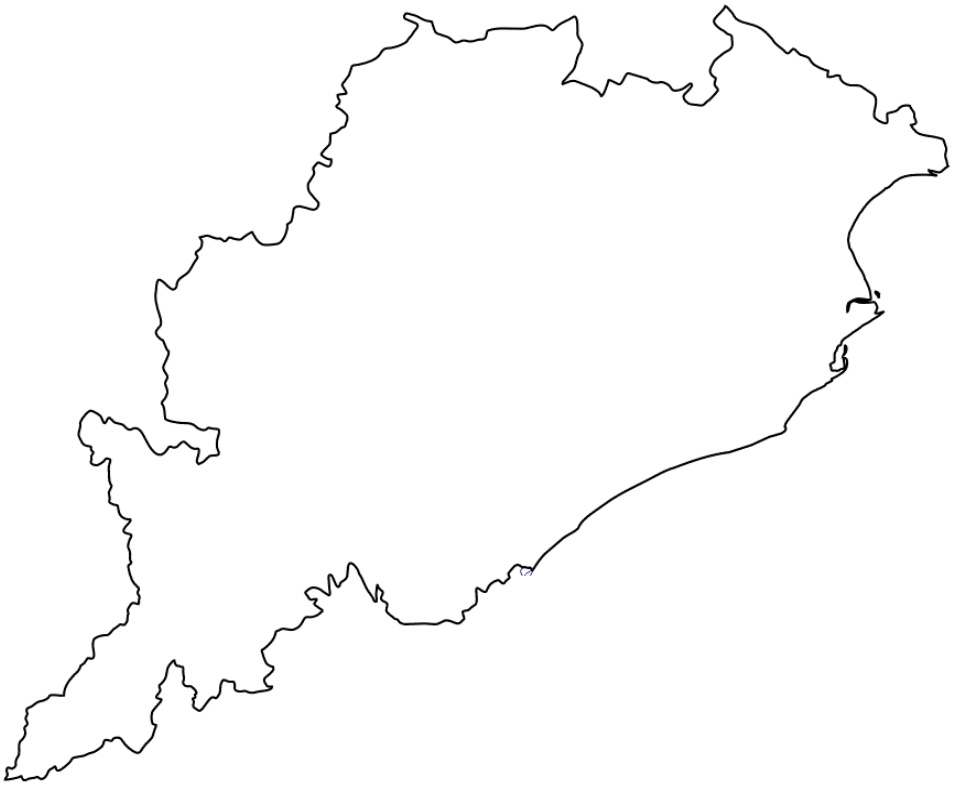
Odisha Economy Discussion Series 8

Nutrient Deficiencies in a Tribal Community



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Nutrient Deficiencies in a Tribal Community[1]

Rashmi Rekha Samal and Srijit Mishra[2]

Abstract

Purpose: This paper proposes to estimate nutrient-specific intake in a tribal community and whether their intake meets the requirement, to analyse the relationship between the numbers of nutrient deficiencies with the number of food groups consumed, and to examine the nutritional status of pregnant and lactating mothers.

Design/methodology/approach: A mixed method approach was follow using quantitative and qualitative information that was collected from 53 household-level interviews using one-day recall of their food consumption, four focus group discussions (FGDs) and one case study. Age, sex, and occupation of household members is used to arrive at nutrient-specific adult equivalent scales and norms for each household. The food intake is converted to nutrient-specific consumptions. A class of measure is used to compute household-specific nutrient-specific deprivation. A chi-square test analyses the relationship between nutrient deficiencies and food groups consumed. Food items consumed by pregnant and lactating mother households are compared with all households and also to a standard menu in Maa Gruha.

Findings: All the 53 households are deficient from at least one of the five nutrients (calorie, protein, fat, calcium and iron) under analysis. The number of nutrient-deficiencies by a household is inversely related to the number of food groups consumed by the household. Pregnant and lactating mother households, when compared with all households, have relatively lower deprivation in calorie and protein, and relatively higher deprivation in calcium. Household having pregnant and lactating mothers eat less food at home when compared to the standard menu of Maa Gruha.

Originality/Value: It has a methodological contribution on household-specific, nutrient-specific deprivation. There are important policy lessons. Nutrient deprivation in the tribal community studied is pervasive and this has adverse implications, particularly for mothers.

Key Words: Adult equivalent scale, Nutrient deprivation, Pregnant and lactating mothers, Tribal community.

JEL Classification: D12, I15, I31, I32

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1. Introduction

Globally, 821 million people (or, one-in-nine people) are undernourished in 2017 and what is worrying is that our commitment towards zero hunger, the second sustainable development goal, seems to have been reversed as the number and proportion of undernourished have increased since 2015 (International Food Policy Research Institute, 2016). In 2011-12, the estimated number of undernourished people in India is 472 million (39% of its population) and that for Odisha is 17 million (40% of its population) (Rawal et al., 2019). As per 2011 census, 40% of Odisha's population are from vulnerable social groups referred to as scheduled tribes (23%) and scheduled castes (17%) and in Kandhamal district, the focus of the current paper, 70% of its population are from these vulnerable social groups (scheduled tribes, 54%. and scheduled castes, 16%), and 90% of the population reside in the rural areas (District Census Handbook, 2011). The politics and economics of coexistence between these two broad social groups, in the context of Kandhamal, has received scholarly attention since the 1950s (Bailey, 1964, Rao, 1985, Patnaik, 2016). In recent times, Kandhamal has been identified as one of the 117 aspirational districts of India because of relative non-performance in development indicators on five aspects with one aspect being health and nutrition (NITI Aayog, 2018).

