming a new source of prepared, processed and convenience foods for consumption both inside and outside the home (Reardon and Gulati 2008a), with supermarket sales growing five times faster than per-capita GDP. In an atypical pattern, supermarket hubs expanded into rural areas early on (Pingali and Khwaja 2004; Reardon and Gulati 2008a,b). According to an exploratory analysis by Senauer (2006), India's high-value food market, including food consumed away from home and prepared foods, was already growing precipitously in the 1990s. By 2005, the AT Kerney Global Retail Development Index had ranked India as the number one most attractive market and single-country investment opportunity for global food retailers and packaged-goods manufacturers. According to McKinsey & Company (2007), if India continues on its current high economic growth path, it will become the world's biggest consumer market by 2025, and food, beverages, and tobacco will continue to be the largest category of Indian spending.

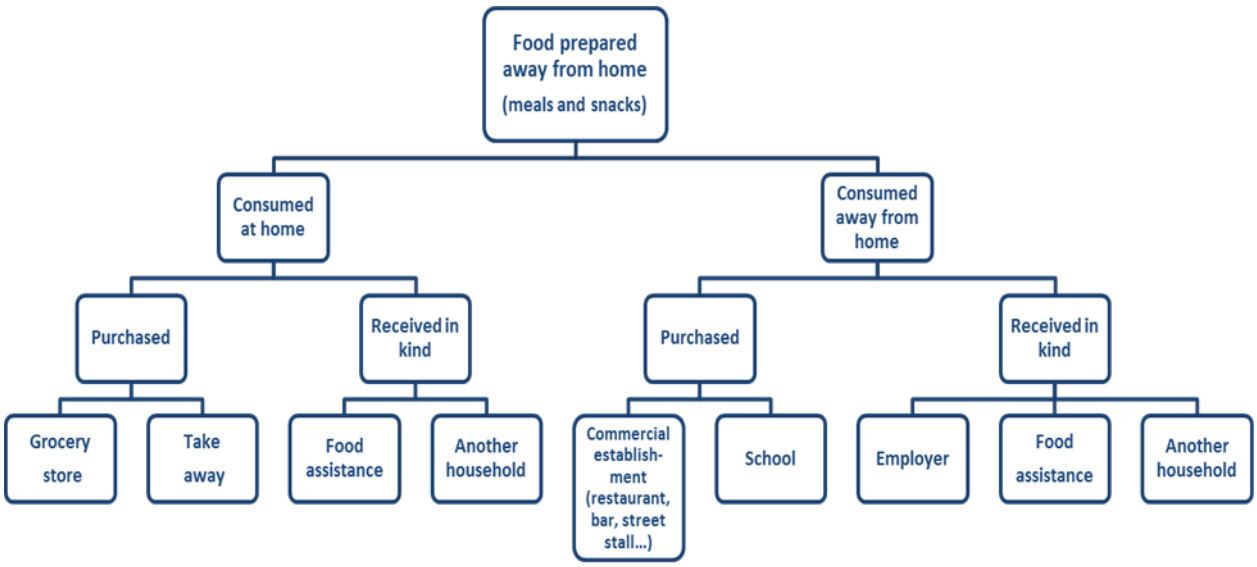
[16] As of 2008, these included (listed in order from best to worst from the standpoint of the calorie, sodium and fat content of meals served to customers):

1. Subway	13. Cold Stone Creamery	25. Pizza Hut
2. Wendy's	14. Taco Bell	26. Baja Fresh
3. McDonald's	15. Ruby Tuesday	27. Chipotle
4. Kentucky Fried Chicken	16. Chili's	28. Krispy Kreme
5. Arby's	17. Chuck E Cheese	29. Romano's Macaroni Grill
6. Panera Bread	18. Dunkin' Donuts	30. T.G.I. Friday's
7. Domino's	19. Jack in the Box	31. Applebees
8. Ben and Jerry's	20. Starbucks	32. IHOP
9. Quizno's	21. Uno Chicago Grill	33. Olive Garden
10. Papa John's	22. Baskin Robbins	34. Outback
11. Au Bon Pain	23. Dairy Queen	35. Red Lobster
12. Burger King	24. P.F. Chang's	

Source: Domain-b.com (2008).

Given this background, survey evidence is next presented on how widespread consumption of food away from home is in India and how it has changed over time. The data come from the 2005 *India Human Development Survey* and the household roster modules of the country's HCESs. Figure 5 gives a typology of food away from home that helps to consider it in a comprehensive manner, including type of consumption (whether meals or snacks), place of consumption (at home or away), mode of acquisition (purchases or in-kind receipts), and source of acquisition (commercial establishments, schools, employers, food aid, and other households).

Figure 5. Typology of food away from home



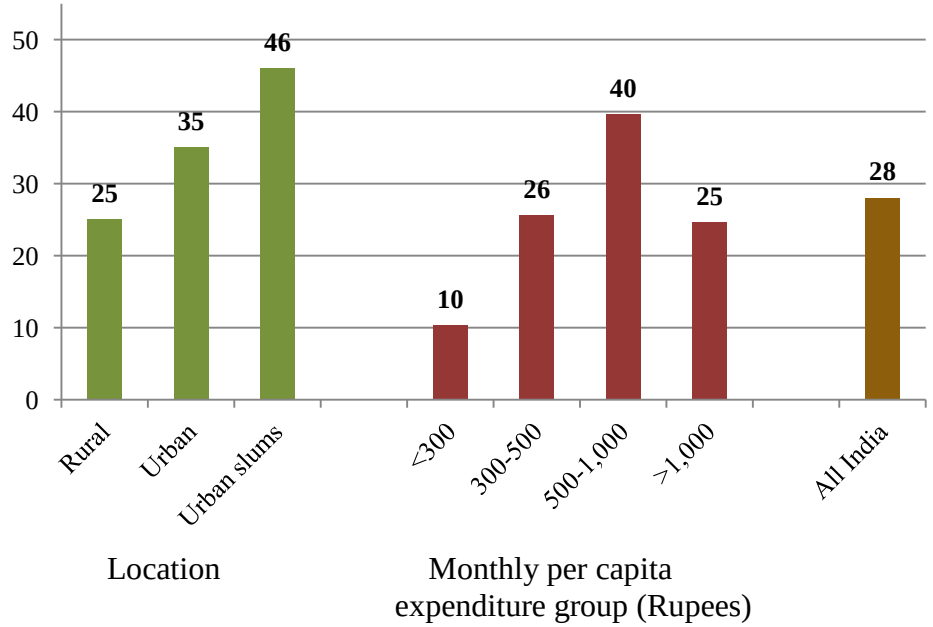
Source: Smith and Frankenberger (2012).

4.1 Evidence on food consumed away from the *India Human Development Survey*

The *India Human Development Survey 2005* (*IHDS*) provides the most recent evidence on food purchased in commercial establishments and then consumed outside of the home in India. It is a nationally-representative survey of over 41,000 households conducted by the University of Maryland and India's National Council of Applied Economic Research (Desai *et al.* 2010). As part of the expenditures module of the survey, households were asked to report on their consumption of food eaten out in the last 30 days, where 'eating out' is defined as consuming meals or snacks served in restaurants, roadside eating places, tea and snack shops, and served by food vendors.

