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Child Malnutrition in Tribal Areas: Evidence from Gujarat

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Abstract

Given the persistent nutritional deprivation in children up to 5 years of age in tribal belts of the nation, this paper attempts to understand incidence and causes of malnutrition among them. The rate of stunting (too short for their age) and underweight (too thin for their age) in tribal children was observed to be 58.4% and 44.4%, respectively. One in every four children was wasted or too thin for their height. Even during the first two years of life, when most babies are breastfed; respectively, 62% and 43% tribal children were found stunted and underweight. Since the prevalence of 'stunting' and 'underweight' is significantly more when compared to 'wasting', it is believed that children from the study areas have been adversely affected by food scarcity over a long period of time. It indicates that even though the state has been doing well with regard to poverty reduction, this success has not been emphatically translated into the reduction of malnutrition among tribal children.

JEL Classification :

Key words : Malnutrition, Child, Tribe, Anthropometry Index

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1. Introduction

The far-reaching consequences of child malnutrition are adequately explained in the literature. It can make the child more susceptible to infection, slower recovery from illness and higher mortality.[1] Nutritional deficiency during the crucial period of early childhood leads to growth retardation, which may cause residual effects later (Mehrotra 2006). Elsewhere, it is mentioned that child malnutrition has lifelong implications; it often starts *in utero* and extends well into adolescent and adult life (Administrative Committee on Coordination/ Sub-committee on Nutrition 2004, Mehrotra 2006). It is argued that children of poor communities suffering from malnutrition not only do not achieve full genetic growth potential and end up as adults with small body size, but are also exposed to a greater risk of child mortality (Pelletier *et al* 1996). Various studies suggest that poor nutritional status of children adversely affects their educational attainment, morbidity and labour productivity.[2] This in turn further reduces chances of such households coming out of impoverishment and confines them to a poverty-nutrition trap (Mohan *et al*, 2016).

Elsewhere, it is mentioned that low birth-weight infants who have suffered intra-uterine growth retardation as foetuses are born undernourished and are more likely to die in the neonatal period or later infancy (Mehrotra 2006).[3] Even if they survive, they are unlikely to catch

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1 An individual is said to be malnourished if his/her diet does not provide adequate calories and protein for growth and maintenance or unable to fully utilise the food he/she eats due to illness.

2 For a more detailed discussion on this, see Jha *et al*. (2009), Grantham McGregor *et al.* (1999) and Dercon and Sanchez (2008).

3 Out of 10.9 million deaths globally among children aged under five years, 2.42 million of these deaths are in India alone and malnutrition has been responsible, explicitly or implicitly, for about more than 50 per cent of such deaths (Gupta 2006).

up with the lost growth later and have higher chances of suffering from different developmental deficits. Though there is a possibility of compensating early childhood growth lost to some extent during adolescence, the effects of early childhood malnutrition on cognitive development and behaviour may not be fully corrected.

Notwithstanding the far-reaching consequences of child malnutrition on their health, education and economic productivity, India contains a bulk of infant under nutrition. Nearly 39 per cent of India's children aged 0-59 months are stunted (too short for their age), 29 per cent are underweight and 15 per cent are wasted (too thin for their height). In rural India, these figures are about 42 per cent, 32 per cent and 15 per cent, respectively (GoI 2014). Though incidence of child malnutrition has declined compared to the 3rd round of National Family Health Survey (NFHS) in 2005-06, it continues to be India's greatest human development challenge. It is stated that an increase in per capita income in India appears to have no positive significant effect on nutrition though it translates into declining poverty rates to some extent (Haddad 2009).[4] Thus, the persistence of under nutrition in the face of India's high rates of economic growth, substantial food grain production, active food policies and the Integrated Child Development Services (ICDS) – a standing programme focused on breaking the inter-generational cycle of malnutrition and overall child development, seems to be extraordinary.

Though child malnutrition is a problem throughout India, it is more prominent in the tribal belts of the nation. The prevalence of underweight and wasting is observed to be the highest among Scheduled Tribes (STs) children than children from other social groups (GoI and UNICEF, 2014).This indicates that tribes seem to have been facing lack of food due to their income poverty and thus tend to suffer from under nutrition. A

[4] International evidence shows that for every 3-4 per cent increase in per capita income, the malnutrition rates as measured by weight-for-age declines by 1 per cent (Haddad et al. 2003).

study by Thorat and Sadana (2009) shows a negative correlation between caste and nutrition & health. They suggest that child mortality, morbidity and nutrition are all worse for scheduled castes and scheduled tribes by 50-100 per cent compared with more favoured castes. Moreover, reduction of malnutrition among tribal children is observed to be slower than those from other social categories (Thorat and Sabharwal 2011). Thus, understanding the dynamics of persistent nutritional deprivation among tribal children reveals its relevance. Against this backdrop, this paper attempts to address the incidence and causes of malnutrition among tribal children up to 5 years of age based on the household level data from Gujarat for policy interventions. It also seeks to assess the impact of services provided through ICDS on nutritional status of the tribal children.

2. Study Area and Database

Since the main purpose of this study is to assess nutritional status of tribal children, an area having high density of tribes in the state of Gujarat is considered. Within this context, Dediapada taluka of Narmada district with 96.4 per cent tribal population was selected *(District Census Handbook – Narmada, 2011)*. The taluka has two distinct sub-regions: plains and hilly tracts spreading over a total geographical area of 1024 sq. km, of which forest area constitutes 63.9 per cent. About 95 per cent of its population lives in the rural areas. The taluka consists of 27,064 hectares cultivable land, which constitutes around 26 per cent of its geographical area. The main crops grown in the taluka are jowar, maize, tuvar and cotton. There is hardly any irrigation facility and the gross cropped area entirely depends upon rainfall in the taluka. People in the local area are of the view that the erratic behaviour of the monsoon, uneven distribution of rainfall during the crop season coupled with occasional long dry spells at post-sowing cause extensive damage to the standing crops almost every alternative year.