There is also an increasing concern on the double burden of malnutrition with countries, sub-national regions, social groups, families or even individuals suffering from this; for instance, being adequately nourished in terms of calorie but having other nutritional deficiencies (Gonmei and Toteja, 2018, FAO, et al., 2018, Gupta, et al., 2018). The outcome indicators are dependent on intake and it is for this that being adequately fed and not remaining hungry has been an important parameter in our understanding of poverty since the beginning of twentieth century (Graham Riches, 1997). In fact, the discourse on measurement of poverty in the Indian context, has gone a step ahead, and used calorie norms and a commensurate purchasing power to arrive at poverty lines (Mishra, 2014). These use food item wise conversion to obtain specific amount of calorie consumed, and the age-sex-occupation distribution to arrive at a normative requirement that is separate for rural and urban areas (National Institute of Nutrition, 2011). Independent of its link to estimating a poverty line, there have been attempts to arrive at calorie, protein, fat and other nutrient deficiencies for different sub-groups of population (Sen, 2005).

Nutritional deficiencies or even double burden of malnutrition could indicate an absence of diet diversity indicating that the food items consumed are from fewer food groups and even perhaps fewer items within each food group. In fact, a study across four districts and three states of India including in Kandhamal of Odisha using one-day recall of food items consumed indicates that the median number of food groups consumed is less than four reflecting low dietary diversity(Gupta et al., 2018).The access to and intake of food among some communities also reduces during lean season such that a study among tribal communities of Odisha indicates to 59% of those surveyed having only one meal a day with limited food items during the lean season and reasons for this was poor employment opportunities, non-

availability of forest products, and financial constraint (Patel, 2016). It can be said that agricultural seasons influence dietary diversity, that is, nutrition intake, which in turn can influence nutrition outcomes (Viswanathan, 2015).

The health of Indian women is among the worst in the world (World Health Organisation, 2009). Compared to men, women are at much greater risk of being both overweight and underweight (Mukherji, 2010). Adolescent girls and adult females are severely anaemic in Orissa (Bulliyya, 2004, IIIPS and Macro International, 2008, IIPS and ICF, 2017). A recent World Bank report put the figures of anaemic and undernourished girls in India at 300 million and that for women at 30 million (World Bank).Poverty, poor infants feeding practices, neglect of the girl child and social customs like eating after the men and the boys have been fed, leave the females undernourished (Ramalingaswami et al., 1996, Nestle et al., 1998, Kehoe, 2019). Poor nutritional status of women, along with a set of other complex interrelated factors, can have adverse implications on the health of the child (Kalita, 2006).

Given the issues of nutrient-specific deficiency, diet diversity understood through number of food groups consumed and its implications on nutritional intake in general and that on mothers in particular, the paper has three objectives. First, to understand nutrient-specific intake of Kandha tribe and whether their intake meets the requirement. Second, to analyse the relationship between the number of nutrient deficiencies with the number of food groups consumed. And, third, to examine the nutritional status of pregnant and lactating mothers. The rest of the paper is divided into data and methods, results, discussions, and conclusion.

2. Data and Methods

Field work was conducted across 14 villages in Phiringia and Daringbadi blocks of Kandhamal district, Odisha from December 2018 to January 2019. The block selection was guided by interventions under Odisha Millets Mission. The district and tribe selection were on account of a larger comparative exercise with Lepchas of Sikkim in understanding Asian Enigma. Futher, Kandhamal, the selected study district, is home of Kandhas/Kondhs where we find them in a specific zone. However, the villages selected, even though purposive, may not differ much in the entire undivided Koraput-Bolangir-Kandhamal (KBK) region from a deprivation perspective (Patel, 2016).

Household selection was guided by presence of pregnant and lactating mothers, and participation under OMM. Mixed method has been used for data collection: 53 interviews to 23-70 year old adults using one-day recall of household-level food consumption, four focused group discussions including one on village health and nutrition day involving all pregnant and lactating mothers and all village-level health service providers (Anganwadi *didi*, Accredited Social Health Activist worker, and Auxiliary Nurse Midwife), and one case study on Maa Gruha (Maternity Waiting Home) was conducted in one of the studied villages, and interaction with other stakeholders. The respondents agreed to interact and helped in the collection of the data by seeing the recommendation letter provided by our institute and the theme of research, which was explained to them in Odia before starting any interaction.

For each of the 53 households interviewed, a household-specific requirement was arrived at for five different nutrients (calorie, protein, fat, calcium, and iron) by taking into consideration

their nutrient-specific adult equivalent scale (AES, that is, as per their age, gender and occupation composition and pregnant/lactating status)based on recommended dietary allowances provided by National Institute of Nutrition (2011). Further, for these households, for each of the food items consumed by them, their intake of the five specific nutrients was computed using National Institute of Nutrition-based nutritive values (Gopalan et al., 2016). In addition, for children who are supposed to take food at Anganwadi (3-6 year old under Integrated Child Development Scheme, ICDS) or schools (class 1-8 under Mid-day Meal, MDM scheme) it was assumed that they ate food during one-day recall and consumed the nutrient equivalent as per norms (Government of India, Ministry of Women and Child Development, 2014, Government of India, Ministry of Human Resource Development, 2016).

Using the household-specific, nutrient-specific requirement and consumption, we propose a class of nutrition-deprivation measure,

(1) $\sum {g_{ij}}^{\alpha} d_{ij} x_{ij} \,/\, \sum y_{ij}$;

where i denotes i^{th} household (HH);j denotes j^{th} nutrient (calorie, protein, fat, calcium and iron);$g_{ij} = (r_{ij} - c_{ij})/\, r_{ij}$ (household-specific, nutrient-specific normalized gap);$r_{ij} =$ requirement of i^{th} HH for j^{th} nutrient; $c_{ij} =$ consumption of i^{th} HH j^{th} nutrient;$\alpha = 0,1, \dots, n$ (when $\alpha = 0$ then all deprived households get a value of 1 each and when $\alpha = 1$ then a deprived household gets a value equal to the normalized gap, g_{ij}, also note that greater values of αimplies higher weight to greater normalized gap); $d_{ij} = 1$ if $c_{ij} < r_{ij}$ and $d_{ij} = 0$ otherwise;$x_{ij} = h_{i\bullet}, f_{i\bullet}, e_{ij}$; $y_{ij} = x_{ij}, x_{ij} d_{ij}$;$h_{i\bullet} = 1 \; \forall \; i$, that is, 1 for each and every HH; $f_{i\bullet} =$ family size of i^{th} HH; and $e_{ij} =$ adult equivalent scale of i^{th} HH for j^{th} nutrient (depends on nutrition norms that are age-specific, gender-specific, occupation-specific and pregnant/lactating status of women).