Using *IHDS* data, Gaiha, Jha and Kulkarni (2009) find that 28 percent of households in India had spent cash income on food away in the previous month. As can be seen in Figure 6, the data confirm that eating out is more prevalent in urban than rural areas, although it is not an exclusively urban phenomenon. The figure shows a sharp increase in eating out as incomes rise, although there is a drop for the most wealthy. The bottom two income groups can be considered 'poor' (falling below the official poverty line). For these groups, the percentage of households spending cash income on food away is not negligible: 10 percent in the lowest group and 26 percent in the second-lowest. That eating out is not only an urban, middle-class phenomenon is reinforced by the fact that a full 46 percent of households in urban slums had a member who ate out. This exceptionally high prevalence may be linked to the fact the many slum households do not have kitchens (Frankenberger 2010).

Figure 6: IHDS estimates of the percent of households consuming purchased meals and snacks away from home in India (30-day recall), 2005



Source: Reported in Gaiha, Jha and Kulkarni (2009) based on data from the *India Human Development Survey 2005.*

4.2 Evidence on food consumed away from India's HCESs

As part of the household roster module of all recent HCESs, respondents are asked to report on the number of meals each household member consumed away from home during the previous 30 days. These data are the only available for looking at trends over time in food away from home consumption. Respondents are asked to report on food away in the following four categories: purchased, consumed at school, provided by an employer, and 'other' meals free of cost. The latter likely includes meals received as free assistance and from other households.

Table 2 reports the percentage of households that reported a member consuming at least one meal away from home for India as a whole and in urban and rural areas. The data are from four HCESs, including that collected in 2004–05, near the time in which the *IHDS* data were collected. According to the HCES data, in that year only six percent of households consumed meals in commercial establishments outside of the home, which is notably far lower than the near 30 percent calculated using *IHDS* data for the same (30-day) recall period. Some of this difference may be due to the fact that data are collected on snacks as well as meals in the *IHDS* surveys. However the large discrepancy suggests that the consumption of purchased meals outside of the home may be significantly underreported in India's HCESs, perhaps having to do with the sequencing and wording of the questions asked by interviewers.

Table 2. HCES estimates of the percent of households consuming meals away from home (30-day recall), by survey year

	1993/94	1999/2000	2004/05	2009/10
All India				
Purchased meals	6.0	5.4	6.1	9.0
Meals received in kind				
Consumed at school	2.6	4.0	15.3	20.0
Provided by employer	2.3	1.5	1.7	1.4
'Other free meals'	15.4	13.2	16.2	16.0
Any type of meal consumed away	23.3	21.5	33.7	39.4
Urban				
Purchased meals	10.4	9.7	10.8	16.4
Meals received in kind				
Consumed at school	2.2	2.4	6.6	8.1
Provided by employer	1.8	1.6	1.6	1.8
'Other free meals'	16.5	14.4	16.6	15.2
Any type of meal consumed away	26.8	24.6	30.4	35.0
Rural				
Purchased meals	4.4	3.8	4.3	5.9
Meals received in kind				
Consumed at school	2.7	4.6	18.6	25.0
Provided by employer	2.5	1.5	1.7	1.2
'Other free meals'	14.9	12.8	16.1	16.3
Any type of meal consumed away	22.1	20.3	34.9	41.2

Source: Author's calculations from data collected as part of the household roster modules of India's Household Consumption and Expenditure Surveys.

Table 2 nevertheless points clearly to the fact that meals received in kind and consumed outside of the home are an important source of food in India. For the latest year for which data are available, 2009/10, 20 percent of households reported that a member consumed a meal at school, and 16 percent that a member consumed 'other free meals' such as at a friend's home. The data also corroborate the *IHDS* data in that the prevalence of purchasing meals away is higher in urban than rural areas.

According to the data, India-wide, the percent of households consuming meals away from home rose precipitously between 1994 and 2010, from 23 to 39 percent. Consistent with the economic and nutrition transitions described above, the data indicate a marked increase in the percent of households with members purchasing meals in commercial establishments. The increase was largest in urban areas, rising from 10 to 16 percent. A particularly sharp increase was registered between 2005 and 2010. The increase in the consumption of meals at schools in rural areas is presumably due to the expansion of the mid-day meal scheme, described in Parikh and Yasmeen (2004).

5. Is food consumed away from home being counted in estimates of calorie consumption?

The evidence presented in the last section suggests that eating purchased food away from home is a common phenomenon in India, crosses the urban/rural and income divides, and is rising. Eating food away provided by schools is also common and increasing. In this section whether this food is being counted in estimates of calorie consumption derived from the data collected in the expenditures modules of India's HCESs is examined. If not, since food consumed at home and away from home are substitutes, then calorie consumption estimates will be increasingly downward biased over time. Any downward bias is expected to be greater if food consumed away from home is more calorie dense than food consumed at home, as it is in the United States (Poti and Popkin 2011; Mancino, Todd and Lin 2009). The section also discusses whether food consumed away is being included in estimates of calorie consumption derived from an alternative data source, India's rural food consumption surveys. The data collected in these surveys also record a decline in calorie consumption over time.

5.1 Evidence from India's 1999/2000 HCES

The food expenditure modules of India's HCESs were originally set up to collect data on the consumption of and expenditures on individual foods destined for in-home preparation and consumption, including foods purchased, home produced, and received in kind. Unlike the recent HCESs of most developing countries, there is no food category specifically referring to food consumed away from home, which tends to contain multi-ingredient, processed food products. There are ten items referring to the latter types of food, however: Cooked meals, Cold beverages (bottled/canned), Fruit juice and shake, Biscuits, Salted refreshments, Prepared sweets, Cake/ pastry, Pickles, Sauce, and Jam/jelly.[17] Reported quantities consumed of these food items may be fully or partially picking up on food being consumed outside of the home.

As mentioned in the last section, data on meals consumed away are collected in the household roster module of the HCESs for the same households for which the consumption and expenditures data are collected. Here, propensity score matching (PSM) (Khandker, Koolwal and Samad 2010) is used to draw on these two sets of data to test whether consuming a meal away has a statistically significant, positive association with estimated calorie consumption per capita. Data from the 1999/2000 HCES are employed for this analysis.[18] For background, seven percent of survey households reported consuming 'cooked meals,' which is far less than the 22 percent that reported consuming a meal outside the home (Table 2).

PSM, typically used in project impact evaluation, is employed here to match sample households that report consuming food away from home in the roster module with sample households that do not but that are identical in terms of observed characteristics that are important determinants of calorie and food-away-from-home consumption. The non-consuming households then serve as a control group. After matching, if the total estimated calories consumed of the 'treated' households that do consume food away is not larger than that of the control group, we can conclude that the reported meals away are not being counted in estimates of calorie consumption.

The PSM analysis is carried out in three steps: 1) Estimate a probit 'treatment' model using the data for all sample households to compute a probability of consuming meals away from home, or 'propensity score,' for each household conditional on relevant observed characteristics. The

[17] This list refers to surveys up to and including the 2004/05 survey.

