Food and Nutrition Insecurity in Eastern India: Evidences from a Household Level Study

Shinoj Parappurathu , Anjani Kumar, MCS Bantilan and PK Joshi

Abstract

Past studies have reported serious levels of food insecurity and under-nutrition existing in the eastern belt of India. To empirically illustrate the prevailing situation in this region, this study specifically examined the food consumption pattern, levels of nutrition intake and nutrition deficiency of sample households in 12 villages of Eastern India based on the VLS data collected during the agricultural year 2011-12. Significant disparity in the level and pattern of food consumption was observed across the sample villages.In general, the observed dietary habits of the sample households indicate very low diversity in their food consumption, with predominant dependence on cereals and vegetables. Consistent with this, the intake of calorie and nutrients also varied significantly across the villages. Subsequent analysis based on household specific calorie and nutrient intake norms suggested that nutrient deficiency was rampant in the sample villages. Among the 12 villagesstudied upon, one village was designated as 'Extreme', 5 villages 'High', 2 villages 'Moderate' and 4 villages 'Low' based on their observed proportion of households with calorie deficiency.Similar findings on deficiency of other major nutrients like protein, fats, iron, vitamins, etc. were also reported. A number of socio-economic, as well as demographic variables were identified that determined thenutrient deficiency status of the households, the knowledge of whichis crucial while planning interventions.

Key words: Household food security, food policy, calorie intake, under-nutrition, India

S Parappurathu (Author for correspondence)
National Centre for Agricultural Economics and Policy Research (NCAP), Pusa, New Delhi 110 012, India
e-mail: pshinoj@gmail.com; Phone: +91 11 9868676087; Fax: +91 11 25842684

A Kumar, PK Joshi
International Food Policy Research Institute, South Asia Office, DPS Marg, New Delhi 110 012, India

MCS Bantilan
International Crops Research Institute for Semi-Arid Tropics (ICRISAT), Patancheru, Hyderabad 502 324, India

Background

Two integral objectives of India's agricultural policy after the inception of planned development (from 1950) have been to raise food production to sustainable levels and to improve food availability to the masses. The green revolution technologies have succeeded in raising food production within a short span of two decades to appreciable levels and the subsequent initiatives have ensured a steady growth in food production matching with the increase in population. Demonstrably, the total food grain production in the country increased nearly five times to reach at 259 Mt, in 2011/12, the highest so far, from a level of 50.8 million tonnes in 1950 (GoI, 2012).Consistent with the larger goal of ensuring food security at micro level, the government intervention in food grain marketing was initiated in the mid-sixties. An agricultural price policy was designed with the primary objectives of providing guaranteed prices to the farm producers, provision of adequate quantity of food grains to the consumers at reasonable prices (subsidized prices for vulnerable sections) and maintaining inter-year price stability irrespective of the status of crop harvests. Consequently, the Agricultural Prices Commission (later renamed as Commission for Agricultural Costs and Prices (CACP)) and Food Corporation of India (FCI) were created with the task of executing the price policy. Based on the recommendations of CACP, the government announces minimum support prices (MSP) every year before the harvesting season and the FCI along with other subsidiary agencies undertakes the activities of food grain procurement, maintenance buffer stock and public distribution through fair price shops (FPS). However, in spite of the above measures and pursuinga wide range of grassroots-level initiatives spread over the last six decades, the goal of ensuring food availability to millions of poor people across the country at affordable prices has remained more or less elusive. The limited access of affordable food for a large majority of people has put India in the league of countries with worst levels of malnutrition in the world. Evidently, India ranks 63 among 120 countries covered in the Global Hunger Index 2013, with the food security status designated as 'alarming' (IFPRI/Welthungerhilfe/Concern Worldwide, 2013). The National Family Health Survey (NFHS) III (2005-06) that reports the key facts related to health and nutritional status of the sample households in the country estimated that nearly 40.4 per cent of children under three are underweight and 44.9 per cent are stunted; 36 per cent of adult women and 34 per cent adult men suffer from chronic energy deficiency; 79 per cent of children and 56 per cent of women are anemic and so on (IIPS and Macro International, 2007).

The situation is more alarming in many backward states of India particularly concentrated in the eastern region like Bihar, Odisha, Jharkhand, Chhattisgarh, West Bengal, etc. The data from NFHS III reveals that nearly 50 per cent of children under 5 years of age are underweight and 20-35 per cent are stunted in the above states. Similarly, around 35 per cent or more of adult men and women of 15-49 years of age are found to be 'thin'[2] in these states. Gulati *et al*, 2012 classified the various Indian states based ontwo indices of malnutrition namely, Normalized Adult Malnutrition Index (NAMI) and Normalized Child Malnutrition Index (NCMI) and found that all the eastern states fell in the top two categories of malnutrition, with Bihar faring the worst among them. A similar study conducted by MS Swaminathan Research Foundation (MSSRF, 2008) classified various Indian states based on a composite index of food insecurity based on seven indicators[3] and found that the eastern states such as Chhattisgarh and Jharkhand fell under the category of 'very high' food insecurity, while Bihar and Odisha were classified under 'high' food insecurity. West Bengal was relatively better off with moderate levels of food insecurity. Such levels of food insecurity and malnutrition existing in eastern India is a stark remainder that thevarious government sponsored measures to alleviate food deficiency in the poverty ridden pockets have actually not reached the targeted population. The performance of Public Distribution System (PDS) which has been successfulelsewhere in India have fared worst[4] in the states like Bihar, Odisha, Jharkhand, etc. There is reportedly very high prevalence of targeting errors (errors of exclusion and inclusion) and unauthorized diversion of PDS food grains in most of the above states (Swaminathan, 2009; Khera, 2011a; 2011b).Moreover, other development programmes intended for employment generation, infrastructure creation, improving farm income and labour productivity, other rural developmental initiatives, etc. have

[2]Refers to a Body Mass Index (BMI) less than the internationally accepted norm of 18.5 kg/m^2, which is reflective of chronic energy deficiency and adult malnutrition.

[3]The seven indicators used for constructing the food insecurity index in the study are (i) percentage of women with any anaemia, (ii) percentage of women with CED, (iii) percentage of children with any anaemia, (iv) percentage of stunted children under three, (v) percentage of population consuming less than 1890 Kcal of energy per day, (vi) percentage of households without access to safe drinking water and (vii) percentage of households without toilet within premises.

[4]The state of Chhattisgarh is an exception, where the recent attempts to revitalize the PDS has brought about inspiring results. The state embraced a near universal PDS in the year 2005 and is highly successful in providing subsidized food grains with negligible levels of unauthorized leakages.

also missed their targets consistently over the years in eastern India. Given the above scenario, this study attempts to comprehensively assess the level offood and nutrition insecurityexisting in three eastern states of India namely, Bihar, Jharkhandand Odisha with the help of household-level primary surveys conducted in select villages. The paper is organized in four sections. The section after introduction deals with data and methodology used for the study. The main findings and corresponding discussion is presented next, followed by conclusions and policy implications.