Our class of nutrition-deprivation measure, while borrowing from α–class of poverty measure, is an improvement as the deprivation value is not fixed but is household specific and nutrient-specific (Foster et al.,1984; Hari and Mishra, 2019; Sarkar, 2020). Besides, the normalized gap can be computed either per deprived unit or per overall unit.

From the class of nutrition-deprivation measure, one can compute proportion of HH deprived ($\alpha = 0, x_{ij} = h_{i\bullet},$ and $y_{ij} = x_{ij}$), proportion of average normalized gap per deprived HH ($\alpha = 1,\ x_{ij} = h_{i\bullet},$ and $y_{ij} = x_{ij} d_{ij}$), proportion of average normalized gap per HH ($\alpha = 1,\ x_{ij} = h_{i\bullet},$ and $y_{ij} = x_{ij}$), proportion of persons deprived ($\alpha = 0,\ x_{ij} = f_{i\bullet},$ and $y_{ij} = x_{ij}$), proportion of average normalized gap per deprived person ($\alpha = 1,\ x_{ij} = f_{i\bullet},$ and $y_{ij} = x_{ij} d_{ij}$), proportion of average normalized gap per person ($\alpha = 1,\ x_{ij} = f_{i\bullet},$ and $y_{ij} = x_{ij}$), proportion of AES deprived ($\alpha = 0,\ x_{ij} = e_{ij},$ and $y_{ij} = x_{ij}$), proportion of average normalized gap per deprived AES ($\alpha = 1,\ x_{ij} = e_{ij},$ and $y_{ij} = x_{ij} d_{ij}$), and proportion of average normalized gap per AES ($\alpha = 1, x_{ij} = e_{ij},$ and $y_{ij} = x_{ij}$).

The food items consumed by households can also be used to derive the number of food groups that a household consumed (a measure of diet diversity for the household). National Institute of Nutrition reference food groups and their sub-groups provided eight food groups

(cereals; pulses and legumes; fruits and vegetables; green leafy vegetables; other vegetables; milk and milk products and meat and meat products; fats and sugar) and on the basis of HH consumption, borrowing Food and Agricultural Organization norms on food groups to understand dietary diversity additional food group (spices, condiments, and beverages) was added and sub-divided into spices and condiments as two independent food groups, which all together becomes 10 food groups (Gopalan et al., 2016, Kennedy et al., 2013). The food consumed one day before survey seems to be a normal food pattern of the HH, as care was taken to avoid it being a festival day or an occasion where food consumption would differ.

This paves the path to examine a relationship between diet diversity and nutritional deprivation (number of nutrients that a household is deficient in), which is evaluated through a chi-square test. Further, to have an item was detailing on food diversity, the composition of each food group during one-day recall and in other times will be probed. Food items consumed by pregnant and lactating mother households are compared with all households and also to a standard menu in Maa Gruha for lactating and pregnant mothers.

3. Results

Socio-economic characteristics of the respondents interviewed, Table 1, indicates the following. All respondents are Kandha/Kondh tribals in the 23-70 age group and all, but one, are married. Farming is their main source of occupation (86.8%) and their subsidiary occupation is largely as wage labourers (62.3%). They are mostly Christians (69.8%) and the remaining are Hindus, but some among them follow the *Mahima* sect. More than 64 per cent are either with primary education (45.3%) or below (18.9%, no education). Common Property Resource (CPR) is collected by 98.1 per cent and 96.2 per cent have their own fruit bearing trees. All had their own kitchen garden and all had access to tube well for drinking water. Almost all the households, HHs (50 out of 53) availed ration under public distribution system. But still around 84.9 per cent HHs suffers from shortage of food during the month of June-October. Further, 34% of the respondents are either pregnant or lactating mothers, and more than two-fifth are OMM participants (41.5%).

Using our class of nutrition-deprivation measure, nutrient-specific deprivation is given in Table 2. for three categories of population: HH, person and AES. The deprivations are broadly similar across the three categories of population, and hence, we elaborate on AES. The proportion of deprivation for AES from least to most is as follows: protein (24.9%), calories (43%), iron (47.5%), fat (98.7%) and calcium (100%). However, when it comes to normalized gap (either per deprived AES or per AES) the deprivation for fat are higher than that for calcium.

Further, we compute nutrition-deprivation measure on AES to different sub-groups of population, each of the two blocks survey – Daringbadi and Phiringia, pregnant and lactating mothers, as also participants under OMM, Table 3. The deprivations are relatively higher in Phiringia when compared with Daringbadi. For pregnant and lactating mothers, when compared with overall AES (Table 2), the deprivation for protein and calorie are relatively lower and that for calcium is relatively higher. OMM participants, in comparison to overall

AES, have relatively lower deprivation in protein, somewhat higher deprivation in calorie (except for normalized gap per deprived AES), and for iron relatively lower deprivation in terms of proportion of AES but relatively higher for normalized gap.