[18] The 1999/2000 data are used because the necessary processed data for both the main variable of interest (calories per-capita) and variables measuring its main determinants were available to the author at the time of the analysis. These data were processed as part of the International Food Policy Research Institute AFINS project (Smith and Subandoro 2007)

characteristics are: household size and age-sex composition, gender and age of the household head, education levels of adults, total expenditures per capita, a dummy variable for urban residence, and a dummy variable for each of India's states to account for state-specific factors such as exposure to globalization and availability of eating establishments; 2) Match households reporting positive food consumed away with non-consuming households having similar propensity scores; 3) Compute the difference in the estimated calorie consumption of the matched groups of consuming and non-consuming (control) households, or the 'average treatment effect on the treated' (ATT).

Accurate estimation of the ATT rests on two key assumptions. The first, 'conditional independence,' is that FCAFH is determined entirely by the observed characteristics used to compute the propensity scores. Given the complex causality of food consumption behavior, it is difficult to fulfill this assumption with the available data. The set of characteristics employed here nevertheless broadly captures the most important known determinants, including demographic traits of households, income, and urban residence. The second assumption is 'common support,' that is, that the treatment observations have control group observations nearby in the propensity score distribution, which is testable with the data. As shown by Rosenbaum and Rubin (1983), when the conditional independence and common support conditions are satisfied, matching on the propensity score gives the same ATT as matching simultaneously on all of the characteristics. PSM is conducted using PSMATCH2 in STATA along with PSTEST to evaluate matching effectiveness (Leuven and Sianesi 2003).[19] A chi-squared test for the joint significance of the characteristics used to predict the propensity scores in determining participation after matching is used to test for matching effectiveness. If the characteristics are no longer jointly significant ($p>0.10$), then matching is considered to have succeeded.

The probit regression results for the overall incidence of consuming meals away from home can be found in the appendix. Of note, they confirm a strong positive relationship between total expenditures per capita and consuming a meal away from home. Table 3 contains the PSM results, with meals broken down by source of acquisition. For all sources and the overall incidence of consuming meals away from home, there is ample common support in the control group propensity score distribution (column C). The chi-squared test for matching quality yields p-values that are not statistically significant (column D), signifying no difference between the treatment and control groups in the characteristics used to estimate propensity scores.

According to the results, the meals taken away from home recorded in the household roster module of India's HCESs are not being counted in estimates of calorie consumption. School meals and purchased meals away have no statistically significant association with measured calorie consumption. Whether a household member consumes a meal provided by an employer and 'other meals' received in kind appear to have a negative association with its measured calorie consumption. Overall, being a household that reported consumption of meals away from home appears to *reduce* measured calorie consumption.

The PSM results confirm that estimates of calorie consumption from the HCESs exclude meals consumed away from home. Furthermore, they indicate that the more meals consumed away, the lower is the recorded food consumed at home. That is, as would be expected, in-home and out-of-home meals are substitutes, with the implication that increased consumption of food away from home will result in increasing downward-biased estimates of calorie consumption per capita.

[19] More specifically, kernel matching, for which each treated household is matched to a group of control households with propensity scores within a certain radius depending on the bandwidth of the kernel, is employed. The bandwidth is chosen using Silverman's (1986) adaptive optimum rule (Salgado-Ugarte, Shimizu and Taniuchi 1995), which is based on optimal smoothing of the control group propensity score density function. The bandwidths range from 0.0009 to 0.0075.

Table 3: Propensity score matching analysis of the relationship between meals taken away from home and estimated household calorie consumption

Source of acquisition	ATT a/	t-statistic b/		Number of consuming households on common support	Chi^2 test for matching quality (p-value)
	(A)	(B)		(C)	(D)
Purchased at a commercial establishment	8.9	0.71		7,480	1.000
Free school meal	0.9	0.06		3,943	0.116
Provided by an employer	-161.1	-7.55	***	1,789	1.000
Other meals received in kind	-40.0	-5.40	***	15,854	1.000
All meals consumed away from home	-42.1	-6.53	***	25,604	1.51

a/ Average treatment effect on the treated.

b/ Stars (***) indicate that the coefficient is statistically significant at the 1% level.

Source: Author's calculations using data from India's 1999/2000 Household Consumption and Expenditure Survey.

Notes: The estimates are derived using Kernel matching (N=118,729 [full sample for matching]).

The ATT represents the effect of a household having a member who consumed a meal away from home (from various sources and in total) on household calorie consumption per capita.

5.2 Observations on food-consumed-away data collection in India's rural food consumption surveys

Similar to the country's HCESs, data collected in India's NNMB rural food consumption surveys indicate a declining trend in calorie consumption over time, in fact a very steep one. As of the last survey, the estimated average consumption of calories in rural areas was so low that it was 24 percent below requirements (NNMB 2006). [20]

Because the common downward time trends from HCESs and the NNMB surveys have been used as empirical support that the former is a 'real' phenomenon, it is important to carefully examine how the NNMB survey data are collected. The only publicly available information indicates that it takes place as follows: For 80 percent of the sample, data are collected at the household level using a 'one day weighment method' on the day of the survey. For the remaining 20 percent of the sample, the 24-hour recall technique is used to compute estimates of the food consumption of individual household members (Ramachandran, K., 2006; Ramachandran P., 2008).

The 24-hour recall method involves asking the respondent, usually a woman who is responsible for cooking, about the foods consumed in the previous 24 hours for each individual living in the household, including the portion sizes consumed. The difficulties of collecting accurate data and identifying trends in nutrient consumption in countries undergoing rapid economic and nutrition

[20] Measured calorie consumption from these surveys has fallen from 2,340 per 'consumer unit' in 1975-79 to 1,834 in 2005, a reduction of 506 kcals per consumer unit. Since consumer units are based on age-sex calorie requirements and take into account physiological status such as pregnancy, lactation and levels of physical activity, these estimates are not directly comparable to calorie consumption per capita estimates. The reference consumer unit is an adult male undertaking sedentary activity with recommended calorie intakes of 2,425 kcal per day (NNMB 2006).

transitions using this method have been well documented (Gibson 2005; Popkin, Lu and Zhai 2002).

First, the composition of commonly consumed dishes, including newly-adopted processed foods, can change radically over time, and the variation in their composition across populations can widen. Because of these changes, in order to calculate calorie consumption it is necessary to obtain the ingredients of each dish and not use reference recipe files that apply to all households, as is common practice (Popkin, Lu and Zhai, 2002). With the rise of snacking between meals, it becomes increasingly essential to obtain information on snack food consumption in order to properly assess changes in calorie consumption. However, not all 24-hour recall surveys are designed to collect detailed data on snack foods (Popkin 2008).

Second, the amount of high-calorie edible oils and condiments used in cooking, which also rises as the nutrition transition proceeds, can vary greatly across households even for the same dish. The traditional 24-hour recall method may not be well suited for picking up on these variations. Some evidence on this issue comes from a modified 24-hour recall food consumption survey conducted in China that included an initial weighing inventory of foods in the household followed by a traditional 24-hour recall questionnaire. Analysis of the data revealed that the estimate of fat intake was 56 grams, compared to only 28 grams using the traditional 24-hour recall only (Popkin, Lu and Zhai, 2002). The traditional method was thus only picking up on half of the calories consumed from fats, which are a very high-calorie source of food.