Data and Methodology

This study is based on the high-frequency panel data collected through the Village Level Studies (VLS)[5] of the International Crops Research Institute for Semi-Arid Tropics (ICRISAT).The high-frequency panel data refers to comprehensive household, individual, and plot level data collected from the selected villages on a continuous basis over years. During data collection, the resident investigators re-interview the participating households many times in a year so as to capture the dynamics in the households pertaining totheir expenditures, incomes, consumption, investments, farming practices, and so on.The data used in this paper pertains to 12 villages in the eastern India (Arap and Bhagakole villages of Patna district and Susari and Inai villages of Darbhanga district of Bihar state; Dubaliya and Hesapiri villages of Ranchi district and Dumariya and Durgapur villages of Dumka district of Jharkhand state; and Sogarand Chandrasekhapur (CSpur)villages of Dhenganal district and Ainlatunga and Bilaikani villages of Bolangir district of Odisha state). The geographical locations of the selected villages are illustrated in Figure 1 and their socio-economic and demographic characteristics are abstracted in Appendix 1. From each village, 40 households were selected (a total of 280 households from 12 villages) and were monitored on a sustained basis. The selected households were categorized into various farm-size classes based on the size of land they possessed. First, all households in a village possessing land area less than or equal to 0.5 acres were classified as 'marginal' households. All the remaining households were categorized into tertile groups, each containing a

[5]The VLS are longitudinal surveys initiated by the ICRISAT in 1975 in 10 Indian villages. The surveys continued for the next 10 years, before formally closing in 1985 in response to budgetary pressure. The surveys were re-opened in 2002 in the initial six villages, starting with low frequency rounds and with higher frequency interviews since 2005-06. Subsequently in 2010, the coverage was enhanced by including 12 villages in the eastern India with the funding support of Bill and Melinda Gates Foundation. The VLS data however cannot be treated as representative data for districts, states or the agro-climatic region within which the villages are located due to the relatively small sampling coverage.

third of the population. The bottom, middle and top tertile groups were referred respectively as 'small', 'medium' and 'large' households.

The paper specifically examines the food consumption pattern, levels of nutrition intake and nutrition deficiency of households in the selected villages using the VLS data collected at monthly intervals during the agricultural year 2011-12 (July, 2011 to June, 2012). The calorie and nutrient intake of the sample households were computed based on the consumption of various food commodities reported by them. The nutrient chart provided by the National Sample Survey Organization (NSSO, 2012) was used for converting the quantity consumption of each food item to its equivalent calorie and other nutrients[6] (protein, fat, iron, carotene, thiamine, riboflavin, niacin, folic acid and vitamin C). The calorie and nutrient deficiency status of a household was assessed by comparing the actual nutrition intake of the members of the household with respect to the Recommended Dietary Allowances (RDA) prescribed by the Indian Council of Medical Research (ICMR) for individuals belonging to different age group, sex, body weight and activity levels (ICMR, 2009). Thus, each household is assessed for its nutrient intake sufficiency (deficiency) based on the household specific intake against household-specific norm. This approach is similar to the one followed by Vishwanathan and Meenakshi, 2006 and Chand and Jumrani, 2013. Further, the share of sample population deficient in intake of calorie as well as dietary nutrients was estimated. The villages were subsequently categorized into four groups based on the severity of deficiency in each nutrient. The categories of under-nutrition defined were: 'Extreme ', if 75 per cent and above of population in the village is deficient in a particular nutrient; 'High' if the share of population deficient in a nutrient is between 50 per cent and less than 75 per cent; 'Moderate' if the share of population deficient in a nutrient is between 25 per cent and less than 50 per cent; and 'Low' if less than 25 per cent of the population is deficient in a nutrient.

Subsequent to identifying the calorie deficiency status of the households based on the above methodology, a probit regression model was fitted to ascertain the major determinants that influence the calorie intake pattern of households. The model was specified as given below;

$$P_i = \alpha + \beta Z_i + \gamma E_i + \delta O_i + \theta S \qquad \ldots\ldots (1)$$

[6]This approach assumes that a particular food item irrespective of its source, quality and level of processing has the same nutrient composition and that there is no distinction between calorie intake and calorie absorption.

Where, P_i is the binary dependent variable that equals 1 if the household in question is deficient in calorie intake, and 0 if not. Among the set of explanatory variables,Z_i represents a vector containing variables on sociological and demographic characteristics of the household such as age, sex and education of the family head, household size, as well as caste affiliation of the household. E_i is a vector that represents the economic statusand access of the household and includes variables such as per capita expenditure of the household, the share of PDS in total cereal consumption, a dummy on access to institutional credit, and another dummy that defines whether any of the household members is holding a salaried job or not.The ownership of the household of productive assets such as land and livestock was represented by the vector O_i. It includes three dummy variables that captures the farm-size class of the households, and another dummy that designates ownership of livestock. The variable S represents Simpson Index of Diversity[7] that measures the diversity of consumption of the household in terms of various food items.

Results and Discussion

Foodconsumptionandexpenditurepattern

The expenditure pattern of the sample households across farm-size groups are presented in Table 1.Significant variations were observed in the level of expenditure made by the households across villages as well as farm-size groups. In the Bihar state, the households belonging to the Baghakole village spent more on their consumables in relation to the other three villages. Similarly, households of Dumariya and Bilaikani were ahead of their counterparts in the respective states in terms of per capita monthly expenditure on all goods. Among all 12 villages, Bilaikani stood out with the highest average expenditure of Rs. 1825/capita/month. On the other hand, villages like Arap, Susari, Hesapiri, Durgapur, etc. were notable for their relatively lower per capita monthly expenditure. Though the expenditure pattern of the households did not match thoroughly with their land possession status, a general trend of progressively increasing expenditure from lower to higher farm-size groups was observed. A few exceptions to this rule

[7]Simpson Index of Diversity (SID) was used in the present context to measure the diversity in food items consumed by the households. It was estimated with the formula, $SID = 1 - \sum_{i=1}^{n} P_i^2$, where, P_i is the proportion of ith food item in total monthly of consumption all food by the members of the household. The monthly estimates were subsequently averaged to get the final estimate for the year under consideration. The index ranges between 0 and 1, where its value moves towards 0 in case of complete specialization.

were Dubaliya, Hesapiri and Durgapur in Jharkhand and Sogar, Ainlatunga and Bilaikani in Odisha. This could be due to the higher non-farm income accrued by the smaller farm-size households in these villages that strengthens their purchasing power. The share of food in total expenditure was estimated to be above 50 per cent in most of the villages irrespective of the farm-size groups. However, a few villages such as Inai in Bihar, Dubaliya in Jharkhand, Sogar, Ainlatunga and Bilaikani in Odisha, etc. exhibited lower allocation of their total expenditure on food. As expected, the average expenditure of these villages was higher than rest of them. Also, the share was found to decrease with increase in farm-size (and with increase in magnitude of total expenditure in general), thereby upholding the Engel's Law.