The male and female literacy rate in the taluka was74.9 per cent and 53.9 percent, respectively which were much lower than the state average. According to the 2011 Census, the total number of workers (main + marginal) in the block was 0.89 lakhs, constituting 50.9 per cent of its total population and a bulk of them are generally engaged in either agriculture or agricultural wage labour. Even employment generation under MGNREGA is quite poor in the study area.[5] As far as the availability of infrastructure facility is concerned, Dediapada taluka is one of the most backward. Only 62 per cent of its villages are electrified. In some of the interior villages, roads are not connected and public transport system does not exist.[6] The condition of existing roads is bad and poorly maintained. The block has 14 secondary schools, six higher secondary schools and one school with science stream. Although nine Agricultural Credit Societies are available in the taluka, only one commercial bank has been functioning for banking facility. Medical facilities are virtually absent in the villages though 36 Primary Health Sub-Centre are officially allotted. For any kind of minor or major health problems, they depend on Primary Health Centre (PHC)/Community Health Centre (CHC) or private doctors available at taluka or district headquarter hospital.[7] For food and nutritional security, the taluka has 58 *fair price shops*[8] and 303Anganwadi Centres (AWC).

With this background, 20 sample villages were randomly selected for the household survey in the study during the financial year 2013-14. From each sample village, service area of one AWC was considered to select sample households for a detailed interview. In total, information was

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5 Out of 663 sample households, 76.2 per cent had job cards. Only 51.9 per cent job card holder families reported getting work under MGNREGA in the last one year of which just 5 families revealed getting 100 days employment.

6 Of the 168 inhabited villages in the block, about 149 (88.7%) villages are connected with bus service (public and/or private).

7 Dediapada taluka has 6 PHCs and one CHC and altogether 30 beds are available for indoor patients.

8 Fair price shop is an Indian food security system which distributes subsidized food and non-food items to India's poor under Public Distribution System (PDS).

collected from 663 tribal households covering 850 children within the age group of zero to five years, 348 lactating mothers, 47 pregnant women, 17 nursing and pregnant women and 142 adolescent girls. Information on anthropometric measurements (height and weight) was collected from residents of selected households. Few family members were absent at the time of interview; information on such measurements was kept blank against their names.

3. Estimation and Analytical Framework

The present paper adopts the anthropometry method based on a new international reference population released by World Health Organisation (WHO Multicentre Growth Reference Study Group) in April 2006 to assess the nutritional status of tribal children up to five years of age. Accordingly, height-for-age (stunting), weight-for-age (underweight) and weight-for-height (wasting) indices have been estimated to assess their nutrition status.[9] Infanto meter and height meter had been used to measure the length of infants (up to two years old) and height of other sample population, respectively. Weighing scale was used to measure weight of our sample population. To obtain an accurate weight of infants, weight of mother and infant was measured together and then deducted mother's weight from the total.

Each anthropometry index evaluates a different aspect of a child's nutritional status. For instance, stunting indicates linear growth retardation and cumulative growth deficit. It reflects the cumulative effects of under nutrition and infections since birth or even before birth. The height-for-age index, therefore, represents the long-term effects of

[9] A disadvantage of anthropometry method is its lack of specificity, because changes in body measurements are also sensitive to several other factors such as altitude, stress and genetic heritage. In case of children up to five years of age, however, the effects of these factors on growth have not reached their full potential and their effects on anthropometric measurements are negligible compared to the effects of malnutrition (Park 2009, Patni 2012).

malnutrition in a population and does not vary according to recent dietary intake. The weight-for-height index measures body mass in relation to body length and describes current nutritional status. In other words, wasting indicates the failure to receive adequate nutrition in the period immediately preceding the survey or may be the result of a recent episode of illness causing loss of weight. Unlike stunting, wasting is quickly reversible. The weight-for-age is the composite index of height-for-age and weight-for-height. It takes into account both acute and chronic malnutrition as weight is influenced by thinness and height.

The nutritional status of a child is normally expressed in terms of the *Z*-score of the concerned indicator and is assumed to follow the standard normal distribution. The height-for-age *Z*-score compares the height of a child of certain age with the median height of the reference population of that age group. The weight-for-age *Z*-score does the same for weight. Similarly, the weight-for-height *Z*-score compares the weight of a child of certain height with the reference median weight of a child with the same height.

The value of the *Z*-score is expressed as the number of standard deviation that the child is away from the median of the concerned indicator of the reference population of that age/gender group. Mathematically, it can be expressed as

$$Z\text{-score} = \frac{\text{Child's anthropometric valve} - \text{Median of reference population}}{\text{Standard deviation of reference population}}$$

For any indicators, a child with *Z*-score below –2 standard deviation from the median of the reference population, is considered to be malnourished. However, the *Z*-score of a child with below –3 standard deviation, indicates severe malnourishment.

To understand a child's exposure to malnutrition, child's nutritional status has been analysed with respect to household characteristics, gender of the child, mother's nutrition and educational status, illness of the child,

household consumption and access to services provided under ICDS. For household characteristics; type of house, number of rooms in the dwelling, status of toilet, household composition, size of the family and wealth index[10] of the household were considered. Owing to the prevailing high female illiteracy in the study area, mothers who had studied above primary school were considered to assess the impact of their educational qualification on child's nutritional status.[11] Since there is a high correlation between mother and child's nutritional status and as poor women are exposed to chronic energy deficiency at a relatively higher rate, assessing the impact of the former on the latter is essential to understand child malnutrition in tribal areas.