Third, with the increase in FCAFH that comes with the nutrition transition, it becomes vital to record all of the food consumed away for each individual household member (Popkins, Lu and Zhai 2002). The amounts eaten of mixed dishes must be approximated, and the amounts of individual foods contained in them must be obtained from vendors so that quantities consumed of actual foods can be assessed (Gibson 2005). Recording accuracy is dependent on respondent memory; if the respondent is not the one eating out, significant under-reporting can occur. Because a woman is typically the respondent for food consumption surveys, if men tend to eat away from home more than women do, as is the case in India,[21] food consumed away will be systematically underestimated.

A final difficultly in gauging trends in calorie consumption using the 24-hour recall method is under-reporting associated with the weight status of the respondent (overweight people tend to underreport more) and with foods considered to be ‘bad,’ such as alcohol, candies, and fatty foods. With the emergence of Western ideals for body image and increased consumption of these foods (Popkins, Lu and Zhai 2002; Gibson 2005), underreporting is likely increasing over time.

When the ‘weighment’ method is used to measure quantities of foods consumed (80 percent of the NNMB sample), enumerators are unable to weigh the food consumed outside of the home since it is not available at the site of the interview for weighing. This food is being prepared and cooked by someone else. It is thus even more unlikely than when the 24-hour recall method is used that enumerators will be able to collect data on the amounts of individual foods consumed (which are needed for calorie conversions) without an effort to actually go to eating establishments and collect this information.

Given the above, it is quite possible that the calories consumed in food away from home, in addition to the calories in processed foods and from edible oils and condiments, are being

[21] Gaiha, Jha and Kulkarni (2009) confirm that that higher the number of adults in the household in paid work, whether male or female, the greater is the likelihood of a household reporting that a member has eaten out. Because males tend to be involved in paid work more than females, they are more likely to eat out. Further evidence from small samples can be found in Barker *et al.* (2010) and Beldona, Moreo and Mundhra (2009).

underestimated in India's rural food consumption surveys and, further, that the underestimation is increasingly severe over time. More information on the data collection methods will help determine whether this is the case.

6. Cross-country perspectives on the quality of food-consumed-away data collection

A recent assessment of the reliability of the food data collected in developing-country HCESs finds the poor quality of data collected on food consumed away from home (FCAFH) to be the most common constraint to accurate measurement of both food insecurity and poverty (Smith, Dupriez and Troubat 2013). Among the 100 surveys assessed, including India's 2009/10 survey, only 42 percent satisfied the study's minimum reliability criteria for FCAFH that (1) data are explicitly and deliberately collected on FCAFH; (2) the recall period is less than or equal to one month; and (3) data are collected on in-kind receipts in addition to purchases. India's HCES, for which FCAFH data are not explicitly collected, was not among these surveys. According to the assessment report, the above three criteria '…fall far below optimal data collection, which would entail detailed recording of the actual foods, dishes and/or meals consumed for food purchases and multiple sources of food received in kind – including from other households, food assistance, and free food received at schools and work places. Hopefully data collection will improve over the coming years, and the quality bar can be raised.' We can thus consider the quality of the FCAFH data from India's HCESs to be far below optimal and note that it is just one among many countries confronting this measurement issue.

But does the quality of FCAFH data collection really matter for estimates of calorie consumption? In this section, data from 44 developing-country HCESs conducted between 1992 and 2009, including India's 2004/05 survey, are used to look into this question. The surveys are among the few for which estimates of calorie consumption per capita are available.

Table 4 lists various techniques that are currently in use to collect data on food consumed away from home in national HCESs. They are listed in order of the expected quality of the data, each being associated with a numeric quality score ranging from one to eight. The lowest one is assigned to the technique in which the interview method is used and there is no explicit reference to food consumed away or prepared meals in the questionnaire. In general, data quality is increased when FCAFH is explicitly referred to in a survey questionnaire, respondents are made aware of multiple places of consumption, data are collected on actual dishes or foods that are consumed, and data are collected on both food purchases and food received in kind. The highest quality scores are for diary surveys, which are more likely to account for eating occasions in which food is consumed away from home in commercial eating establishments. This is because it is made clear to respondents that they are to include all of the expenses they make throughout a day's time. India's survey falls into the second-lowest quality category, for which there is no explicit mention of food consumed away from home but at least one food item referring to prepared meals.

The last column of Table 4 reports estimated calorie consumption per capita. It increases precipitously (if not monotonically) as the quality of FCAFH data collection improves, from 2,056 in the lowest quality group to 2,344 in the highest. Table 5 examines the relationship using OLS regression, controlling for countries' per-capita GDP, regional location, the year of data collection, and whether or not the diary method is used. The latter helps take into account the fact that the diary method tends to yield higher estimates of per-capita calorie consumption for reasons beyond the quality of FCAFH data collection (Beegle *et al.* 2012). The results for all

Table 4. The quality of food-consumed-away-from-home data collection in 44 developing-country Household Consumption and Expenditure Surveys

Description of quality group	Quality score	Number of country/year observations	Mean calorie consumption per capita
Interview surveys			
Questionnaire has no reference to FCAFH or prepared meals.	1	2	2,056
No reference to FCAFH but at least one food item refers to prepared meals (*India's 2004/05 HCES is in this group*).	2	5	2,048
Questionnaire has one line item referring explicitly to FCAFH.			
Data collected only on purchases.	3	4	2,061
Data collected on both purchases and food received in kind.	4	6	2,107
Questionnaire has multiple line items referring to FCAFH, with multiple places or foods/dishes enumerated.			
Data collected only on purchases.	5	8	2,291
Data collected on both purchases and food received in kind.	6	6	2,232
Diary surveys			
Data collected only on purchases.	7	8	2,299
Data collected on both purchases and food received in kind.	8	5	2,344
Total number of observations		44	

Note: Forty developing countries are represented in total (with four having data for two points in time). Their regional distribution is as follows: Sub-Saharan Africa (13), Asia (12), Latin America and the Caribbean (8), Europe and Central Asia (5) and Middle East and North Africa (2).

Data sources: The majority of the undernourishment estimates (N=27) were provided by FAO's Statistics Division. The other estimates are from Smith and Subandoro (2007) (N=11), Sibrian (2008) (N=3), State Department of Statistics for Georgia (2001) (N=1), Hoang (2009) (N=1), FAO (2006b) (N=1).

Table 5. The relationship between the quality of food-consumed-away-from-home data collection and estimated calorie consumption per capita: Cross-country regression analysis

	Urban and Rural						Urban			Rural		
	All countries (A)			Excluding East Asia (B)			(C)			(D)		
	Coefficient	t-stat		Coefficient	t-stat		Coefficient	t-stat		Coefficient	t-stat	
Index for quality of FCAFH data collection	45.7	1.77	*	81.61	2.76	***	38.1	1.1		63.6	2.01	*
Per capita GDP	0.0	0.31		0.01	0.45		0.0	-0.1		0.0	-0.05	
Region a/												
Sub Saharan Africa	-605.1	-5.36	***	-624.26	-5.59	***	-289.9	-2.0	*	-879.6	-6.59	***
Asia	-467.6	-4.11	***	-538.33	-3.91	***	-362.7	-2.4	**	-583.1	-4.29	***
Latin America & Caribbean	-301.9	-2.51	**	-307.58	-2.57	**	-26.4	-0.2		-558.2	-3.93	***
Year of data collection	-4.7	-0.56		-10.25	-1.09		1.0	0.1		-13.9	-1.40	
Diary method used	-150.9	-1.31		-307.94	-2.34	**	-159.6	-1.0		-178.4	-1.27	
R-squared	0.551			0.644			0.297			0.633		
Number of observations	44			36			42			42		

Notes: Stars indicate coefficient is statistically significant at the 10% (*), 5%(**) or 1%(***) levels.

a/ The reference category is comprised of the countries from Europe and Central Asia and Middle East and North Africa.