Table 2 shows the average consumption of various food items in the sample households in the selected villages. Cereals were the main source of dietary nutrients in all the villages, with rice and wheat being the main staples. The share of cereals in total food expenditure varied between 24.3 per cent in Chandrasekharpur to as high as 79.5 per cent in Hesapiri. Significant disparity in cereal consumption was noticed across the villages, with CSpur consuming the lowest at 11.92 kg/capita/month, whereas villages like Ainlatunga and Bilaikani consumed almost double the amount of that of CSpur. However, a point worth noting is that, cereal consumption in all the sample villages was higher than the all India rural average of 11.35 kg/capita/month for the year 2009-10. The consumption of pulses and oils on the other hand, were relatively lower(less than 1 kg/capita/month) in most of the villages except Ainlatunga and Bilaikani. As with pulses and oils, limited consumption of fresh fruits was reported by the households belonging to the villages of Bihar and Jharkhand, whereas those from Odisha consumed higher quantities in comparison. On the contrary, vegetable consumption was quite high in most of the villages, with Dumariya (20.37 kg/capita/month), Ainlatunga (9.49 kg/capita/month) and Bilaikani(13.81 kg/capita/month) topping the list. The villages of Bihar, particularly Arap and Baghakole, were far ahead of their counterparts from Jharkhand and Odisha in terms of milk consumption. Quite notably, majority of the villages in the study area were proved to be predominantly vegetarian, with the exception of Ainlatunga and Bilaikani, where the consumption of meat, fish and egg combined were higher at 0.87 kg/capita/month and 1.70 kg/capita/month respectively. A general observation that could be drawn from the observed dietary habits of the sample villages is that, the diversity of food consumption was very low in most of them, with predominant dependence on cereals and vegetables (and milk in the villages of Bihar) for meeting their energy and

nutrient requirements. Evidently, the consumption of fruits, milk (with the exception of Bihar), and non-vegetarian food items were much lower than the All-India average[8] in majority of the villages. All villages of Bihar and Jharkhand as well as two villages of Odisha (Sogar and Chandrasekharpur) belonged to this category, while Dumariya, Ainlatunga and Bilaikani were clear exceptions. The latter three villages were conspicuous by their exceptionally high consumption of almost all food items, even higher than what was observed in rest of India. As obvious from the results, the cereal and vegetable consumption in these villages was 2-3 times higher than All-India average and speaks of their deviance from rest of the country. Such deviation could be attributed to the variant eating habits in certain pockets of eastern India particularly in Odisha, attributable to their nature of work, caste and religious affiliations[9].Interestingly, a detailed investigation on this aspect revealed that the residents of these villages resorted to cheaper quality cereals and low-priced seasonal vegetables for their consumption thereby minimizing the impact on their household budget. In nutshell, the sample villages were diverse in their dietary habits with high variations in absolute as well as relative levels of consumption of various food items.

The level of self-sufficiency of the sample households in the food items consumed by them is depicted in Table 3. In general, the sample villages of Bihar were found to be highly self-sufficient in most of the food they consumed, except the non-vegetarian items. The share of home produce in total cereals consumed was above 60 per cent, while the share ranged between 15-72 per cent in pulses across the four villages that belonged to the Bihar state. In case of edible oils, while Arap was the most self-sufficient (62.4 per cent home-produced), Susaristoodat the opposite extreme with 100 per cent dependence on outside sources. The Bihar villages were particularly self-reliant on milk with 42-86 per cent their consumption being produced at home. In Jharkhand, the share of home-produce in total consumption was relatively higher in the case of cereals, vegetables and milk, though disparate trends were observed across the villages on individual items. Unlike in most other villages, Hesapiri and Durgapur of Jharkhand produced

[8]The all-India average monthly consumption of various food items in rural areas as per the 2009-10 NSS round survey are; Cereals: 11.35 kg/capita; pulses: 0.65 kg/capita; oils: 0.65 kg/capita; vegetables: 4.04 kg/capita; fresh fruits: 0.91 kg/capita; milk: 4.12 kg/capita and meat, fish and egg: 0.59 kg/capita.

[9]People belonging to upper-castes, particularly Brahmins are known to eat heavily in relation to others, irrespective of their economic status.

nearly one-fifth of their requirements of meat, fish and egg as a group. In Odisha too, the households were more or less self-reliant on cereals and milk, but lower on pulses, fresh fruits and vegetables and the least on oils and non-vegetarian food items.

In the sample villages, the household food requirement beyond that is produced at home was obtained either from the open market or the PDS[10]. Estimates suggest that, in majority of the villages covered under the study, PDS turned out to be a major source of cereals. In relative terms, the dependence of the households on PDS for cereals was the highest in Odisha followed by Jharkhand and the least in Bihar. The observed inter-village and inter-state disparity in PDS dependence could be attributed to a number of determinants such as relative performance of PDS delivery services in the states, the socio-economic profile of the households, consumption habits of people and so on. Among the four Bihar villages, Arap sourced 18.7 per cent of their cereals consumed from PDS, followed by Baghakole (11.8 %), Inai (3.3 %) and the least beingSusari (0.40%). In Jharkhand, PDS accounted for 25-36 per cent of the cereals consumed by the households, whereas in Odisha, PDS dependence ranged between 16-50 per cent. Among all, Ainlatungawas the most PDS oriented state with almost half its cereal requirement being met from this subsidized grain delivery system. On further examining the shares across land-size classes, it was revealed that households belonging to smaller land categories relied more on PDS for grains in relation to their counterparts in general. This indirectly indicates thatbeneficiary targeting is successful in the study area. A few exceptions to this rule include CSpur, Ainlatunga and Bilakani of Odisha, where the smaller land-size classes were economically stronger due to their higher non-farm income.

Calorie and Nutrient Consumption

The dietary profile of sample villages in terms of their calorie and nutrient consumption is presented in Table 5. It could be discerned from the estimates that, as in the case of consumption of various food items, the intake of calorie and nutrients also varied significantly across the villages. The average calorie consumption in Bihar varied in the range of 2007 Kcal/person/day in Susari, to 2988 Kcal/person/day in Baghakole. In Jharkhand also, the calorie consumption of respondent households fell in similar range, except in Dumariya, where the average intake was estimated to be 4128 Kcal/person/day. The inter-village calorie disparity was the highest in

[10]Only cereals (rice and wheat) are provided through PDS in India.