Table 1: Socio-Economic Characteristics of Respondents

Indicators	*Sub-Indicator*	*No.*	*%*
Category	Kandha, Scheduled Tribe (ST)	53	100.0
Age-group	23-70 years	53	100.0
Marital Status	Married	52	98.1
	Single	1	1.9
Occupation (Main)	Farming	46	86.8
	Salaried job	5	9.4
	Wage labour	1	1.9
	Truck owner/driver	1	1.9
Occupation (Subsidiary)	Wage labour	33	62.3
	NTFP collection	3	5.7
Religion	Christian	37	69.8
	Hindu	16	30.2
Education (Respondent)	No Education	10	18.9
	Primary	24	45.3
	Upper Primary	10	18.9
	Secondary	6	11.3
	Senior Secondary	1	1.9
	Graduation	2	3.8
Drinking water source	Tube well	53	100.0
Kitchen garden	Have	53	100.0
Collection from CPR	Uncultivated food items	52	98.1
Fruit bearing trees	Have	51	96.2
PDS Ration	Availed	50	94.3
Shortage of food	Lean period	45	84.9
Mothers	Pregnant	2	3.8
	Lactating	16	30.2
OMM Participant	As millet producer	22	41.5

Notes: NTFP is Non-Timber Forest Product, PDS is Public Distribution System. Wage labour and NTFP under subsidiary occupation are not mutually exclusive. CPR is Common Property Resource. The maximum number of food items that any household (HH) collected from CPR ranges from one to seven; however, across households the number of food items collected from CPR are 14 (leafy vegetables, yam, roots and tubers, Indian gooseberry, sweet potato, black plum, *bhalia* (local berries), bamboo shoot, honey, mushroom, *mohula*, *salpha,* wild fruitsand other wild vegetables.The number of fruit trees observed around the HH is nine (papaya, mango, jackfruit, banana, wood apple, guava, *bhalia* (local berries), dates and black plum); the number of fruit bearing trees available in HH courtyard ranges from one to six. OMM is Odisha Millets Mission.
Source: Primary data

Table 2: Nutrient-specific Deprivation: Households, Persons and AES

(per cent)

Category	*Indicator*	*Protein*	*Calorie*	*Iron*	*Fat*	*Calcium*
HH	Deprived HH	24.5	39.6	49.1	98.1	100
	Normalized Gap/Deprived HH	12.7	17.1	24.6	75.3	53.7
	Normalized Gap/HH	3.1	6.8	12.1	73.9	53.7
Person	Deprived Persons	22.1	40.7	47.1	98.9	100.0
	Normalized Gap/Deprived Person	13.4	17.6	27.2	75.6	53.4
	Normalized Gap/Person	2.9	7.1	12.8	74.7	53.4
AES	Deprived AES	24.9	43.0	47.5	98.7	100.0
	Normalized Gap/Deprived AES	13.5	17.5	26.6	75.9	54.3
	Normalized Gap/AES	3.3	7.5	12.6	75.0	54.3

Note: AES is Adult Equivalent Scale, HH is Household
Source: Primary data

Table 3: Nutrient-specific Deprivation for AES across different Sub-groups

(per cent)

Sub-groups	*Indicator*	*Protein*	*Calorie*	*Iron*	*Fat*	*Calcium*
Daringbadi	Deprived AES	12.8	37.1	29.3	98.2	100.0
	Normalized Gap/Deprived AES	3.2	12.1	23.1	74.6	49.3
	Normalized Gap/AES	0.4	4.9	6.8	73.3	49.3
Phiringia	Deprived AES	52.6	57.1	90.3	100.0	100.0
	Normalized Gap/Deprived AES	19.2	26.0	29.3	79.2	65.9
	Normalized Gap/AES	10.1	14.8	26.5	79.2	65.9
Pregnant and Lactating	Deprived AES	18.0	34.4	52.4	100.0	100.0
	Normalized Gap/Deprived AES	12.6	18.2	23.5	73.0	61.9
	Normalized Gap/AES	2.3	6.3	12.0	73.0	62.0
OMM participants	Deprived AES	19.2	48.9	43.5	97.1	100.0
	Normalized Gap/Deprived AES	6.1	16.4	32.0	76.3	54.1
	Normalized Gap/AES	1.2	8.0	13.9	74.2	54.1

Note: AES is Adult Equivalent Scale, OMM is Odisha Millets Mission
Source: Primary data

Table 4. represents two major components of household's food consumption: number of food groups consumed and deprivation in intake for five nutrients. Their cross tabulation and the resultant chi-square suggest that the number of food groups and the number of nutrient deficiencies are not independent of each other. They may be dependent.

Table 5. is a further explanation of Table 4. From the 18 HHs who consumed three number of food groups, 33.3% had all five nutrient-deficiencies; the maximum across categories among number of food groups consumed. For the 18 HHs who consumed four number of food groups, half had either three (27.8%) or four (22.2%) nutrient deficiencies. For the 14 HHs who consumed five number of food groups, 57.1% had two nutrient deficiencies, which is the highest for that category across number of nutrient deficiencies. For two HH who consumed

six food groups, all of them have two nutrient deficiencies. And, for one HH who consumed seven food groups, it has only one nutrient deficiency. For each of the categories under the number of food groups consumed, as the number of food groups increases from three to six the proportion of HH with two nutrient deficiencies increases indicating that as the number of food groups increases their share among fewer number of nutrient deficiency increases. These along with results of Table 4 suggests that there perhaps is an inverse relationship – the HH that consumed fewer number of food groups had greater number of nutrient deficiencies.

Table 4: Number of Nutrient Deficiencies by Number of Food Groups Consumed

Number of food groups consumed	*Number of nutrient deficiencies*						
	1	*2*	*3*	*4*	*5*	*Row Total*	*(Share)*
3	0	5	6	1	6	18	(34.0)
4	0	6	5	4	3	18	(34.0)
5	0	8	2	2	2	14	(26.4)
6	0	2	0	0	0	2	(3.8)
7	1	0	0	0	0	1	(1.9)
Column Total	1	21	13	7	11	53	(100.0)

Note: Pearson chi^2 (df: 16)= 62.8552, Pr = 0.000.
Source: Primary data

Table 5: Number of Nutrient Specific Deficiencies by Number of Food Groups Consumed