44 countries (Column A) show that even after controlling for these other factors the relationship between the quality of FCAFH data collection and estimates of per-capita calorie consumption is positive. This is especially so when the East Asian countries are excluded (Column B), which nearly doubles the coefficient on the quality score. While FCAFH tends to be higher in urban areas (see Section 4), the positive association between the quality of its data collection and calorie consumption appears to be stronger in rural areas (Columns C and D).

The sample size for this analysis is far too small for this evidence to be conclusive when it comes to the magnitude of the effect. However, it suggests that the quality of data on FCAFH likely makes a substantial difference to national estimates of per-capita calorie consumption and thus prevalences of undernourishment. Specifically in the case of India, the regression results (Column A) would predict calorie consumption per capita to increase by 274 kilocalories if the country moved from the second-lowest quality category to the highest. This increase is far more than the entire decline found between India's 1987/88 and 2004/05 HCESs of 175 kcals.

7. Conclusion

To summarize, this paper's review of the Indian calorie debate finds that many of the proposed explanations for declining calorie consumption are not plausible given that undernourishment has risen as well and people would not voluntarily enter into a state of hunger. The paper presents evidence that food and calorie consumption have been rising during India's recent economic, nutrition and epidemiological transitions. There has also been a gradual shift towards more food being consumed outside of the home. The empirical analyses indicate that (1) food consumed away is not being fully counted in estimates of calorie consumption; and (2) seen from a cross-country perspective, doing so matters for estimates of calorie consumption from national HCESs.

The main conclusion is that the declining trend in calorie consumption registered using India's HCESs is at least partially, if not fully, a result of incomplete collection of data on food consumed away from home. Such incomplete data collection leads to increasingly downward-biased estimates of calorie consumption because food consumed away is rising over time and is a substitute for food consumed at home. The bias is accentuated by the fact that away-food tends to be more calorie dense than food consumed at home. In this country undernourishment estimates rise when calorie consumption falls. Measurement error thus helps explain the anomalous conflicting trends in poverty, on the one hand, and calorie consumption and undernourishment, on the other, that sparked the Indian calorie debate.

How much of the calorie decline in recent years can be explained by the failure to fully account for food consumed away from home? We won't know the answer to this question until food consumed away is measured properly. However, it wouldn't take radical assumptions on its magnitude and changes over time to completely reverse the downward trend. For example, if food consumed away was ten percent of total calories in 1988 and increased by 0.6 percentage points per year thereafter,[22] by 2005 (17 years later) total calorie consumption would have registered an upturn of 96 kilocalories.

It is important to note that India is not alone: mis-measurement of food consumed away from home is a widespread problem afflicting the majority of current developing-country HCESs (Smith, Dupriez and Troubat 2013). If these surveys are to be considered a viable source of data for measuring food insecurity in India and other countries undergoing rapid economic and nutrition transitions, questionnaires need to be updated to reflect the accompanying changes in

[22] For reference, in the United States the calories in food prepared away from home increased from 18 percent of total calorie consumption in 1978 to 32 percent by 1995, or just over 0.80 percentage points per year (Guthrie, Lin and Frazao 2002).

food consumption patterns, including the shift towards consuming more and higher-calorie food away from home.[23] HCES data have a plethora of current and potential uses beyond measuring food insecurity and poverty, including: providing information for food-based nutrition interventions such as mass food fortification programs, compiling Food Balance Sheets and national accounts, calculating consumer price indices, and meeting private sector marketing informational needs (Smith, Dupriez and Troubat 2013). All of these users will benefit from more reliable collection of data on food consumed away from home in HCESs.

The paper's analysis has the implication that undernourishment in India is likely not as high as previously thought and possibly not increasing. It is nevertheless clear from the review of its food and nutrition situation presented here that food insecurity and malnutrition, including overnutrition, are serious issues in India. The levels of and changes in indicators used to measure them merit the close scrutiny and analysis they have received thus far as efforts to ameliorate the situation continue. Policy makers need an accurate picture of where and for whom these problems are most severe. They need to know how the situation is changing over time to determine whether current efforts are making any difference. And, taking all information into account, they need to have a properly balanced perspective on which factors need to be prioritized to ameliorate them. For example, to address child malnutrition the state of food insecurity compared to that of its other underlying determinants (the quality of caring practices for women and children and of health environments), needs to be understood. When indicators of food security do not reflect reality, policy makers can receive conflicting information on these matters. The ultimate consequence is slower declines in food insecurity and malnutrition. This means more people without secure access to enough food to eat – a basic human right – and more children with compromised health, educational achievement, and productivity as adults.

Indian government statisticians were the first to recognize the need for better collection of data on food consumed away from home in the country's HCESs. In a recent HCES report Gupta (2008), in explaining the continual decline in cereal consumption seen in India over the last few decades, writes that 'Eating out and purchase of cooked meals have increased… the cereal content of meals taken outside at own cost or at public cost is hardly known…' (p. 61). In the recent NSSO-FAO review of undernourishment estimates derived from India's HCESs, Chattapadhyay and Chowdhury (2010) recommend that the surveys be amended to include food consumed outside of the home if they are to be used for comprehensive food security analysis. This paper shows that doing so will help solve the long-debated puzzles arising from the data collected in the HCESs, and is vital for accurately assessing trends in undernourishment and, indeed, trends in poverty, in India.

[23] Specific categories of food-consumed-away consumption that need to be taken into account are paid-for meals and snacks consumed in restaurants and other commercial establishments, those consumed at schools and work, including 'hosted meals' (paid for by an employer, see Bai *et al.* 2008), and food received as free assistance. While cooked meals and snacks prepared away from home and then consumed at home (including take away and home-delivered) (see Beldona, Moreo and Mundhra 2010 for evidence from Bangalore) were not explored in this paper, they are also most likely under-reported in India's HCESs. Smith and Subandoro (2007) suggest a technique for collecting data on purchased foods prepared away from home that draws on methods used in food consumption surveys.

Appendix

Propensity score estimation: Probit estimates for consumption of any meals away from home

	Coefficient	t-statistic b/	
Household size	0.037	16.91	***
Percent of females 0-15 years a/			
Percent of females 16-30 years	-0.003	-7.86	***
Percent of females 30 years or older	-0.006	-15.28	***
Percent of males 0-15 years	0.001	3.26	***
Percent of males 16-30 years	0.004	11.14	***
Percent of males 30 years or older	0.003	7.97	***
Whether household is headed by a female	0.116	6.79	***
Age of household head	-0.004	-8.70	***
Whether no adult member has any education a/			
Whether adult member has primary education	0.067	5.71	***
Whether adult member has secondary education	0.026	2.17	***
Total expenditure quintile			
First (poorest) a/			
Second	0.019	1.38	
Third	0.074	5.05	***
Fourth	0.180	11.58	***
Fifth (richest)	0.394	22.67	***
Whether household located in an urban area	-0.056	-5.77	***
State of residence (results not shown)			
Pseudo R-squared		0.067	
Number of observations		118,726	

a/ Reference category to which others are compared.
b/ Stars (***) indicate that the coefficient is statistically significant at the 1% level.
Source: Author's calculations using data from India's 1999/2000 Household Consumption and Expenditure Survey.
.