To measure impact of household consumption on nutritional status of the child; monthly per capita cereals consumption (MPCC), number of times of consuming non-grain items in the previous week and monthly per capita consumption expenditure (MPCE) were analysed. Consumption of rice, wheat, jowar, bajra, maize, nagli, banti, mor and kodara were considered while estimating MPCC; whereas frequency of consuming pulses, green vegetables, fruits, milk, eggs, meat and fish were taken into account to assess consumption of non-grain items. Quantity consumed from own cultivation, purchased through PDS and open market was considered to arrive at MPCC. Quantity of crop sold by households had

[10] The *wealth index* is said to be reflecting the quality of life. It has been calculated by using household assets including operational size of landholding, consumer durables, productive assets and livestock. For the latter three assets, approximate market value has been multiplied by its respective number to convert these assets into monetary term. The monetary value of these assets of the i^{th} household is then summed up to arrive at its total worth of assets owned. The maximum value of assets owned is then assigned 100 points and the score of other households have been calculated accordingly with respect to their total assets value. Score on operational size of landholding (landless =0, from 0.01-2.5 acre=1, 2.51-5 acre=2, 5.01-10 acre=3 and above 10 acre=4) is then added to arrive at the aggregate score of each sample household.

[11] Out of 593 mothers interviewed whose child was aged up to 5 years, 282 (47.5%) were illiterate, 117 (19.7%) had studied up to primary and the remaining (32.7%) mothers had studied above primary school.

been adjusted with their own production while estimating MPCC. Data on number of times of non-grain item consumption in the previous week excluding the day of survey was collected on recall method. Households who had expressed non-consumption of one or more non-grain items even once in the previous week were also asked for how long they had not consumed such items. Other things remaining the same, MPCC is expected to have a positive correlation with the child's nutritional status.

For calculating MPCE, information on what all food and non-food items they had purchased in the previous month and their respective prices was collected. For food items, expenditure on food grains, vegetables, fruits, milk, eggs, fish, meat, sugar, edible oil, beverages, salt and spices were considered. For non-food items, cooking fuel and electricity, soap, washing powder, hair oil and other cosmetics, intoxicants, phone, travelling, clothing, medical expenses, education, other miscellaneous expenses covering footwear, etc were included. As expenditure on clothing, footwear, medical exigencies and education does not happen on a regular basis, annual expenditure on such items was divided by 12 to arrive at the monthly figure. For the remaining food and non-food items, monthly expenditure was calculated in two ways. In few cases, item-wise total expenditure was directly provided. In the second situation, item-wise quantity purchased was multiplied with their respective prices to arrive at monthly expenditure. For few households, even both the methods were adopted to calculate their MPCE. As MPCE reflects directly the individual or household's capacity to spend on food and non-food daily requirements, it is expected to have inverse relationship with childhood malnutrition.

The other component which influences a child's exposure to malnutrition is accessibility to services provided under ICDS. The main focus of this programme is early childhood care and development covering nutrition,

health and education. A package of services including supplementary nutrition (SNP), immunisation, health check-up and referral services are provided to children below six years of age, expectant women and lactating mothers. It also provides non-formal pre-school education (PSE) to children in the age group of 3 to 6 years and nutrition and health education (NHE) to pregnant women and nursing mothers. On the whole, the ICDS appears to be an important welfare scheme for the promotion of health and development of children and mothers. Also, it has the potential to break the life cycle of malnutrition by improving health and nutrition of pregnant women and adolescent girls. Given this, the *chi-square* test[12] has been used to assess the effect of each explanatory variable on a child's exposure to malnutrition.

4. Incidence of Child Malnutrition

The rate of under nourished tribal children as classified by three anthropometric indices of nutritional status is presented in Table 1. It is observed that 58.4 per cent children up to five years of age were stunted and 44.4 per cent were underweight at the time of survey. It implies that on average, three among every five children from the tribal communities are too short for their age and every second child is found underweight. The proportion of children who are severely undernourished (i.e. children below –3 standard deviations from the median of the reference population) is also remarkable – 36.8 per cent according to height-for-age and 13.4 per cent according to weight-for-age. Even during the first two years of life, when most babies are breastfed, about 62 per cent and 43 per cent tribal children were found stunted and underweight, respectively.

[12] The *chi-square* test of independence is used to test the hypothesis that two categorical variables (i.e., child's exposure to malnutrition and other indicators) are independent of each other. If the *p*-value (2-sided significance reported in the row corresponding to the Pearson Chi-square) is less than the significance level expected (5 %), the null hypothesis is then rejected and we conclude that there is some significant association between two variables.

Apparently, the prevalence of stunting (61.5%) and underweight (44.9%) was found higher among toddlers compared to 37-60 months age group children (51.3% were stunted and 42.7% were underweight). Notably, the prevalence of stunting and underweight was marginally higher among boys compared to girls; such difference was insignificant. This reflects almost an equal deprivation among tribal boys and girls with respect to long-term or chronic malnourishment.

The incidence of wasting was 20.2 per cent for children aged less than 6 months. It was 22.4 per cent for children aged 0.06-3 years and 27.7 per cent for 3.01-5 year old children (Table 1). The prevalence of wasting in children is observed to be increasing with respect to their age. Apparently, similar to stunting and underweight, no significant difference has been observed among tribal boys and girls in terms of wasting. Overall, the incidence of wasting was 23.9 per cent amongst children up to age of five years. It implies that on average, one out of every four tribal children from the study areas suffers from short-term malnutrition either because of inadequate diet and/or illness in the recent period immediately preceding the survey.