Number of food groups con-sumed	*Number of nutrient-specific deficiencies*							
	1	*2*	*3*		*4*		*5*	*Total*
	Ca	*Ca, Fat*	*Ca, Fat, Fe*	*Ca, Fat, Kcal*	*Ca, Fat, Kcal, Fe*	*Ca, Fat, Kcal, Protein*	*Ca, Fat, Fe, Kcal, Protein*	
3	0.0	27.8	22.2	11.1	0.0	5.6	33.3	100.0
4	0.0	33.3	22.2	5.6	22.2	0.0	16.7	100.0
5	0.0	57.1	14.3	0.0	7.1	7.1	14.3	100.0
6	0.0	100.0	0.0	0.0	0.0	0.0	0.0	100.0
7	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
All	1.9	39.6	18.9	5.7	9.4	3.8	20.8	100.0

Notes: Ca is calcium, Fe is Iron, Kcal is calories
Source: Primary data

Table 6: Food Items Consumed across Food Groups during One-day Recall and Additional Items Not Captured during One-day Recall

Food group	*One-day recall (no of households)*	*Varie-ties*	*Additional items not cap-tured in one-day recall*	*Varie-ties*
Cereals	Rice (53),ragi/finger millet (4) maize/corn (4), jowar/sorghum (3)	4	Little millet	1
Pulses and Legumes	Cow pea (44), horse gram(1), local pulse*kaulka*(1)	3	Beans, black gram, green gram, red lentil, peas, soyabeans, local pulses (*zhatta*, *barbati*)	8
Fruits	Tomato (36), banana (1)	2	black plum, dates, guava, jackfruit, mango, orange, papaya, local berries (*bhalia, kantei*)	8-9
Green Leafy Vegetables	Mustard leaves (26)	1	Moringa, pumpkin leaves, wild varieties	3-5
Other Vegetables	Chilly (52), potato (45), brinjal (35), papaya (30), french bean (17), onion (14), pumpkin (11), field bean (5), cauliflower (4), jackfruit (3), lady finger (1), snake bean(1), jackfruit seed (1)	13	Cabbage, drumstick, roots and tubers including yam, wild vegetables	5
Fat and Sugar	Mustard oil (27), peanut (3), sugar (13, with tea and contains in *chattua*)	2	*Gara*oil (*mahua* seed), refined oil	2
Milk and Milk Products	Milk (1, with tea)	1	Cottage cheese (*paneer*), milk powder	2
Meat and Meat Products	-	0	Mutton, pork (occasionally), [chicken, egg, fish/dry fish, (once in a month)]	5
Spices and condiments	Turmeric (7), garlic (6), local spice *dhulia*(6), mango pickle (4), cumin seeds (2)	6	Mustard	1
Alcohol	-		Locally brewed *mahula* and*tadi*	2

Note: Food group categories uses NIN based five food groups as a starting point. In NIN food group, fruits and vegetables have three sub groups and we consider each of this as an independent food group. Similarly, NIN food group milk and meat products, has two subgroups, and we consider each of this as an independent food group. Hence, we have eight food groups. In addition, from FAO norms we use two food groups: spices and condiments, and alcohol. In all, we have 10 food groups.
Source: Primary data.

Table 6 provides details of food items consumed under each of the 10 food groups as per one day recall and at other times. As per one day recall the items or food groups consumed fall under seven of the 10 food groups. On the basis of household details on consumptionfood groups under which items were consumed are cereals, pulses and legumes, green leafy vegetables, other vegetables, and spices and condiments. No food items were consumed from three food groups: milk and milk products, meat and meat products, and alcohol.

Maa Gruha is a programme by National Rural Health Mission for pregnant and lactating mothers. They have a standard meal for the pregnant and lactating mother during their stay, they also add local health food like*ragi*(finger millet), organic green leafy vegetables and lemon in their diet. The 18 HHs having pregnant and lactating mothers consumed food, as per their one-day recall, which seems to be less when compared to meals of Maa Gruha shown in Table 7. In fact, food composition of lactating and pregnant mothers HHs is similar to other HHs.

In an interaction with the coordinator of Maa Gruha, it is reported that with the support of Maa Gruha, institutional delivery in the area of Phiringia has increased and number of gravid (number of pregnancies) which was 10-11**,** over the time period it has come down to gravid 4-5 to para (number of birth that a woman had) 4-5**.**

Table 7: Meals Consumed by the Pregnant and Lactating Mothers Households as per One-day Recall and Meals served for Pregnant and Lactating Mothers at Maa Gruha

Meals	*One-day recall*	*Menu of Maa Gruha*
Breakfast	Fermented rice (with onion, chilli and salt),roasted vegetables (average 2 types of vegetables)	Upma/bread, channa curry/potato curry, ragi kheer/corn kheer/wheat flour kheer/ vermicelli kheer/milk with banana/seasonal fruit
Lunch	Rice, dal and green leafy vegetables/stir fried vegetables; or, rice with *dalma*	Rice, dalma/dal, fish/chicken/egg curry/paneer curry, stir fried green leafy vegetable/stir fried vegetable, and green salad
Evening Snacks	Chattua/puffed rice/boiled corn/peanuts/left over lunch	Puffed rice/fried flatten rice/popcorn, and roasted peanut/roasted cheak peas
Dinner	Rice, dal, boiled vegetables/fried vegetables; or, rice with *dalma*	Rice/chapattis with *dalma*/ potato soyabean curry, milk, green salad

Note: One-day recall is from 18 lactating and pregnant mothers. Six out of 18 reported that they have not taken any evening snacks in the one day recall. At Maa Gruha, *paneer* (cottage cheese) is served to vegetarian mothers when there is chicken/fish/egg curry for non-vegetarians. *Dalma*is a local recipe made up of pulses, vegetables and spices. HH is household (s).
Source: Primary Survey

4. Discussions

We have used mixed methods to examine food consumption among Kandha tribe of Odisha, their nutritional status and its dynamics. In this perspective, we discuss nutrient deprivation,

number of deficiencies by number of food groups consumed, food diversity, and food consumption of pregnant and lactating mothers.