References

Bai, Junfei; Wahl, Thomas I.; Lohmar, Bryan T. and Jikun Huang (2008) 'Estimating the Relationship between Food-Away-from-Home Consumption and Demographic Changes in China: The Role of Hosted Meals', paper presented at the International Agricultural Trade and Research Consortium (IATRC) Meeting, Washington DC, 7–9 January

Banerjee, Abhijit and Duflo, Esther (2011a) 'More than 1 Billion People are Hungry in the World. But what if the Experts are Wrong?', *Foreign Policy,* May/June

Barker, Mary; Chorghade, Ginny; Crozier, Sarah; Leary, Sam and Fall, Caroline (2006) 'Gender Differences in Body Mass Index in Rural India are Determined by Socio-Economic Factors and Lifestyle', *The Journal of Nutrition* 136: 3062–8

Basu, Deepankar and Basole, Amit (2012) *The Calorie Consumption Puzzle in India: An Empirical Investigation,* PERI Working Paper Series 285, Amherst: Political Economy Research Institute, University of Massachusetts

Beegle, Kathleen; De Weerdt, Joachim; Friedman, Jed and Gibson, John (2012) 'Methods of Household Consumption Measurement through Surveys: Experimental Results from Tanzania', *Journal of Development Economics* 98.1: 3–18

Beldona, Srikanth; Moreo, Andrew P. and Mundhra, Gokul Das (2010) 'The Role of Involvement and Variety-Seeking in Eating Out Behaviors', *International Journal of Contemporary Hospitality Management* 22.3: 433–44

Bleich S.; Cutler, D.; Murray, C. and Adams, A. (2008) 'Why is the Developed World Obese?', *Annual Review of Public Health* 29: 273–95

Bouis, Howarth and Haddad, Lawrence (1992) 'Are Estimates of Calorie-Income Elasticities Too High? A Recalibration of the Plausible Range', *Journal of Development Economics* 39.2: 333–64

Bouis, Howarth; Haddad, Lawrence and Kennedy, Eileen (1992) 'Does it Matter how we Survey Demand for Food? Evidence from Kenya and the Philippines', *Food Policy*, October

Chattapadhyay, Gopa and Chowdhury, Atanu Kumar (2010) 'Trends in Food Insecurity in India: Review of Food Insecurity Assessment and Trends in India and Provinces. Analysis of India Consumer Expenditure Surveys 1988–2005', draft report, Rome: Food and Agriculture Organization of the United Nations

Chatterjee, Sumeet and Singh, Neha (2011) *Mcdonald's India Franchisee to Open 30 Stores In 2011*, Thomson Reuters, Business-msnbc.com (updated 21 February 2011)

Clark, Gregoy; Hubermand, Michale and Lindert, Peter (1995) 'A British Food Puzzle', *The Economic History Review* 48.2: 215–37

Deaton, A. and Drèze, J.P. (2010a) 'From Calorie Fundamentalism to Cereal Accounting', *Economic and Political Weekly* 20 Nov, XLV.47

Deaton, A. and Drèze, J.P. (2010b) 'Nutrition, Poverty and Calorie Fundamentalism: Response to Utsa Patnaik', *Economic and Political Weekly,* 3 April, XLV.14

Deaton, A. and Drèze, J.P. (2009) 'Food and Nutrition in India: Facts and Interpretations', *Economic and Political Weekly*, 14 February, XLIV.7 http://www.princeton.edu/~deaton/downloads/Food_and_Nutrition_in_India_Facts_and_Interpretations.pdf

Deaton, A. and Kozel, Valerie (2005) 'Data and Dogma: The Great Indian Poverty Debate', *World Bank Research Observer* 20.2: 177–99

de Onis, Mercedes; Garza, Cutberto; Victora, Cesar G.; Bhan, Maharaj K. and Norum, Kaare R. (guest editors) (2004) 'The WHO Multicentre Growth Reference Study (MGRS): Rationale, Planning, and Implementation', *Food and Nutrition Bulletin* 25 (supplement 1): S3–S84

Desai, S.; Dubey, A.; Joshi, B.; Sen, M.; Shariff, A. and Vanneman, R. (2010) *Human Development in India: Challenges for a Society in Transition*, New Delhi: Oxford University Press

Domain-b.com (2008) *Study Reveals America's Worst Restaurants for Kids; Some of them are in India as Well,* 5 August

Drèze, Jean and Sen, Amartya (2011) 'Putting Growth in its Place', *Outlook India*, 10 November

Du, S.; Lu, B.; Zhai, F. and Popkin, B. (2002) 'A New Stage of the Nutrition Transition in China', *Public Health Nutrition* 5.1A: 169–74

Economic Times (2011) 'India's GDP Grows at 8.5% in FY-2011, Q4 Growth at 7.8%', 31May

Eli, Shari and Li, Nicholas (2012) 'Can Caloric Needs Explain Three Food Consumption Puzzles? Evidence from India', mimeo, University of Toronto

FAO (2012a) *The State of Food Insecurity in the World 2012',* Rome: Food and Agriculture Organization of the United Nations

FAO (2012b) *The State of Food Insecurity in The World 2012*. *Food Security Indicators,* Rome: Food and Agriculture Organization of the United Nations, www.fao.org/publications/sofi/food-security-indicators/en/ (accessed 25 October 2012)

FAO (2012c) *FAOSTAT*, Rome:Food and Agriculture Organization of the United Nations, http://faostat3.fao.org/home/index.html (accessed 29 October 2012)

FAO (2010) Assessment of Undernourishment Estimates and Trends for India', project progress report (Draft), Rome: Food and Agriculture Organization of the United Nations

FAO (2006a) *The Double Burden of Malnutrition: Case Studies from Six Developing Countries,* FAO Food and Nutrition Paper 84, Rome: Food and Agriculture Organization of the United Nations

FAO (2006b) *Monitoring MDG and WFS Targets: Latin America and the Caribbean,* Statistics Division Working Paper Series ESS/ESSA/003a *The Double Burden of Malnutrition: Case Studies from Six Developing Countries*, FAO Food and Nutrition Paper 84, Rome: Food and Agriculture Organization of the United Nations

Fiedler, John L. (2009) *Strengthening Household Income and Expenditure Surveys as a Tool for Designing and Assessing Food Fortification Programs,* IHSN Working Paper 001, International Household Survey Network

Frankenberger, Tim (2010) Personal communication

Gaiha, Raghav; Jha, Raghbendra and Kulkarni, Vani S. (2010) *Affluence, Obesity and Non-Communicable Diseases in India,* ASARC Working Paper 2010/08, Canberra: Australia South Asia Research Centre, Arndt-Corden Division of Economics. Australian National University