Odisha with CSpur faring the worst (1976 Kcal/person/day) on the one hand, and Bilaikani registering the highest (4651 Kcal/person/day) among all 12 villages.The relatively higher calorie intake in villages like Dumariya, Ainlatunga and Bilaikani could be directly attributed to their higher consumption of cereals as indicated before. A perusal on calorie consumption by farm-size groups across the villages reveals that households possessing larger farms were consuming more calories than lower category households (Table 6). The trend was pervasive across states, though with minor deviations in a few villages.

Like in the case of calorie, the average intake of other nutrients also showed disparate trends in the villages under study. Protein intake was the highest in Bilaikani (116 gm), followed by Dumariya (105 gm) and Baghakole (84 gm). On the other hand, CSpur and Hesapiri recorded the lowest protein intake (Table 5). In terms of fat consumption,Dumariya stood ahead (63 gm) of all others, though Bilaikani, Arap and Baghakole trailed closely.The intake offat was lower in Dubaliya (25 gm), Hesapiri (16 gm) and CSpur (25 gm). The dietary intake of Iron was more even across Bihar villages than that of Jharkhand and Odisha.However, the villages such as Dubaliya, Hesapiri and CSpur were notable for their low Iron intake. The two villages of Bihar (Arap and Baghakole), one village of Jharkhand (Dumariya) and two of Odisha (Ainlatunga and Bilaikani) stood out with their relative richness inintake of essential vitamins. On the other hand,Susari, Hesapiri, Durgapur, Sogar and CSpur were particularly notable on account of the low intake of almost all the vitamins by their respondent households.

Energy and nutrition deficiency in eastern India

Following the approach specified in the section on methodology, the villages were classified into four groups of under-nutrition based on the calorie and nutrient deficiency of their sample population asdepicted in Table 6.Among the 12 villages, one village was designated as ‘Extreme’, 5 villages ‘High’, 2 villages ‘Moderate’ and 4 villages ‘Low’ based on their observed proportion of households withcalorie deficiency. Evidently, CSpur belonging to the Odisha state was found to be housing more than 75 per cent of its sample population that are deficient in calorie intake asper the ICMR norm.Iani and Susari of Bihar, Hesapiri and Durgapur of Jharkhand and Sogar of Odisha fell in the category of ‘High’ calorie under-nutrition, with 50-75 per cent of their sample population being calorie-deprived. The calorie intake status of Arap and Dubaliya was also not inspiring as 25-50 per cent of their population wastaking lower calories

than prescribed for a healthy living. Baghakole, Dumariya, Ainlatunga and Bilaikani were comparatively better-off with less than 25 per cent of their respondents being designated calorie deficient. The protein intake status of the sample villages were relatively better, with none of the villages falling under the 'Extreme'category. However, Hesapiri, Durgapur and CSpur were backward in terms of protein intake as well, as evident from their 'High' protein under-nutrition status. Sogar and Dubaliya were moderately protein under-nourished whereas rest of the villages were 'Low' in their protein deficiency status. On the contrary, the deficiency of fat and Iron were more pronounced in the sample villages with 2 of them falling under 'Extreme' fat deficiency and five of them classified under 'Extreme' Iron deficiency. The situation was alarming in the case of carotene deficiency with all 12 villages being designated as 'Extreme'. In case of other vitamins as well, the situation was not very inspiring.There were five 'Extreme'thiamine deficient villagesand 8 'Extreme' Riboflavin deficient villages. Even Ainlatunga, a comparatively better-off village in terms of intake status of most other nutrients fell in the topmost category in case of Riboflavindeficiency. Similarly, 6 villages were reported to have 'Extreme' Folic acid deficiency. The status of Niacin and Vitamin C deficiency were relatively better with lower numbers of villages that fell in the top two classes of under-nutrition.

It is worth correlating the nutrient deficiency status of the villages with the quality and diversity of their food consumption. As clear from Table 2, the villages likeArap, Baghakole,Dumariya, Ainlatunga, Bilaikani, etc. with higheraverage consumption of major food items were low on the deficiency matrix. Among the above 5 villages, Dumariya exhibited the best nutritional outcome with 'Low' deficiency of all nutrients except carotene. It is worth noting that the households of this village not only consumed higher quantities of cereals and pulses but also quality dietary items such as fresh fruits, vegetables, milk, meat, fish and egg, etc. which are rich in essential nutrients. The relatively higher proportion of people deficient in major vitamins in Ainlatunga could be attributed to their low consumption of milk.

On the other hand, villages like Dubaliya, Hesapiri, Durgapur, Sogar, CSpur, etc. that fared low on the nutritional outcomes were conspicuous by their low consumption of quality food items such as fresh fruits, vegetables, milk, non-vegetarian food, etc. Durgapur, which fell in the top two categories of under-nutrition for all the nutrients considered, was particularly noteworthy for its meagre consumption of nutrient-rich dietary ingredients such as fresh fruits, vegetables, milk and other non-vegetarian items.

To understand the disparity in nutritional outcomes across the farm-size classes, state-wise deficiency status on major nutrients was obtained by pooling the villages in a state. The general trend as revealed from Table 7 suggests that, nutritional outcome of households improved as one moves from lower farm-size categories to larger ones. For instance, the marginal households in Bihar was at 'High' calorie deficiency whereas, the rest three farm-size classes belonged to the 'Moderate' deficiency category.Similarly, fat deficiency status changed from 'High' to 'Moderate' and further to 'Low' across marginal, small and the top two farm-size classes in Bihar. A similar transition was observed in the case of Riboflavin, Folic acid and Vitamin C deficiency status in Bihar. Comparable changes in nutrient deficiency status across farm-size classes were also observed in the cases of Fat, Iron and Niacin in Odisha. However, contrary to the general trend, the proportion of deficient households was more among small farm-size class than in the case of marginal class in Jharkhand. The general rule of 'higher deficiency among lower farm-size classes' was found true even when all the sample households were pooled as a single group as illustrated in Table 7.

Determinants of calorie deficiency

Calorie intake being the primary indicator of nutritional security, various factors that determines the calorie intake pattern of households was investigated upon in this section. The determinants of calorie intake include several socio-economic and demographic characteristics of the households such as age, gender, education of the household head, household size, caste affiliation, annual income of the household, its level of access to credit, share of PDS in cereal consumption, salaried employment of members, ownership of the household of productive assets such as land and livestock, diversity in food consumption, and so on. The choice of the explanatory variables included in the analysis was guided by previous empirical literature on this issue (Arene and Anyaeji, 2010; Babatunde and Qaim, 2010; Mallick and Rafi, 2010; Kassie *et al*, 2012; Cock *et al*, 2013). Accordingly, a probit regression model was fitted, taking calorie deficiency status of the households as the binary dependent variable. The results of the estimated model are presented in Table 8. The overall fit of the model was significant at 1 per cent level with pseudo R^2 value of 0.13. The coefficient of variable 'age of the household head' was positive and significant, suggesting that, households with older heads were at higher odds to be calorie insecure. However, education of the household head was found to be insignificant in determining the calorie deficiency status of the household. So was the case with gender of the