4.1 Nutritional Deprivation Across Groups

The proposed deprivation measure uses a requirement that is nutrient-specific and household-specific (National Institute of Nutrition, 2011). In particular, it takes into consideration age, sex, occupation and pregnant/lactating status of each individual member of the household to arrive at the requirement. However, even if the norm of requirement is based on characteristic of individual members of the household, one can compute deprivation at the household level (assumes that all households are equal and each household is one unit), population level (assumes that all individuals are equal and each individual is one unit), or adult equivalent level. The incidence of deprivation or the headcount at the household and population level provides an idea of intervention. But, when requirements are household-specific, the normalized gap per deprived unit of adult equivalent, or per unit of adult equivalent will provide an easier conceptualization of the nutrient-specific shortfall. It is for this that deprivation at the level of adult equivalent scale is important. In other words, the basis of arriving at a requirement and the calculation of deprivation using the same unit, the adult equivalent scale (or, AES), has certain advantages.

All the households have calcium deprivation and all, except one, household have fat deprivation. This is worrying. In fact, for these two nutrients, the normalized gap at AES is higher than that measured at household level or population level.

What is more, households with lactating and pregnant mothers do not seem to differ much from the general population. Their greater requirement (National Institute of Nutrition, 2011; Venkatachalam et al., 2011) may be compensated by greater compensation, but deprivations are pervasive. The normalized gap for calcium, a greater requirement for mothers, is a matter of concern. This is compounded by the fact that for religious and cultural regions, Kandha's do not consume milk and milk products, an important source of calcium.

Between the two blocks, deprivation is higher is Phiringia when compared to Daringbadi. It so happens that the number of food groups consumed in Phiringia ranges from three to five whereas the number of food groups consumed in Daringbadi ranges from three to seven. Further, relatively lesser number of households consumed millets in Phiringia.

Compared to all households, there is no clear pattern for Odisha Millets Mission participant households, but for the fact that they have relatively lower deprivation in protein. Incidence of fat deprivation among Odisha Millets Mission participant households is also relatively lower, but deprivation in normalized gap is relatively higher. This could be because most households did not consume millets during one-day recall.

4.2 Food Groups Consumed and Nutrient Deficiencies

A matter of concern is that there are 18 households (34%) who in the one-day recall consumed food items only from three of the ten defined food groups, and hence, fail in the minimum dietary diversity wherein food consumed should be from four or more food groups

(Kennedy et al., 2013). In fact, these households mostly consume rice (a cereal) with either *dal* (a pulse) and other vegetables (mostly chilly, onion and brinjal among others), or *dal* and tomato (technically, a fruit), or *saga* (a green leafy vegetable) with chilly, or some other combination. These households' consumption of *dal*, *dalma* (curry like dish made up of pulses and other vegetables) or roasted vegetables/tomato did not have oil or spices in their one-day recall. From our analysis of deficiencies in five nutrients, these household suffer from deficiencies in two-to-five nutrients; one-third (or, six of them) suffering from deficiencies in all the five nutrients.

Another 18 households (34%) have consumed food items from four food groups only. One observes that seven of these households happen to be lactating/pregnant mothers and in the one-day recall all of them ate *chattua* (which was provided by Anganwadi centres and it includes items from three food groups). Further, all households consumed either *dal* (15 households) or *dalma* (three households). Their food items also had more vegetables like raw papaya and snake beans over and above the vegetables consumed by households consuming food items from three food groups. Some of these households also consumed pickle and *chatni*. These households also suffer from deficiencies in two-to-five nutrients, but a maximum of six (or, one-third) were with two deficiencies and a minimum of three (or, one-sixth) were with five deficiencies.

There were 14 (26%) households that consumed five food groups: All these households consumed cereals, other vegetables, pulses, and oil. Green leafy vegetables were consumed by nine households, fruits by five households (four had tomatoes and one bananas), and spices by only one household. Their breakfast had items with three food groups (cereals, pulses and fats). Some of them also added either oil or spices in their *dalma*. There were some that consumed either *chattua* or puffed rice/flattened rice with peanuts in their evening snacks. These households have also two to five nutrient deficiencies, but eight (or, four-seventh) have two nutrient deficiencies and two (or, one-seventh) each have three to five nutrient deficiencies.

There are two household consuming six food groups and they have only two nutrient deficiencies each. Their breakfast is similar to those who consumed five food groups. They had *dalma* with oil and spices either for lunch or dinner. And, for the other meal they either consumed *dal* with green leafy vegetables or stir-fried vegetables. Their snacks are boiled corn and puffed rice.

Only one household which has consumed seven food groups is deficient in only one nutrient, calcium. This household also seems to be an outlier as they own a truck and are economically relatively better off.

Our analysis also shows that calcium deprivation is the highest with all 53 households suffering from its deficiency. The households do not consume calcium rich food in adequate amounts. Milk and milk products being a cultural taboo, as it is meant for the calf (Almerico, 2014). The outlier household does consume milk products like *paneer* (cottage cheese) once in a while, but did not consume it during one-day recall. Availability of finger millet, a rich

source of calcium, which is currently being revived under Odisha millets mission, had reduced over time(Government of Odisha, 2015, National Food Security Mission Cell, Government of Odisha, 2016). From one-day recall, only four households consumed finger millet.

All except the outlier household suffer from fat deficiency. This is so because of limited consumption of oil and fat rich food. Iron deficiency is there among nearly half of the households: at least three-fifths each for households who consumed either three or four food groups and at least one-third for households who consumed five food groups.

Calorie deficiency is among two-fifth of households: half of the households who consumed three food groups, four-ninth of households who consumed four food groups and two-seventh of households who consumed five food groups. Protein deficiency is among nearly one-fourth of households: nearly two-fifth from households who consumed three food groups, one-sixth from households who consumed four food groups and more than one-fifth from households who consumed five food groups.

The discussion of number of food groups consumed and the number of nutrient deficiencies suggest that there is an inverse relationship, that is, households that consume a greater number of food groups have a smaller number of nutrient deficiencies. This also substantiates our chi-square result rejecting independence between the two in favour of an alternative hypothesis suggesting possible association. Given this, we now take up an analysis of diversity of food items per se and particularly within each group.