Gaiha, Raghav; Jha, Raghbendra and Kulkarni, Vani S. (2009) *How Pervasive is Eating Out In India?,* ASARC Working Paper 2009/17, Canberra: Australia South Asia Research Centre, Arndt-Corden Division of Economics. Australian National University

Gale, Fred and Huang, Kuo (2007) *Demand for Food Quantity and Quality in China,* ERS Report Summary, Markets and Trade. Washington DC: Economic Research Service, U.S. Department of Agriculture

Gibson, Rosalind S. (2005) *Principles of Nutritional Assessment,* second edition, New York: Oxford University Press

Gulati, Ashok (2004) 'An Indian Diet Revolution', *India Today*, 13 December

Gupta, Nivedita (2008) 'An Integrated Summary of NSS 61st Round (July 2004–June 2005) on "Household Consumer Expenditure in India"', *Sarvekshana: Journal of National Sample Survey Organization,* 93rd Issues, XXVIII.1&2

Guthrie, J.F.; Lin, Bh.H. and Frazao, E. (2002) 'Role of Food Prepared Away From Home in the American Diet, 1977–78 versus 1994–96: Changes and Consequences', *J Nutr Educ Behav* 34.3: 140–50

Haddad, Lawrence (2011) 'Why India Needs a National Nutrition Strategy', *BMJ* 343: d6687

Heady, Derek (2013) 'The Impact of the Global Food Crisis on Self-Assessed Food Security', *World Bank Economic Review,* published online, 7 January

Hindu, The (2012) 'India Tops World Diabetes Sufferers List', Dubai, 14 November

Hoang, Linh Vu (2009) *Analysis of Calorie and Micronutrient Consumption in Vietnam,* DEPOCEN Working Paper Series 2009/15, Center for Agricultural Policy, Institute of Policy and Strategy for Agriculture and Rural Development

IIPS (International Institute for Population Sciences) and Macro International (2007) *National Family Health Survey (NFHS-3), 2005–06: India: Volume I*, Mumbai: IIPS

India Knowledge@Wharton (2008) *Jumbo King: The Making of an Indian Fast-food Chain*, University of Pennsylvania, http://knowledge.wharton.upenn.edu/india/article.cfm?articleid=4321 (accessed December 2010)

Infochange India (2009)

Institute of Medicine (2000) *Dietary Reference Intakes: Applications In Dietary Assessment,* Report of the Subcommittee on Interpretation and Uses of Dietary Reference Intakes and the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine, Washington DC: National Academy Press

Islam, Gazi Nurul; Shzee Yew, Tai Kusairi Mohd Noh and Nik Mustapha R. Abdullah (2009) 'Getting Rich and Eating out: Does it Hold True for Malaysian Consumers?', Universiti Putra Malaysia, *OPTIONS* 14.2: 3–4

James & Schofield (1990) *Human Energy Requirements,* FAO and Oxford Medical Publications

Kaur, P.S.R. Rao; Radhakrishnan, E.; Ramachandran, R.; Venkatachalam, R. and Gupte, M.D. (2011) 'High Prevalence of Tobacco Use, Alcohol Use and Overweight in a Rural Population in Tamil Nadu, India', *J Postgrad Med* 57.1: 9–15

Khandker, Shahidur; Koolwal, Gayatri B. and Samad, Hassain A. (2010) *Handbook On Impact Evaluation: Quantitative Methods And Practices*, Washington DC: The World Bank

Landy, Frédéric (2009) 'India, "Cultural Density" and the Model of Food Transition', *Economic and Political Weekly* XLIV.20: 59–61

Leuven, E. and Sianesi, B. (2003) 'PSMATCH2: Stata Module to Perform Full Mahalanobis and Propensity Score Matching, Common Support Graphing, And Covariate Imbalance Testing'. Version 3.1.5 2may2009 E. Leuven, B. Sianesi

Ma, Henguyn; Huang, Jikun; Fuller, Frank and Rozelle, Scott (2006) 'Getting Rich and Eating Out: Consumption of Food Away from Home in Urban China', *Canadian Journal of Agricultural Economics* 54: 101–19

Mancino, Lisa; Todd, Jessica and Lin, Biing-Hwan 'Separating What We Eat From Where: Measuring the Effect of Food Away from Home on Diet Quality', *Food Policy* 34.6: 557–62

Mason, John B. (2002) 'Measuring Hunger and Malnutrition', FIVIMS International Scientific Conference on Methods of Measurement and Assessment of Food Deprivation and Undernutrition. June 26–28, Rome, Italy, Food and Agriculture Organization of the United Nations

Maxwell, Simon and Slater, Rachel (2003) 'Food Policy Old And New', *Development Policy Review* 21.5–6: 531–53

McKinsey & Company (2010) *India's Urban Awakening: Building Inclusive Cities, Sustaining Economic Growth,* New York: McKinsey Global Institute

McKinsey & Company (2007) *The 'Bird Of Gold': The Rise of India's Consumer Market,* New York: McKinsey Global Institute

Ng, Eva (2005) *A 360º View of Fast Food and Impulse Habits,* Nielsen Trends and Insights, http://asiapacific.acnielsen.com/pubs/2005_q2_ap_fastfood.shtml (accessed December 2010)

Ng, S.W. and Popkin, B.M. (2012) 'Time Use and Physical Activity: A Shift Away from Movement Across the Globe', *Obesity Reviews* 13: 659–80

NNMB (National Nutrition Monitoring Bureau) (2006) *Diet and Nutritional Status of Population and Prevalence of Hypertension Among Adults in Rural Areas*, NNMB Technical Report 24. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad

NSSO (National Sample Survey Office) (2012) *Nutritional Intake in India,* NSS 66th Round, Government of India, Report 540 (66/1.0/2), Ministry of Statistics and Programme Implementation, National Statistical Organisation, National Sample Survey Office

Palmer-Jones, Richard (2005) 'Can We Set Poverty Lines Using Calorie Norms in India or Bangladesh?', draft manuscript, University of East Anglia

Palmer-Jones, Richard and Dubey, Amaresh (2010) 'New Poverty Lines In India – The Last Hurrah?', draft, Norwich: School of International Development, University of East Anglia and New Delhi: Jawaharlal Nehru University

Parikh, Kalpana and Yasmeen, Summiya (2004) 'Groundswell For Mid-Day Meal Scheme', *India Together* newsletter, January

Patnaik, Utsa (2010a) 'A Critical Look at Some Propositions on Consumption and Poverty', *Economic and Political Weekly,* 6 Feb, XLV.47

Patnaik, Utsa (2010b) 'On Some Fatal Fallacies', *Economic and Political Weekly*, 20 Nov, XLV.47

Pingali, Prabhu and Khwaja, Yasmeen (2004) *Globalization of Indian Diets and the Transformation of Food Supply Systems*, ESA Working Paper 04–05, Rome: Agricultural and Development Economics Division. Food and Agricultural Organization of the United Nations

Popkin, Barry M. (2008) *The World is Fat: The Fads, Trends, Policies and Products that are Fattening the Human Race,* New York: Avery-Penguin Press