Table 1. Nutritional Status of Children (in %)

Age group (in years)	Gender	Number of children	Height-for-Age		Weight-for-Age		Weight-for-Height	
			Below -3 SD	Below -2 SD	Below -3 SD	Below -2 SD	Below -3 SD	Below -2 SD
<0.06	Boys	52	48.1	71.2	25.0	50.0	11.5	21.2
	Girls	32	34.4	46.9	12.5	40.6	3.1	18.8
	Sub-total	84	42.9	61.9	20.2	46.4	8.3	20.2
0.06-2.00	Boys	155	38.1	60.6	18.1	43.2	11.6	21.3
	Girls	153	39.2	62.7	11.8	40.5	7.2	22.9
	Sub-total	308	38.6	61.7	14.9	41.9	9.4	22.1
2.01-3.00	Boys	97	39.2	56.7	16.5	47.4	9.3	25.8
	Girls	94	51.1	66.0	12.8	52.1	9.6	20.2
	Sub-total	191	45.0	61.3	14.7	49.7	9.4	23.0
0.06-3.00	Boys	252	38.5	59.1	17.5	44.8	10.7	23.0
	Girls	247	43.7	64.0	12.1	44.9	8.1	21.9
	Sub-total	499	41.1	61.5	14.8	44.9	9.4	22.4
3.01-5.00	Boys	127	26.8	53.5	7.1	44.9	9.4	24.4
	Girls	140	27.1	49.3	10.0	40.7	8.6	30.7
	Sub-total	267	27.0	51.3	8.6	42.7	9.0	27.7
Overall	Boys	431	36.2	58.9	15.3	45.5	10.4	23.2
	Girls	419	37.5	57.8	11.5	43.2	7.9	24.6
	Total	850	36.8	58.4	13.4	44.4	9.2	23.9

Data presented in Table 2 shows that of the 496 children who were stunted, 62.1 of them were found to be underweight. Similarly, among 377 underweight children, 81.7 per cent were stunted or too short for their age. This clearly indicates the extent to which tribal children from the study areas are vulnerable to nutritional deprivation in terms of stunting and underweight simultaneously. Apparently, from among stunted and underweight children, 17.5 per cent and 38.7 per cent were found to be suffering from wasting, respectively. It is also observed that

from among 203 children who were wasting, correspondingly 71.9 per cent and 42.9 per cent were found underweight and too short for their age. Hence, wasting though indicates short-term malnourishment, most of the tribal children up to five years of age are observed to have been suffering from chronic malnutrition.

Table 2 Malnutrition Matrix

Nature of nutritional deprivation	Number of malnourished children	Extent to which they are malnourished in other aspects (in %)		
		Stunting	Underweight	Wasting
Stunting	496	-	62.1	17.5
Underweight	377	81.7	-	38.7
Wasting	203	42.9	71.9	-

This data was collected in October 2013 when agricultural activity was lean. This being the pre-harvest season, supply of food is unlikely to be abundant. Therefore, for few cases, the problem of wasting in tribal children can be seasonal. However, given the incidence of stunting and underweight, food scarcity seems to be an important issue for tribal children. This also reflects the ineffectiveness of supplementary nutrition programme (SNP) in the study area in reducing malnourishment among tribal children up to 5 years of age.

5. Factors Affecting Child Malnutrition

The *chi-square* test result of child's nutritional status with respect to gender of the child, household characteristics, mother's nutrition and her educational status, illness and household consumption are outlined in Table 3. It is observed that the tribal children, whether boys or girls, both are similarly affected by chronic and short-term malnourishment. In other words, whether it is height-for-age ($p>0.05$), weight-for-age ($p>0.05$) or weight-for-height ($p>0.05$) measurements, no significant relation was observed between sex of the child and malnutrition.

The *chi-square* result shows that children living in *pucca* or *semi-pucca* houses appeared to be less stunted (50.4%) compared to children living in *kachha* houses (59.8%) and this difference is found statistically significant at 5% level. Similarly, if a dwelling consisting of two or more rooms, appears to have a positive effect on child's nutritional status irrespective of being measured by height-for-age or weight-for-age. It is worth mentioning here that 262 (39.5%) sample households had just one room dwelling. Also 515 (78%) sample households had no separate room/house for cooking and they usually cooked food inside their house. Vast majority of sample households use solid fuels (firewood by 662 families, dung cake by 431 families, straw/leaves/shrub by 69 families) for cooking that generate smoke and unhealthy conditions when inhaled. This situation may be creating more respiratory-related health problems particularly in children. This may be one of the reasons why children from families having two or more rooms in their dwelling are relatively less affected by acute and chronic malnutrition.

Notably, no significant relationship between status of toilet in the dwelling and a child's nutritional status was observed. Among our sample households, a vast majority (87.8%) practise open defecation. This may be polluting the surrounding of their habitat and spreading infections. Hence, the malnutrition status of children is observed to be quite similar irrespective of having toilet in their dwelling and currently in use or not ($p>0.05$). Similarly, our analysis found no significant difference in the status of a child's chronic or short-term malnutrition across household composition (nuclear or joint/extended, $p>0.05$). Other things remaining the same, a small size family is expected to have some positive impact on the child's nutritional status. However, the *chi-square* value indicates that there was no significant difference in the prevalence of child malnutrition irrespective of whether the child is from a big or small family ($p>0.05$). It implies that child malnutrition seems to be independent of the family size. One can thus infer that the perception about child malnutrition in the study areas does not seem to vary with respect to the size of the family. Apparently, the incidence of height-for-age or weight-for-age malnourishment appeared to be less for households whose wealth index lies above the median level compared to household having wealth index below the median level. In other words, the chronic

nature of malnutrition is significantly less in children from among economically better-off household than poor households (household whose wealth index lies below the median level) ($p<0.05$). However, the short-term malnourishment (weight-for-height) seems to be independent of the family's wealth index ($p>0.05$).