4.3 Diversity Among Food Groups

Cereals consumption was predominantly rice. In fact, all the households consumed rice at least once in our one-day recall. As conveyed in our focus group discussions (FGDs), rice obtained through public distribution system has become an indispensable part of their daily diet. The FGDs also convey that the production and consumption of millets have been concurrently declining since about three decades. The recent revival under Odisha millet mission has had some impact, particularly in Daringbadi. In fact, from the seven cases of millets consumption, six are from Daringbadi and 17 produced millets under the mission. The baseline report under the mission does indicate that households in our survey areas have been consuming millets, perhaps relatively more in summer in the form of *mandia jau* (finger millet porridge) or *torani* (fermented gruel made up of *mandia*/finger millet or rice), and with more number of recipes in Daringbadi when compared with Phiringia (NCDS, 2019). The field notes and FGDs also indicate that the households consumed *janhakhai* (pop sorghum) and *suanjau*/*kheeri* (little millet porridge). The diversity within cereals is limited and one hopes that the Odisha millets mission, which was in its first year during our survey, will be able to address this to some extent.

The consumption of pulses and legumes during one-day recall was largely *kandula* (pigeon pea) and there was one instance each of *kolatha* (horse gram), *kaulka* (a local pulse) and black gram consumption. In our FGDs and other interaction, another eight varieties of pulses and legumes were indicated, which were mostly cultivated in the region, but households may sell them without keeping adequate amounts for self-consumption or for household's nutritional

security. There were also a few who purchased, particularly *masoor dal* (red lentil), which is relatively cheaper, for consumption. However, it is a matter of concern that seven households did not consume any pulse during one-day recall. All these households consumed food items from three food groups.

Consumption of fruits in one-day recall was tomatoes, which is technically a fruit but for all purposes is consumed as a vegetable. Only one household during our one-day recall consumed bananas. Another eight-to-nine varieties of fruits, which are seasonal in nature and locally produced, were also consumed during different times of the year, as per FGDs. But, during our one-day recall, if one excludes tomatoes, there was hardly any consumption of fruits. What is more, from the fieldwork one observed that gooseberry and other local berries were being transported in truck loads to plants where they would be further processed into health products. These berries and other fruits were also available in the nearby urban centres, but, unfortunately, these were not consumed by any of the households surveyed.

The only green leafy vegetable that the households consumed during one-day recall was mustard leaves. This is intriguing because one-day recall is based on survey during the month of December when in India more varieties of green leafy vegetables ought to be available. Our FGDs and interactions also revealed consumption of moringa leaves, pumpkin leaves and other wild varieties during other times. Since the availability of some green leaves are seasonal, a practise in this region is to sundry, powder and store them for use when vegetables are in short supply.

The number of other vegetables consumed is 13 and except for potato and onion, all the other 11 are locally produced. In addition to these, the household also consume another five varieties of cultivated and uncultivated vegetables. This is the food group with maximum number of items, but in our one-day recall the average number of other vegetables consumed per household is about 4.1 and its median is 4.

For fat and sugar, as per one-day recall, 27 households consumed only mustard oil. This means that nearly half of the households did not consume oil. In addition, as per FGDs, at other times, some of the households consumed refined oil and those in Phiringia also consumed *gara* oil (extracted from *mahua* seeds). There were three household that consumed peanut, as part of evening snacks, during one-day recall. Black sesame seeds are produced for selling purpose and are not generally consumed by the households, as per our FGDs, which is unfortunate, as these seeds are fat-rich, each gram equivalent to an equal amount of fat and nine kilocalories (Gopalan et al., 2016). Sugar is occasionally consumed if they may prepare sweetmeats, but during one-day recall it was consumed in only one household with tea and the household who have consumed *chattua.*

There was only one household that consumed milk with tea. As per Kondha cultural traditions, milk and milk products are not consumed, as it is meant for the calf. This thinking was substantiated in the FGDs by limited availability of fodder. Whatever be the reason, milking of cows has not been a practise among Kondhs, unlike the Hindu (*Gauda*) community who also reside in some nearby villages. The exceptions being the outlier household that consumes

cottage cheese (paneer) and milk once in a while and in the use of milk powder when people fall sick. As Kondhs have cultural and functional reasons to not consume milk, and acculturation of milk consumption is still yet to happen, other calcium-rich food like millets need to be encouraged (Almerico, 2014).

None of the households consumed meat and meat products during one-day recall. As per FGDs, meat is consumed on special occasions, once or twice a year. In such occasions they may consume either mutton or pork. Once a month, they may consume chicken or egg from the poultry that they rear. Children (3-6 years) and pregnant and lactating mothers consume eggs thrice a week at Anganwadi centres (not reflected in one-day recall food items). Some of the households also consumed fish/dry fish once in a while. These indicate that their consumption of animal-based protein is limited. A matter of serious concern, as their consumption of plant-based protein through pulses, a major source, is also limited.

Spices and condiments, if one excludes dry chilly, are hardly consumed. Turmeric a local product that is famous across the country, and also with a Geographical Indicator tag, was consumed by only seven households during one-day recall. Six consumed garlic and six also added a local spice *dhulia* to their *dalma* preparation. Four HHs consumed mango pickle and only two used cumin seeds in their food preparations. There is a case to spice up their food.

Consumption of alcohol is not captured in the one day-recall. However, 28 households mentioned consuming locally brewed *mahula*(made up of mahua flower) and *tadi* (from date palm) during other times.

Our one-day recall refers to 32 food items and another 40 food items from FGDs and other interactions. However, more than two-thirds consumed items from three-to-four food groups only during one-day recall. This is a matter of concern, as one-day recall took place during the month of December, a post-harvest period, when food availability is relatively better. The lean period is from June to October when some households may not have sufficient food to eat, which also occurs in other parts of Odisha (Patel, 2016).