household wherein female headed households in the sample did not show any particular vulnerability to malnutrition as reported by several past studies like Kassie *et al*, 2010, Mallick and Rafi, 2010, etc. The positive and significant coefficient with respect to the variable 'household size' signifies that larger households are more prone to calorie deficiency than smaller households. The 'caste dummy' was insignificant suggesting the absence of any linkage between social status on caste basis and food insecurity of the sample households. Among the economic variables, the level of annual per capita expenditure of the household was having a strong influence on its calorie intake. As obvious from the negative coefficient of this variable which is significant at 1 per cent level, it could be easily inferred that the probability that a household is self-sufficient in calorie intake improves with the increase in its overall expenditure through the year.The role of PDS in augmenting nutritional security of households in India has been proved beyond doubt in a number of past studies. This fact is further reinforced here as the results suggest that, higher the share of PDS in cereal consumption of a household, higher would be the probability that the household is sufficient in terms of calorie intake of its members. An assured and steady flow of income through salaried job of a member of the household is also proved to be positively contributing to the calorie sufficiency of the household. The coefficient of this variable was negative and significant at 1 per cent level. Similarly, access to formal credit through the ownership of Kisan Credit Card (KCC) was found to be favoring a household to achieve higher level of calorie intake. Among the four land classes, the households belonging to the 'marginal' category were prone to calorie deficiency as indicated by the positive and significant coefficient of the dummy variable representing the land class I. The coefficients of the other categories were not significant. The livestock dummy that captures ownership of livestock by the household was found significant at 10 per cent level. This suggests that ownership of livestock improves calorie intake of households through home-produced livestock products as well as higher income assured through their possession. One of the most notable observations from the probit estimation was that, diversity in food consumption improves calorie sufficiency of the households. Evidently, the coefficient of the variable, Simpson Index of Diversity was significant at 5 per cent level and had a negative sign. In nutshell, the above probit model makes it abundantly clear that, the calorie deficiency of a household is dependent on a number of socio-economic and demographic variables discussed above that characterize its ability to get access to sufficient amount of nutritionally superior food. Though the above

exercise is limited only to calorie intake status of the households, the results are applicable in general to other dietary nutrients as well.

Conclusions

Significant disparity was observed in the pattern of food consumption across the sample villages. Cereals were the main staples being consumed in the study area, though its share in total food expenditure varied considerably across the villages. In general, the observed dietary habits of the sample households indicated very low diversity in their food consumption, with predominant dependence on cereals and vegetables for meeting their energy and nutrient requirements. The consumption of non-vegetarian food items was particularly low in the study area.The sample villages were high on self-sufficiency in the food they consumed. The share of home produce in total cereals consumed in the villages of Bihar was above 60 per cent, while the share ranged between 15-72 per cent in pulses and 42-86 per cent in milk, across the four villages that belonged to the State. In Jharkhand, the share of home-produce was relatively higher in the case of cereals, vegetables and milk, though disparate trends were observed across the villages on individual items. In Odisha too, the households were more or less self-reliant on cereals and milk, but lower on pulses, fresh fruits and vegetables and the least on oils and non-vegetarian food items. PDS was a main source of cereals, beyond what is produced at home, in the sample villages. In relative terms, the dependence of the households on PDS for cereals was the highest in Odisha followed by Jharkhand and the least in Bihar. Irrespective of location, the households belonging to smaller land categories relied more on PDS for grains in relation to their counterparts in general.

The observed dietary profile of sample villages suggested that, the intake of calorie and nutrients also varied significantly across the villages, consistent with the general disparity in their food consumption pattern. Quite in line with intuitive logic, the households possessing larger farms were consuming more calories than lower category households, with the trend pervasive across states.Subsequent analysis based on household specific calorie and nutrient intake norms suggested that nutrient deficiency was rampant in the sample villages. Among the 12 sample villages, one village was designated as ‘Extreme’, 5 villages ‘High’, 2 villages ‘Moderate’ and 4 villages ‘Low’ based on their observed proportion of households with calorie deficiency. The protein intake status of the sample villages were relatively better, with none of them falling under

the ‘Extreme’ category. On the contrary, the deficiency of fat and Iron were more pronounced in the sample villages with 2 of them falling under ‘Extreme’ fat deficiency and five of them classified under ‘Extreme’ Iron deficiency. The situation was alarming in the case of carotene deficiency with all 12 villages being designated as ‘Extreme’. In case of other vitamins as well, the condition was not very inspiring. There were five ‘Extreme’ thiamine deficient villages and 8 ‘Extreme’ Riboflavin deficient villages.Notably, the nutritional outcome of the villages was closely associated with the quality and diversity of their food consumption. The villages with higher average consumption of quality dietary items such as fresh fruits, vegetables, milk, meat, fish and egg, etc. were better-off in terms of nutritional outcomes. The determinants of calorie intake, as revealed from the binary probit analysis included socio-economic and demographic variables such as age of the household head, household size, annual income of the household, its level of access to credit, share of PDS in cereal consumption, salaried employment of members, ownership of the household of productive assets such as land and livestock, diversity in food consumption, etc. It is important to note that, though the above analysis is limited only to the sample area which is of relatively small coverage, the broad findings arising out of it have larger implications.The observed linkages between the consumption pattern and nutritional outcomes, its relationship with the quality and diversity of the food basket, the general trends across farm-size and expenditure classes, etc. are of substantive relevance not only for the eastern India, but for a considerable section of the developing world.

Acknowledgements:

This paper is drawn from the research work undertaken under the Project ‘Village Dynamics in South Asia (VDSA)’ coordinated by the ICRISAT with funding support from the Bill and Melinda Gates Foundation (BMGF). The authors thank the BMGF for the financial assistanceand ICRISAT for the overall coordination, technical and administrative support. We are equally grateful to NCAP, a network partner under the project for facilitating the data collection and other technical activities. The guidance extended by Dr. Ramesh Chand, Director, NCAP and Principal Investigator of the Project at NCAPis thankfully acknowledged. The comments and suggestions of Dr. Mruthyunjaya in improving this draft areworth mentioning.We are also indebted to other collaborating scientists under the project whose expert directions from time to time were useful in shaping-up this paper. The technical and secretarial assistance from Mr. Shivjee, the data collection and enumeration services from the field staff and the comments and suggestions received from the participants of various seminars and conferences organized under the Project are also gratefully acknowledged.

References

Arene, C.J. and Anyaeji, R.C. (2010). Determinants of food security among households in Nsukka Metropolis of Enugu State, Nigeria, *Pakistan Journal of Social Sciences*, **30**(1): 9-16.

Babatunde, R.O. and Qaim, Matin (2010). Impact of off-farm income on food security and nutrition in Nigeria, *Food Policy*, **35**: 303-311.