Table 3. Child's Nutritional Status with respect to Different Indicators

Indicator/ Description	χ^2 significance		
	Height-for-Age (Child with Z-score below -2 SD=1, otherwise=0)	**Weight-for-Age (Child with Z-score below -2 SD=1, otherwise=0)**	**Weight-for-Height (Child with Z-score below -2 SD=1, otherwise=0)**
Sex of the child			
If a child is male = 1 (*N* = 431), female = 0 (*N* = 419)	1=58.9%, 0=57.8% *P*=.73 (χ^2 =.121, *df*=1)	1=45.5 %, 0=43.2% *P*=.50 (χ^2=.447, *df* =1)	1=23.2 %, 0=24.6% *P*=.64 (χ^2=.223, *df*= 1)
Household characteristics			
If dwelling of the household is pucca or semi-pucca = 1(*N*=129), otherwise = 0 (*N*= 721)	1=50.4%, 0=59.8% *P*=.05 (χ^2 =3.97, *df*=1)	1=39.5%, 0=45.2% *P* =.23 (χ^2=1.43, *df*=1)	1=26.4%, 0=23.4% *P*=.47 (χ^2=.512, *df*=1)
If the dwelling has two or more rooms = 1 (*N*=503), otherwise = 0 (*N*= 347)	1=55.1%, 0=63.1% *P*=.02 (χ^2=5.47, *df*=1)	1=41.7%, 0=48.1% *P*=.07 (χ^2=3.38, *df*=1)	1=26.4%, 0=20.2% *P*=.03 (χ^2=4.44, *df*=1)
If there is a toilet in the dwelling and currently in use = 1 (*N*=86), otherwise = 0 (*N*=764)	1=64 %, 0=57.7% *P*=.27 (χ^2=1.23, *df*=1)	1=43.0%, 0=44.5% *P* =.79 (χ^2=.069, *df*=1)	1=18.6%, 0=24.5% *P*=.23 (χ^2=1.466, *df*=1)
If the household is nuclear = 1 (*N*=487), otherwise = 0 (*N*=363)	1=57.1%, 0=60.1% *P*=.38 (χ^2=.755, *df*=1)	1=45.6%, 0=42.7% *P*=.40 (χ^2=.702, *df*=1)	1=27.3%, 0=19.3% *P*=.01 (χ^2=7.37, *df*=1)

Indicator/ Description	χ^2 significance		
	Height-for-Age (Child with Z-score below -2 SD=1, otherwise=0)	**Weight-for-Age (Child with Z-score below -2 SD=1, otherwise=0)**	**Weight-for-Height (Child with Z-score below -2 SD=1, otherwise=0)**
If the size of the family is above the median level = 1 (*N*=284), otherwise = 0 (*N*=566)	1=60.6%, 0=57.2% *P*=.35 (χ^2=.857, *df*=1)	1=44.7%, 0=44.2% *P*=.88 (χ^2=.023, *df*=1)	1=21.5%, 0=25.1% *P*=.24 (χ^2=1.36, *df*=1)
If wealth index of the household is above the median level = 1 (*N*=372), otherwise = 0 (*N*=478)	1=54%, 0=61.7% *P*=.02 (χ^2=5.08, *df*=1)	1=40.3%, 0=47.5% *P*=.04 (χ^2=4.35, *df*=1)	1=24.5%, 0=23.4% *P*=.73 (χ^2=.122, *df*=1)
Mother's nutrition and educational status			
If mother of a child has studied above primary school = 1 (*N*=268), otherwise = 0 (*N*= 582)	1=60.4%, 0=57. 4% *P*=.40 (χ^2=.707, *df*=1)	1= 41.4%, 0= 45.7% *P*=.24 (χ^2=1.37, *df*=1)	1=19%, 0=26.1% *P*=.02 (χ^2=5.07 ,*df*=1)
If mother of a child is malnourished = 1 (*N*=525), otherwise = 0 (*N*=310)	1=58.1% , 0=58.7% *P*=.86 (χ^2=.03, *df*=1)	1=48.4% , 0=37.1% *P*=.00 (χ^2=10.06, *df*=1)	1=26.1% , 0=19.7% *P*=.04 (χ^2=4.44, *df*=1)
Illness of the child			
If the child (.06-5 years old) was ill in the previousmonth = 1 (*N*=91), otherwise = 0 (*N*=759)	1 = 69.2%, 0 = 57% *P*=.03 (χ^2=4.96, *df*=1)	1 = 47.3%, 0 = 44% *P*=.56 (χ^2=.347, *df*=1)	1 = 19.8%, 0 = 24.4% *P*=.33 (χ^2=.943, *df*=1)

Note: The percentage figure corresponding to 1 and 0 indicates the extent of malnutrition under each condition of the respective indicator.

A significantly less proportion of tribal children are observed to be malnourished, as per weight-for-height index, whose mothers' had studied above primary school compared to children whose mothers are either illiterate or studied up to primary school*($p<0.05$)*. However, no such difference in the incidence of child malnutrition in terms of stunting and underweight is observed with respect to mother's education

(p>0.05). It implies that mother's educational qualification (above primary) is observed to save the child from short-term malnourishment (wasting) to some extent, whereas it has no noteworthy contribution in reducing child's chronic (long-term) malnutrition. This finding does not support the argument of inverse relationship between mother's educational qualification and child's nutritional status (Nussbaum, 2000 and Mehrotra, 2006). *Ceteris paribus*, the paucity of food with poor or no access to basic amenities and healthcare services, mothers with above primary education appears to hardly bearany impact on reducing a child's chronic malnutrition in the study area.