Popkin, Barry M. (2006) 'Global Nutrition Dynamics: The World is Shifting Rapidly Toward a Diet Linked with Noncommunicable Diseases (NCDs)', *American Journal of Clinical Nutrition* 84: 289–98

Popkin, Barry M.; Lu, Bing and Zhai, Fengying (2002) 'Understanding the Nutrition Transition: Measuring Rapid Dietary Changes in Transitional Countries', *Public Health Nutrition* 5.6A: 947–53

Popkin, Barry; Horton, Susan; Kim, Soowon; Mahal, Ajay and Shuigao, Jin (2001) 'Trends in Diet, Nutritional Status, and Diet-Related Noncommunicable Diseases in China and India: The Economic Costs of the Nutrition Transition', *Nutrition Reviews* 59.12: 379–90

Poti, J.M. and Popkin, B.M. (2011) 'Trends in Energy Intake among US Children by Eating Location and Food Source, 1977–2006', *J Am Diet Assoc* 111.8: 1156–64

Pourhassan, M. and Najafabadi, A.T. (2009) 'Survey Prevalence and Prevention of Childhood Obesity', *Shiraz E Medical Journal* 10.3, July

Ramachandran, K. (2006) *Nutrition Monitoring and Surveillance,* New Delhi: Nutrition Foundation of India

Ramachandran, Prema (2008) *Nutrition Transition in India* 1947–2007, New Delhi: Nutrition Foundation of India, http://nutritionfoundationofindia.res.in/NutritionTransition.asp

Ramachandran, Prema (2006) *The Double Burden of Malnutrition in India. In the Double Burden of Malnutrition: Case Studies from Six Developing Countries,* FAO Food and Nutrition Paper 84, Rome: Food and Agriculture Organization of the United Nations

Rao, C. H. Hanumanthu (2000) 'Declining Demand for Foodgrains in Rural India: Causes and Implications', *Economic and Political Weekly* 35.4: 201–6

Ray, Ranjan (2007) 'Dietary Changes, Calorie Intake and Undernourishment: A Comparative Study of India and Vietnam', paper prepared for the International Seminar on 'Revisiting the Poverty Issue: Measurement, Identification and Eradication' in Patna, India, 20–22 July

Reardon, Thomas and Gulati, Ashok (2008a) 'Supermarkets in Emerging Markets: Surprises in and Lessons for India', presentation at Food Forum India 2008, 7 May

Reardon, Thomas and Gulati, Ashok (2008b) *The Rise of Supermarkets and their Development Implications: International Experience Relevant For India,* IFPRI Discussion Paper 00752, Washington DC: International Food Policy Research Institute

Reddy, K. Srinath (2009) 'Regional Case Studies – India', in Kalhan, Satish C., Andrew M. Prentice and Chittaranjan S. Yajnik (eds) *Emerging Societies – Coexistence of Childhood Malnutrition and Obesity,* Nestlé Nutrition Institute Workshop Series Pediatric Program, Vol 63, pp. 15–24. Nestec Ltd., Vevey?s. Karger AG, Basel

Salgado-Ugarte, Isaias Hazarmabeth, Makoto Shimizu and Toru Taniuchi (1995) 'Practical Rules For Bandwidth Selection In Univariate Density Estimation', *Stata Technical Bulletin* 27

Salois, Matthew J.; Tiffin, Richard and Balcombe, Kelvin (2011) 'Impact of Income on Calorie and Nutrient Intakes: A Cross-Country Analysis', selected paper prepared for presentation at the Agricultural & Applied Economics Association's 2011 AAEA & NAREA Joint Annual Meeting, Pittsburgh, Pennsylvania, 24–26 July

Senauer, Ben (2006) 'The Growing Market for High-Value Food Products in Developing and Transition Countries', *Journal of Food Distribution Research* 37.1: 22–7

Shetty, Prakash (2002) 'Nutrition Transition in India', *Public Health Nutrition* 5.1A: 175–82

Sibrian, Ricardo (ed.) (2008) *Deriving Food Security Information from National Household Budget Surveys; Experiences, Achievements, Challenges*, Rome: Food and Agriculture Organization of the United Nations

Sibrián, Ricardo; Ramasawmy, Seevalingum and Mernies, Jorge (2008) *Measuring Hunger at Sub National Levels from Household Surveys Using the FAO Approach: Manual,* Statistics Division Working Paper Series ESS/ESSGA/5, Rome: Food and Agriculture Organization of the United Nations

Smith, Lisa C. and Frankenberger, Timothy R. (2012) *Typology of Food Away From Home,* TANGO, International, Tucson, AZ. USA Smith, Lisa C. and Subandoro, Ali (2007) *Measuring Food Security Using Household Expenditure Surveys,* Food Security in Practice Series, Washington DC: International Food Policy Research Institute

Smith, Lisa C.; Dupriez, Olivier and Troubat, Nathalie (2013) 'Assessment of the Reliability and Relevance of the Food Data Collected in National Household Consumption and Expenditure Surveys', mimeo, Washington DC: International Household Survey Network

State Department of Statistics for Georgia (2001) 'Georgia Food Security Situation: Trends in Figures', *Statistical Bulletin* 4, September

Stubbs, Christina O. and Lee, Amanda J. (2004) 'The Obesity Epidemic: Both Energy Intake and Physical Activity Contribute', *MJA, The Medical Journal of Australia* 181.9: 489–91

Subramanian, S.V. and Smith, George Davey (2006) 'Patterns, Distribution, and Determinants of Under- and Overnutrition: A Population-Based Study of Women in India', *American Journal of Clinical Nutrition* 84.3: 633–40

Sukhdev, Mahima (2010) 'Obese India: A Ticking Time Bomb', *RxPG News: Medical News Channel*, 25 November 2008

UNU, WHO, and FAO (United Nations University, World Health Organization, and Food and Agriculture Organization of the United Nations) (2004) *Human Energy Requirements: Report of a Joint FAO/WHO/UNU Expert Consultation, Rome, 17–24 October 2001,* FAO Food and Nutrition Technical Report Series 1. Rome: FAO

U.S. Census Bureau (2012) *International Programs, International Programs Data,* www.census.gov/population/international/data (accessed 25 October 2012)

Von Grebmer, Klaus; Ruel, Marie T.; Menon, Purnima; Nestorova, Bella; Olofinbiyi, Tolulope; Fritschel, Heidi; Yohannes, Yisehac; von Oppeln, Constanze; Towey, Olive; Golden, Kate and Thompson, Jennifer (2010) *2010 Global Hunger Index*. *The Challenge of Hunger: Focus on the Crisis of Child Undernutrition,* Bonn, Washington DC, Dublin: Welt hunger hilfe, International Food Policy Research Institute and Concern Worldwide

Wang, Y.; Chen, H.-J.; Shaikh, S. and Mathur, P. (2009) 'Is Obesity Becoming a Public Health Problem In India? Examining the Shift from Under- to Overnutrition Problems Over Time', *Obesity Reviews* 10: 456–74

World Bank (2012) *World Development Indicators,* http://data.worldbank.org/data-catalog/world-development-indicators (accessed October 2012)

World Bank (2010) *Poverty Headcount Ratio at $1.25 A Day (PPP) (% of Population),* http://data.worldbank.org/indicator/SI.POV.DDAY (accessed December 2010)