Cock, De, N., D'Haese, M., Vink, N., van Rooyen, C.J., Staelens, L., Schonfeldt, H.C. and D'Haese, L. (2013). Food security in rural areas of Limpopo province, South Africa, *Food Security*,**5** (2): 269-282.

GoI (2012).*Agricultural Statistics at Glance 2012*, Directorate of Economics and Statistics,Ministry of Agriculture, Government of India.

Swaminathan, Madhura (2009). Neo-liberal policies and food security in India: Impact on public distribution system, Proceedings of the Conference on 'The Crisis of Neo-liberalism in India: Challenges and Alternatives'', Tata Institute of Social Sciences (TISS), Mumbai and International Development Economics Associates (IDEAs), 13 -15, March 2009.

MSSRF (2008).*Report on the State of Food Security in Rural India*, MS Swaminathan Research Foundation, Chennai.

Gulati, Ashok, Kumar, Ganesh, A., Shreedhar, Ganga and Nandakumar, T. (2012). Agriculture and malnutrition in India, *Food and Nutrition Bulletin*, **33**(1): 74-86.

Khera, Reetika (2011a). Trends in diversion of grain from the public distribution system, *Economic and Political Weekly*, **46** (21): 106-114.

Khera, Reetika (2011b). India's public distribution system: Utilization and Impact, *Journal of Development Studies*, **47** (7): 1038-1060.

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

IFPRI/Welthungerhilfe/Concern Worldwide (2013).*Global Hunger Index-The Challenge of Hunger: Building Resilience to Achieve Food and Nutrition Security*, Bonn/Washington, DC, Dublin.

ICMR (2009).*Nutrient Requirement and Recommended Dietary Allowances for Indians, A Report of the Expert Group of the Indian Council of Medical Research*, National Institute of Nutrition, Indian Council of Medical Research, Hyderabad.

Kassie, Menale, Ndiritu, Wagura Simon, Shifero, Bekele (2012). Determinants of food security in Kenya, a gender perspective, Proceedings of the 86th Annual Conference oftheAgricultural Economics Society, University of Warwick, United Kingdom, 16-18 April, 2012.

Mallick, Debdulal and Rafi, Mohammad (2010). Are female-headed households more food insecure? Evidence from Bangladesh, *World Development*, **38** (4): 593-605.

NSSO (2012).*Nutrition Intake in India*, Report No. 540 (66/1.0/2, NSS 66th Round (July 2009-June, 2010), Ministry of Statistics and Programme Implementation, Government of India.

Vishwanathan, B. and Meenakshi, J.V. (2006) *The Changing Pattern of Under nutrition in India: A Comparative Analysis across Regions*, UNU-WIDER Research Paper No. 2006/118.

Chand, Ramesh and Jumarani, Jaya (2013). Food Security and Undernourishment in India: Assessment of Alternative Norms and the Income Effect, *Indian Journal of Agricultural Economics*, **68** (1): 39-53.

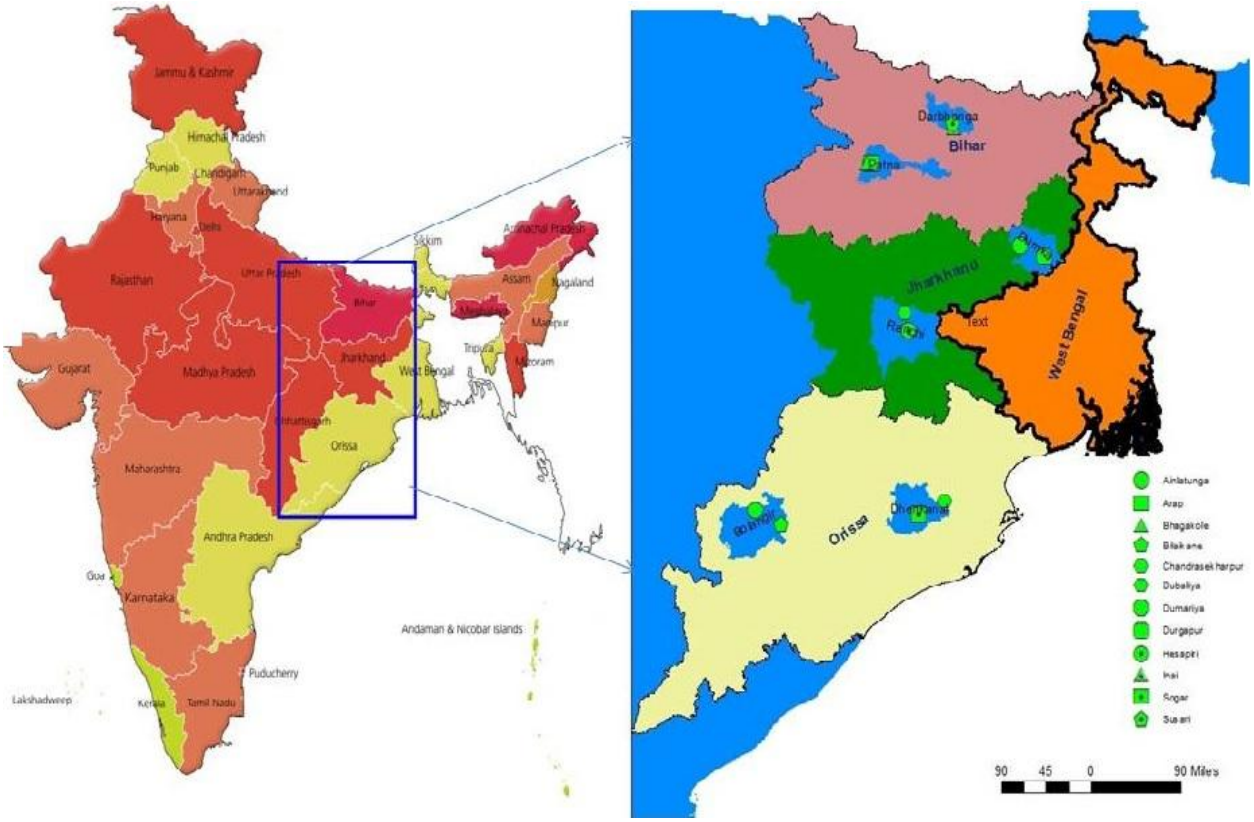

Figure 1. Map showing geographic locations of the selected villages in Bihar, Jharkhand and Odisha (Orissa) states of India

Table 1: Average monthly per capita expenditure across farm-size classes in sample households in eastern-India, 2011

(Rupees/capita/month)