The incidence of weight-for-age malnourishment was observed to be significantly more among children whose mother's body mass index was below 18.5 than for children whose mothers were not underweight (*p<0.05*). This indicates that the chronic energy deficiency among mothers seems to have an adverse effect on their child's nutritional status.[13]Notably, 85.1 per cent pregnant women, 64.1 per cent lactating mothers and 76.5 per cent pregnant as well as lactating women were malnourished at the time of our interview. As the likelihood of undernourished mother giving birth to low birth-weight babies is higher, this reflects the extent to which child malnutrition in tribal communities starts in the uterus itself. While factors such asaccess to adequate food, health care, clean drinking water as well as other amenities have strong bearing on a child's weight, poor nourishment is likely to be a problem transmitted through generations with poorly fed anaemic mothers giving birth to underweight children who are mostly becoming malnourished at later stage.

Apparently, no statistically significant difference in the incidence of malnutrition in pregnant women, lactating mothers and pregnant as well as lactating women was noticed irrespective of whether they are from nuclear, joint or extended families. This clearly indicates that family composition has nothing to do with this higher rate of malnourishment in these women. Such phenomenon rather appears to have strong

[13] This finding corroborates with earlier studies by Radhakrishna 2005, Mehrotra 2006and Gupta 2006.

connection with the practice of intra-household allocation of available foods and their limited or no access to basic amenities and healthcare services. Some of our respondents informed that normally it is the female, including mothers/wives and daughter-in-laws and to some extent even adolescent girls who eats at last and they manage with leftover food. Thus, the intra-household allocation of available food seems to be not complying with the physiological requirements of each individual household member. In other words, even if a household accesses enough and nutritious food, it does not assure adequate food intake to all its family members, especially to females. Combined with the work burden in the family, early marriage and motherhood, the limited availability and/or poor quality food appear to be further deteriorating women's nutritional status; and this in turn, results in persistent childhood malnutrition in tribal areas.

The incidence of stunting was observed to be comparatively more among children who were sick the previous month in relation to children who were not ill during the same reference period. It implies that the prevalence of stunting among tribal children is the reflection of their victimisation by long-term malnourishment and not the recent illness.

5.1 Household Consumption versus Child Malnutrition

The MPCC was estimated as7.71 kg for these households, which is lower than the national figure of rural India and state (Gujarat) level.[14] The quantity of MPCC was found relatively less among 386 (58.2%) sample tribal families compared to state average of rural areas. Of the total cereal consumption, on average, they could meet 39 per cent through own production and another 21.3 per cent through the market. The contribution of PDS to monthly average quantity of cereals consumption per household was estimated to be 39.6 per cent. The lower quantity of per capita cereal consumption, therefore, to some extent, is attributed to failure in covering entire tribal households under PDS on the one hand; and non-availability of grains as per their entitlement, on the other.

[14] For rural India, the MPCC was estimated as 11.22 kg during 2011-12 and for rural Gujarat, the figure was 8.72 kg (NSSO, 68th round).

Under the Minimum Common Need Programme of Government of India, the BPL and AAY ration cardholders are entitled to35 kg of food grains per month (wheat + rice) at subsidized rate.[15] However, the average quantity of wheat and rice obtained by such households in the previous month was found to be 14.5 kg and 7.7 kg, respectively, which was less than that of the entitlement amount.[16]Only 10.5 per cent AAY or BPL cardholders had reported procurement of food grains as per their entitlement in the previous month. It implies that a great majority of AAY of BPL ration cardholders are not procuring food grains as per their entitlement in the study villages.

Major difficulties experienced by tribals in purchasing from ration shop include occasional/rare opening of PDS shop, open for a short duration, ration items being sold only for 3 to 4 days in a month, etc. Given the hilly topography and lack of stable approach road, some villages cannot reach the ration shop on the allotted day/date to procure their ration items, especially during rainy season. Another important difficulty experienced by tribes in purchase of ration items is non-availability of commodities due to exhaustion of stock declared by the PDS shop owner. Even 11 per cent of the sample families had no ration card to purchase subsidized items supplied under PDS.It shows that though the PDS is functioning in the study area, it has to improve much to reach people at an optimal level.

Data on the consumption of non-grain items by tribal households shows that about 74 per cent and 66 per cent of them had consumed pulses and vegetables at least four times in the previous week, respectively (Table 4). However, when it comes to consumption of fruits, milk, egg, fish and meat/chicken, the frequency is quite less. For instance, more than 54 per cent of tribal households had revealed that they did not consume fruits and milk even once in the last seven days. Similarly, more than 82 per cent families had reported about not consuming egg, fish and meat or

[15] Out of 663 sample tribal households, 72 per cent of them had either Below Poverty Line (BPL) Antyodaya Anna Yojana (AAY) card. The AAY scheme was launched in December 2000 for the poorest among the BPL families.

[16] Average quantity of sugar, salt and kerosene obtained by AAY/BPL cardholders in the previous month was 1.6 kg, 0.2 kg and 5.9 litre, respectively.

chicken in the previous week. About 10 to 15 per cent families had reported about not eating fruits, milk, egg, fish and meat for one to three months. Even two to five per cent families said they do not remember exactly when they had last consumed the above items. It indicates that the regularity of consumption of protein, fats and vitamins rich food is uncommon in the food basket of these tribal households, may be due to their poor purchasing capacity.

Table 4. Frequency of Consumption of Non-grain Items in the Previous Week

Number of times consumed in previous week	% of households by items consumed						
	Pulses	Green vegetables	Fruits	Milk	Egg	Fish	Meat/ Chicken
0	4.4	3.8	54.8	54.3	84.8	91.0	82.8
1 – 3	22.0	30.2	39.5	24.0	15.2	8.1	17.2
4 – 6	31.8	25.8	4.1	6.0	-	0.9	-
7 and above	41.8	40.3	1.7	15.7	-	-	-

These tribes thus appear to derive fat and protein from pulses and cereals to some extent and iron, calcium, vitamin-C, folic acid, etc., from green vegetables. Overall, there is a dominance of cereals in their food basket and hence, much of their food is dominated by carbohydrates. This could be the reason why there was no significant difference ($p>0.05$) in the incidence of child malnourishment among households with monthly per capita cereal consumption above or below the state (Gujarat) average in rural areas (Table 5). It implies that when households cannot afford nutritionally rich food, child malnutrition is more likely to occur irrespective of the quantity of per capita cereal consumption.