This could have adverse implications on lactating and pregnant mothers. In such lean periods, people collect some jungle food or uncultivated forest food like leafy vegetables, roots and tubers, honey, mango seeds, berries, jackfruit to cope up with scarcity. Some even migrate to other nearby states. This is the case with other tribal areas also, for instance, studies done by Living Farm (a non-governmental organization in Odisha) across three districts of Odisha, found that dependency of forest food depends on the availability of other source and almost all the households are into it but the proportion of household relying on forest food varies from village to village. Some studies indicate that the requirement of a number of micronutrients are obtained from these forest food (Deb, 2017, Deb et al., 2014).

It is observed that, fruits like gooseberry that grows in the region and is known for its nutritional value, oilseeds like black sesame with greater fat and calorie content, spices like the famed turmeric of Kandhamal known for its medicinal values with a global market, and meat and meat products that are reared by households in the region and is also considered as one of the fastest growing products in terms of value addition to the national income seem

to absent in the food based on our one-day recall. The FGDs and others interactions indicate that these products, through a series of transactions, perhaps go out of the region, akin to grain drain (Mishra, 1996, 1999). Besides, the FGDs also point to people cultivating non-food cash crops like marijuana in parts of Phiringia, which is an open secret as it is not legally permitted, and eucalyptus in Daringbadi, for the paper industry, even when people know that such fast growing trees reduce the water table. All these will have adverse implications on availability of food including that among pregnant and lactating mothers. There have been some initiatives to address the nutritional wellbeing of mothers. We elaborate these further.

4.4 Nutritional Wellbeing of Mothers

There are a number of initiatives to address the nutritional health of pregnant and lactating mothers. One of them is homes for expectant mothers (or, *Maa Gruha*) to have *Susta Maa O Susta Pila* (healthy mother and healthy baby). One such *Maa Gruha*, which happens to be managed by an organization that is also a partner under Odisha millets mission, visited during fieldwork indicates that expectant mothers come from the neighbouring villages come and stay in *Maa Gruha* for about 7-10 days prior to their due date of delivery and also for another 7-8 days after delivery of their child. It is the responsibility of the auxiliary nurse midwife and coordinator to bring the mother to *Maa Gruha* who are looked after during their stay at the *Maa Gruha*, taken to the nearest hospital to facilitate institutional delivery, and are also provided with balanced and nutritious meals during their stay (National Rural Health Mission, Odisha). This particular *Maa Gruha* had a kitchen garden where vegetables were grown without pesticides and their menu also had *mandia* (finger millet, which is rich in iron and calcium), at times (Gopalan et al., 2016).

Compared to meals at *Maa Gruha*, the meals consumed by pregnant and lactating mothers based on one-day recall have less food items. In addition, the food items consumed by households with pregnant and lactating mothers during one-day recall are similar to that from other households.

Kandha women, as is also the case among many other communities, take care of family and farm. Further, because of anticipatory socialization (Lane et al., 1968), or, adaptive preference (Sen, 1999), the prioritisation of work in favour of family and farm may lead to a neglect of personal health by these women. In particular, they may eat less than their requirement during normal times as also when they are pregnant, avoid taking supplements and additional food during pregnancy for fear of gaining weight that would come in the way of their ease of mobility, work late into pregnancy with instances of childbirth in agricultural fields, and have long work hours that makes exclusive breastfeeding difficult. Activities of fetching firewood and water can also add to their burden (Goodwin et al., 2005, Mitra and Rao, 2019). All these can have adverse implications on the health of mothers and children (Kehoe, 2019).

Given these, the provisioning of *chattua* (prepared using a cereal, a pulse and sugar) and eggs through Anganwadi centres to pregnant and lactating mothers is praiseworthy. However, as the mother prioritises family and work over her personal health, she may end up sharing this food with other family members. This is largely because of limited awareness on the

importance of nutrition and health of the mother on the child, particularly during the first 1000 days of the child that is from conception till two years after birth (WHO, 2013). Our visit to a *Maa Gruha* and interaction with their staff and other care providers like the auxiliary nurse midwife and Anganwadi worker as also participation in a *Gaon Swasthya O Poshan Dina* (village health and nutrition day) meeting, which is held once every month with all pregnant and lactating mothers as also all adolescent girls, indicates that there has been an increase in awareness on implication of mother's health and nutrition on development of child. In spite of this, as some of our FGDs indicate, the mothers did not consume *chattua* because what was provided to them was of poor quality and not fit for consumption. This is not only a serious drawback of the programme, but is also a criminal waste (Mishra, 2012).

5. Conclusion

To sum up, this paper, first, proposes a measure where the norm for deprivation line (or, poverty line) is household-specific and nutrient-specific. Second, it uses mixed method to obtain field level data using one-day recall and other tools to collect information on household consumption. The consumed items are converted to nutrient-equivalents and the shortfall is computed at the household, population and adult equivalent level to measure deprivation in five nutrients (calorie, protein, fat, calcium and iron). From the 53 households surveyed, all are calcium deficient, and all excluding one are fat deficient. Further, it is observed that there is an inverse relationship between the number of food groups consumed and the number of nutrient deficiencies. The study area has seasonal lean periods, but it is worrying that the pervasive deprivations are observed during a period of relative abundance. Higher the food groups lower the nutrient deficiency denotes that food diversity not only even throughout the year but also in the platter on a daily basis (normal days) is a need of the people to combat deficiencies on macro nutrients and addressing hidden hunger. This, along with calcium, fat and iron deficiencies should be a matter of concern, particularly for mothers and children.

While one should be cautious in generalizing from a purposive sample from a particular tribal community. Nevertheless, the tell-tale signs, including the broader indicators provided in the introduction, do suggest an important policy implication for the district or even beyond that. In this context, the role of Maa Gruha, and the recently initiated Odisha Millets Mission can have positive implications. The scope of Maa Gruha needs to be extended beyond 15 days before and after delivery and should cover longer periods. Further, inclusion of locally available nutritious food like millets (ragi with high calcium and iron content), black sesame seeds, gooseberry, and local mustard oil into their diet needs to be encouraged. This will be an important step towards *Susta Maa O Susta Pila* (healthy mother and healthy baby).

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