State	Village	Marginal	Small	Medium	Large	All
Bihar	Arap	520	849	1146	1425	995
		(65.8)	(74.2)	(64.9)	(74.1)	(70.3)
	Baghakole	615	1044	1548	1892	1226
		(67.1)	(63.3)	(51.8)	(58.4)	(58.9)
	Inai	922	1055	1301	1485	1210
		(45.8)	(42.2)	(38.4)	(39.3)	(40.9)
	Susari	661	733	889	1046	848
		(56.8)	(61.1)	(54.8)	(44.6)	(52.7)
Jharkhand	Dubaliya	1655	964	958	1172	1156
		(29.3)	(46.6)	(55.3)	(55.3)	(46.3)
	Hesapiri	506	442	546	652	540
		(65.4)	(72.5)	(67.4)	(58.7)	(65.2)
	Dumariya	1607	1825	1852	1916	1800
		(65.2)	(58.8)	(55.7)	(65.6)	(60.9)
	Durgapur	676	518	570	826	639
		(56.0)	(63.9)	(67.9)	(56.8)	(60.8)
Odisha	Sogar	924	1408	965	1428	1192
		(51.1)	(44.1)	(56.2)	(47.5)	(49.2)
	CSpur	698	729	1330	1403	1063
		(74.6)	(68.2)	(43.7)	(39.5)	(50.7)
	Ainlatunga	1123	1736	1288	1661	1482
		(57.3)	(42.6)	(61.7)	(48.4)	(50.9)
	Bilaikani	1848	1560	1390	2474	1825
		(47.2)	(58.7)	(60.4)	(47.1)	(52.4)

Note: Figures in parentheses indicate share (%) of food in total expenditure.

Table 2. Consumption of various food items in sample households of eastern-India, 2011

(kg/person/month)

State	Village	Cereals	Pulses	Oils	Fresh fruits	Vegetables	Milk	Meat, fish & egg	Others
Bihar	Arap	18.72	0.68	0.74	0.71	8.35	13.01	0.05	-
		(27.4)	(4.0)	(8.7)	(1.9)	(13.0)	(33.0)	(0.7)	(11.2)
	Baghakole	17.70	0.78	0.66	0.60	10.79	8.68	0.12	-
		(31.5)	(5.0)	(7.6)	(2.9)	(13.2)	(24.4)	(1.3)	(14.1)
	Inai	13.40	0.60	0.41	0.87	6.54	4.36	0.34	-
		(36.7)	(5.2)	(7.4)	(4.9)	(12.4)	(17.3)	(8.3)	(7.8)
	Susari	12.51	0.62	0.38	0.35	4.21	6.04	0.11	-
		(37.1)	(6.6)	(7.7)	(2.1)	(9.1)	(27.2)	(2.9)	(7.3)
Jharkhand	Dubaliya	16.33	0.32	0.53	0.29	6.81	0.79	0.62	-
		(39.3)	(3.2)	(8.8)	(2.1)	(14.6)	(4.2)	(13.5)	(14.2)
	Hesapiri	14.02	0.51	0.33	0.08	6.77	0.31	0.20	-
		(79.5)	(2.9)	(4.4)	(0.1)	(6.2)	(0.5)	(0.4)	(6.0)
	Dumariya	21.57	1.46	1.15	0.72	20.37	4.93	0.79	-
		(24.4)	(6.8)	(9.0)	(2.0)	(16.8)	(14.0)	(8.6)	(18.4)
	Durgapur	15.11	0.49	0.51	0.10	5.85	0.32	0.42	-
		(46.4)	(7.5)	(11.6)	(0.7)	(14.1)	(1.8)	(8.7)	(9.2)
Odisha	Sogar	13.29	0.93	0.54	1.41	6.92	2.49	0.47	-
		(35.4)	(7.4)	(6.8)	(3.4)	(15.3)	(10.7)	(9.5)	(11.6)
	CSpur	11.92	0.71	0.51	1.06	6.76	2.01	0.66	-
		(24.3)	(8.6)	(9.9)	(4.4)	(15.7)	(12.2)	(12.7)	(12.2)
	Ainlatunga	20.16	1.60	0.83	1.67	9.49	0.47	0.87	-
		(24.8)	(11.0)	(9.0)	(4.8)	(17.0)	(1.4)	(13.7)	(18.3)
	Bilaikani	28.92	2.12	1.09	1.47	13.81	2.12	1.70	-
		(25.7)	(6.5)	(8.0)	(3.6)	(16.9)	(2.7)	(18.1)	(18.4)

Note: Figures in parentheses indicate share (per cent) of each food item in total food expenditure.

Table 3. Share of home produce in consumption of various food items in sample households of eastern-India, 2011

(Per cent)

State	Village	Cereals	Pulses	Oils	Fresh fruits	Vegetables	Milk	Meat, fish & egg
Bihar	Arap	64.7	71.7	62.4	55.8	29.2	86.4	1.4
	Baghakole	66.5	14.6	13.5	4.6	23.0	86.4	0.0
	Inai	63.0	40.7	21.2	15.6	25.1	41.8	0.0
	Susari	66.8	30.2	0.0	46.1	15.2	59.7	0.0
Jharkhand	Dubaliya	39.8	6.2	2.2	40.4	25.6	57.0	2.5
	Hesapiri	46.6	32.3	0.8	2.8	27.9	61.5	21.0
	Dumariya	20.6	13.0	0.0	3.1	24.1	66.6	8.3
	Durgapur	38.5	0.8	0.0	53.6	6.4	92.8	21.9
Odisha	Sogar	58.6	21.6	0.5	19.4	15.1	64.1	4.5
	CSpur	56.7	8.2	0.2	23.7	25.8	45.5	0.1
	Ainlatunga	9.3	4.2	1.9	16.0	7.0	38.2	1.4
	Bilaikani	42.4	43.3	0.0	18.0	11.1	60.5	27.6

Table 4. Share of PDS in consumption of cereals in sample households of eastern-India, 2011

(Per cent)

	Village	Marginal	Small	Medium	Large	All
Bihar	Arap	43.5	25.1	12.8	0.0	18.7
	Baghakole	30.7	12.0	3.8	0.0	11.8
	Inai	8.6	1.7	3.5	0.2	3.3
	Susari	1.0	0.4	0.2	0.0	0.4
Jharkhand	Dubaliya	25.2	23.9	22.4	33.7	26.9
	Hesapiri	46.1	38.3	31.8	31.1	36.4
	Dumariya	34.3	33.4	25.1	18.6	27.3
	Durgapur	21.0	34.4	21.2	24.6	25.3
Odisha	Sogar	38.5	14.5	9.9	6.3	16.2
	CSpur	41.4	47.4	48.1	23.4	39.0
	Ainlatunga	46.6	52.8	48.8	49.9	49.9
	Bilaikani	30.1	37.5	32.2	19.6	29.5

Table 5. Average consumption of calorie and nutrients in sample households of eastern-India, 2011

(Unit/person/day)