Table 5. Household Consumption and Child Malnutrition

Indicator/Description	χ^2 significance		
	Height-for-Age *(Child with Z-score below -2 SD=1, otherwise=0)*	Weight-for-Age *(Child with Z-score below -2 SD=1, otherwise=0)*	Weight-for-Height *(Child with Z-score below -2 SD=1, otherwise=0)*
If the monthly per capita cereal consumption is above the state average (rural) = 1 (*N*=344), otherwise = 0 (*N*=506)	1 = 57.8%, 0 = 58.7% *P*= 81 (χ^2=.060, *df*=1)	1 = 45.9%, 0 = 43.3% *P*=.44 (χ^2=.582, *df*=1)	1 = 25.9%, 0 = 22.5% *P*=.26 (χ^2=1.26, *df*=1)
If the average monthly per capita consumption expenditure of the household is above state-specific poverty line (rural Gujarat) = 1(*N*=26), otherwise = 0 (*N*=824)	1 = 57.7%, 0 = 58.4% *P* =.94 (χ^2=.005, *df*=1)	1 = 38.5%, 0 = 44.5% *P*=.54 (χ^2=.377, *df*=1)	1 = 11.5%, 0 = 24.3% *P*=.13 (χ^2=2.248, *df*=1)

Similarly, no significant difference (*p>0.05*) among households with MPCE above or below the state (Gujarat) poverty line is observed with respect to incidence of child malnutrition, irrespective of being measured through height-for-age, weight-for-age and weight-for-height (Table 5).[17] Based on this finding, the following inference can be drawn. First, even if some of the tribal households are having MPCE above the state-specific poverty line, they find it difficult to eradicate completely the influence of non-income factors in child malnutrition. Second, as 96.5 per cent tribal households are having average MPCE below the critical level; even though one assumes no adverse impact of their poor access to basic

[17] Among sample households, the highest amount of MPCE was Rs.2741.46 and the lowest was Rs.286.97 with an average MPCE of Rs.607. Only 23 (3.5%) sample households had MPCE above the state-specific poverty line of rural Gujarat i.e., Rs.1102.83 *(the Rangarajan Committee, Planning Commission, Government of India, June 2014).*Even 591 (89%) sample households had MPCE below the all-India average for ST (Rs.872.85). *NSS report No.554: Household Consumption Expenditure across Socio-Economic Groups (October 2012).*

amenities and healthcare services, the incidence of child malnutrition is likely to remain high among tribal children.

5.2 ICDS versus Child Malnutrition

The *chi-square* test statistics of nutritional status of children with respect to their access to services provided through ICDS are outlined in Table 6. For this, the mother's view on frequency of child attending the AWC, growth monitoring, immunization, and regularity and adequacy of supplementary food *vis-à-vis* nutritional status of the child has been analysed. A big difference was noticed in the rates of height-for-age and weight-for-age malnourishment among children who are said to be attending the AWC regularly compared to those who are not.[18] Based on this indicator, 64.8 per cent of children not attending the AWC regularly were stunted, relative to only 38.1 per cent children who were attending the AWC regularly ($p<0.05$). Similarly, among the former and latter group children, 54.4 per cent and 32.8 per cent were underweight, respectively. This clearly demonstrates a positive relationship between children's regular attendance at the AWC and their nutritional status. Apparently, regularity and adequacy of food served at the AWC is found to have a positive effect on the nutritional status of the children ($p<0.05$).In other words, the incidence of malnourishment is significantly less among those children whose mothers had reported that their children received regular and/or adequate food at the AWC against children who did not receive the food. Conversely, though the rate of malnutrition among children (6 months to 3years old) receiving regular nutritional supplement (*balbhog)* is observed to be less compared to those having irregular or no access to it, this difference was not statistically significant at the accepted 5% level. This could be attributed to the following two reasons. First, the supply of *balbhog* was not regular.[19] Second, even if households received *balbhog*, in some cases, it was not provided to the child on a regular basis because of family consumption.

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[18] If a child is attending the AWC at least four days in a week is defined as regular. At the time of our survey, only 51.9 per cent of children enrolled were attending the AWC regularly in the study area.

[19] Only 43 per cent mothers were of the view that the supply of THR was regular.