State	Village	Calorie (KCal)	Protein (gm)	Fat (gm)	Iron (mg)	Carotene (µg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Folic acid (µg)	Vitamin C (ug)
Bihar	Arap	2722	77	53	21	872	2.07	1.38	20	220	92
	Baghakole	2988	84	50	24	827	2.28	1.40	23	228	99
	Inai	2141	61	30	17	774	1.64	0.92	17	163	58
	Susari	2007	58	33	16	441	1.47	0.91	15	140	34
Jharkhand	Dubaliya	2443	57	25	9	620	0.75	0.62	14	107	71
	Hesapiri	2033	48	16	8	613	0.66	0.58	12	130	69
	Dumariya	4128	105	63	30	1786	2.45	1.55	29	281	167
	Durgapur	2230	52	21	10	455	0.80	0.56	14	102	53
Odisha	Sogar	2254	56	31	14	455	0.85	0.65	13	126	63
	Cspur	1976	49	25	7	352	0.61	0.50	11	111	50
	Ainlatunga	3296	81	39	17	969	1.26	0.94	19	229	104
	Bilaikani	4651	116	55	23	1672	1.65	1.38	27	310	161

Table 6. Calorie consumption by farm-size groups in sample households of eastern-India, 2011

(Unit/person/day)

State	Village	Marginal	Small	Medium	Large
Bihar	Arap	2049	2634	2840	3333
	Baghakole	2401	2771	3139	3831
	Inai	2108	2005	2112	2292
	Susari	1890	1961	2158	2015
Jharkhand	Dubaliya	2355	2001	2541	2790
	Hesapiri	2026	1988	2046	2067
	Dumariya	3908	4213	3961	4515
	Durgapur	2199	2077	2310	2352
Odisha	Sogar	2237	2286	2149	2337
	CSpur	1943	1933	2130	1923
	Ainlatunga	2911	3319	3236	3585
	Bilaikani	4417	4620	4505	4984

Table 6. Calorie and nutrient deficiency of sample population of selected households of eastern India, 2011

State	Village	Calorie	Protein	Fat	Iron	Carotene	Thiamine	Riboflavin	Niacin	Folic acid	Vitamin C
Bihar	Arap										
	Baghakole										
	Inai										
	Susari										
Jharkhand	Dubaliya										
	Hesapiri										
	Dumariya										
	Durgapur										
Odisha	Sogar										
	CSpur										
	Ainlatunga										
	Bilaikani										

Note: Cells in red, orange, yellow and green colours denotes 'Extreme' (>75% population deficient in a nutrient), 'High' (50 per cent to <75 per cent population deficient in a nutrient), 'Moderate' (25 per cent to <50 per cent population deficient in a nutrient) and 'Low' (Less than 25 per cent population deficient in a nutrient), levels of under-nutrition respectively.

Table 7. Calorie and nutrient deficiency of sample population across farm-size classes in eastern India

Region	Farm-size class	Calorie	Protein	Fat	Iron	Carotene	Thiamine	Riboflavin	Niacin	Folic acid	Vitamin C
Bihar	Marginal										
	Small										
	Medium										
	Large										
Jharkhand	Marginal										
	Small										
	Medium										
	Large										
Odisha	Marginal										
	Small										
	Medium										
	Large										
All villages	Marginal										
	Small										
	Medium										
	Large										

Note: Cells in red, orange, yellow and green colours denotes 'Extreme' (>75% population deficient in a nutrient), 'High' (50 per cent to <75 per cent population deficient in a nutrient), 'Moderate' (25 per cent to <50 per cent population deficient in a nutrient) and 'Low' (Less than 25 per cent population deficient in a nutrient), levels of under-nutrition respectively.

Table 8: Binary Probit estimation: factors contributing to calorie deficiency of sample households

Dependent variable – Calorie deficiency of households (deficient =1, otherwise = 0)		
Variable	Coefficient	Standard error
Constant	-0.6851	0.9855
Age of the household head (year)	0.0762**	0.0325
Age squared	-0.0007**	0.0003
Education of the household head (year)	-0.0277	0.0176
Gender of the household head (male = 1, female = 0)	-0.1037	0.2888
Household size (no.)	0.0494*	0.0287
Caste dummy (general = 1, others = 0)	0.0747	0.1805
Annual per capita expenditure (Rs.)	-0.0001***	0.0000
Share of PDS in cereal consumption (per cent)	-0.0060**	0.0029
Occupation type (salaried = 1, otherwise = 0)	-0.3862***	0.1483
Access to credit (KCC card holder = 1, otherwise = 0)	-0.8279*	0.4859
Land class 1 (marginal = 1 otherwise = 0)	0.4454**	0.2077
Land class 2 (small = 1 otherwise = 0)	0.2063	0.1970
Land class 3 (medium = 1 otherwise = 0)	0.0568	0.1968
Livestock dummy (own livestock = 1, otherwise = 0)	-0.2870*	0.1644
Simpson Index of dietary diversity	-1.806**	0.8800
No. of observations	480	
Pseudo R^2	0.13	
LR Chi^2	70.45***	
Log likelihood	-249.32	

Note: ***, ** and * denote significance at 1 percent, 5 percent and 10 per cent respectively.

Appendix 1. Socio-economic and demographic profile of the sample households in Eastern India, 2011

Particulars/ Village	Unit	Bihar				Jharkhand			Odisha				
		Arap	Baghakole	Inai	Susari	Dubaliya	Dumariya	Durgapur	Hesapiri	Ainlatunga	Bilaikani	CSpur	Sogar
Number of households	No.	722.0	503.0	590.0	644.0	211.0	293.0	298.0	355.0	307.0	171.0	302.0	428.0
Average age	Years	55.0	49.0	51.0	55.0	49.0	53.0	45.0	42.0	44.0	46.0	53.0	53.0
Family size	No.	6.9	7.4	7.3	8.1	5.6	5.6	4.9	6.2	4.7	5.0	5.0	6.7
Male-headed household	Per cent	95.0	95.0	87.5	95.0	87.5	97.5	82.5	100.0	100.0	100.0	95.0	100.0
Sex-ratio	Per 1000 Male	895.1	846.2	847.1	975.5	811.5	833.3	927.8	959.3	936.2	982.5	949.5	800.0
Education	Year	8.8	9.7	5.6	6.4	4.5	4.0	4.1	3.7	4.2	5.6	4.1	5.4
Literacy	Per cent	78.3	83.1	72.3	73.0	76.7	70.2	54.6	54.2	72.4	80.5	70.3	84.1
Average size of operational holding	Hectare	1.2	1.6	1.2	0.8	0.9	0.6	0.7	0.9	1.0	1.2	1.7	0.8
Irrigated area	Per cent	96.1	95.3	51.7	96.2	22.2	19.5	0.0	15.5	26.6	42.9	4.7	54.0
Average annual income	1000 Rupees	238.7	387.2	156.7	105.1	167.6	90.4	40.0	92.6	47.4	114.4	76.6	125.9
Share of income from farm	Per cent	12.3	27.8	5.9	1.8	19.8	18.1	11.8	16.2	32.5	39.8	45.7	8.3

Source: Farm survey 2011, VLS Studies