Table 6. Access to Services under ICDS and Child Malnutrition

Indicator/Description	χ^2 significance		
	Height-for-Age *(Child with Z-score below -2 SD=1, otherwise=0)*	Weight-for-Age *(Child with Z-score below -2 SD=1, otherwise=0)*	Weight-for-Height *(Child with Z-score below -2 SD=1, otherwise=0)*
If child (3.01-5 years old) attends the AWC regularly =1(*N*=134) , otherwise =0 (*N*=125)	1=38.1%, 0=64.8% *P*=.00 (χ^2=18.5, *df*=1)	1=32.8%, 0=54.4% *P*=.00 (χ^2=12.25, *df*=1)	1=25.4%, 0=31.2% *P*=.30 (χ^2=1.08, *df*=1)
If the cooked food given to child (3.01 - 5 years old) at the AWC is regular =1 (*N*=137), otherwise=0 (*N*=122)	1=40.1%, 0=63.1% *P*=.00 (χ^2=13.62, *df* =1)	1=32.8%, 0=54.9% *P*=.00 (χ^2=12.81, *df*=1)	1=21.2%, 0=36.1% *P*=.01 (χ^2=7.08, *df*=1)
If the amount of supplementary food given to the child (3.01 - 5 years old) is adequate=1(*N*=124), otherwise=0 (*N*=135)	1=33.9%, 0=66.7% *P*=.00 (χ^2=27.82, *df* =1)	1=25.8%, 0=59.3% *P*=.00 (χ^2=29.47, *df*=1)	1=17.7%, 0=37.8% *P*=.00 (χ^2=12.82, *df* =1)
If the frequency of receiving nutritional supplement for child (.06-3 years old) is regular=1 (*N*=200), otherwise=0 (*N*=267)	1=56.5%, 0=64% *P*=.09 (χ^2=2.73, *df* =1)	1=38.5%, 0=47.2% *P*=.06 (χ^2=3.52, *df* =1)	1=21.0%, 0=24.7% *P*=.35 (χ^2=.890, *df* =1)
If child's (.06 - 5 years old) weight or growth chart had been discussed = 1(*N*=331), otherwise=0 (*N*=395)	1=52.9%, 0=61.0% *P*=.06 (χ^2=3.88, *df*=1)	1=40.2%, 0=46.1% *P*=.10 (χ^2=2.55, *df* =1)	1=24.5%, 0=25.3% *P*=.79 (χ^2=.069, *df*=1)
If the child (.06 - 5 years old) is ever immunized =1(*N*=663), otherwise=0 (*N*=103)	1=56.7%, 0=66.0% *P*=.07 (χ^2=3.17, *df* =1)	1=42.8%, 0=52.4% *P*=.07 (χ^2=3.33, *df*=1)	1=25.3%, 0=17.5% *P*=.08 (χ^2=3.00, *df* =1)

Discussion on child's weight or growth chart with mother/parents was expected to have some impact on his/her nutritional status. However, the *chi-square* test value indicates that there was no significant difference in the prevalence of stunting and underweight among children whose weight or growth chart had been discussed with mother/parents compared to children where it was not ($p>0.05$). It implies that the nutritional status of a child seems to be independent of discussing or not discussing his/her growth chart.Even if Anganwadi workers notice that a particular child is too short and/or underweight for his/her age, in most cases, they neither inform the parents nor officially declare it. They may be doing this either because of lack of time or to avoid uncomfortable questions or explanation to higher authority or local public. As a result of this, the actual number of stunting, underweight and wasting children is more than the number of malnourished children officially declared. This situation is observed in the service area of almost all AWCs in the study area. It is also worth mentioning here that there was hardly any evidence of parents, especially mothers wanting to know a child's weight or growth either because of their ignorance about the adverse impact of underweight and/or poor growth or their perception about malnutrition differs from the WHO definition. Thus, no discussion on weight or growth chart of children appears to be a configured expression of supply as well as demand side factors in the study area.

Though the prevalence of stunting and underweight was observed to be relatively less among children who were ever immunized against those who were not, this difference was insignificant ($p>0.05$). This can be attributed to widespread partial immunization in the study area. For instance, *BCG* was received by 73.2 per cent children, whereas, *hepatitis-B* and *OPV* birth dose were administered to 51.9 per cent and 53.7 per cent children, respectively. About 44.2 per cent and 51.5 per cent children received at least one dose of Pentavalent and polio, respectively. Similarly, less than half proportion (46.3%) of children within the age group of 12 to 24 months received *measles* vaccine and only 43.7 per cent children in the same age group are reported to be given *vitamin-A* vaccine. These vaccinations thus appear to be unsuccessful in controlling some of the preventable diseases such as diarrhoea and dysentery; and in turn, adversely affecting the efficiency of conversion of food into energy.

At the time of fieldwork as well as from our discussion with the Anganwadi workers, it was also realised that food at AWC is not served always according to the menu. Few of them even said that they can hardly follow the menu. The most common reasons cited for this include lack of supply of materials on time, nonavailability of vegitables and pulses and delay in the reimbursement of expenses. Not giving food as per menu is unlikely to fulfill the protein energy gap and this, in turn, may be having adverse impact on the nutritional status of tribal children. Factors like not having own buildings, lack of separate space for cooking, no safe storage facility, non-availability of safe drinking water within the premises, difficulty in refilling of gas cylinder etc are separately or jointly insisting most of the Anganwadi Helpers/Anganwadi workers to cook food at their home and brings it to the Centre. Because of this, they often find difficulty in providing hot cooked food to children. Moreover, not all AWCs are giving morning and afternoon *nasta* on every working day. It is said that even the same food is being served twice some days. Since there is no effective monitoring by third party, the food served at the AWC is appearing to be completely at the mercy of the Anganwadi workers. All these factors are likely to have implications on menu and quality of food. Hence, mere enrolment of children under ICDS programme may not necessarily ensure their nutritional security in the study area.

6. Conclusions

Drawing upon household-level data, this paper examined nutritional deprivation among tribal children up to 5 years of age. Their anthropometric measurement shows that 58.4% and 44.4% of them were stunted and underweight, respectively. Also, one in every four children was found too thin for his/her height. Even during the first two years of life, when most babies are breastfed, about 62% and 43% tribal children were found stunted and underweight, respectively. Since the prevalence of ‘stunting’ and ‘underweight’ is significantly more than ‘wasting’, it is believed that children from the study areas have been adversely affected by food scarcity over a long period of time.

Tribal children, irrespective of gender, are similarly affected by chronic and short-term malnourishment. Children living in *pucca* or *semi-pucca* houses appeared to be less stunted compared to children living in *kachha* houses. It has been argued that since most of the tribals cook food inside their house using solid fuels, the smoke generated from it seems to be creating respiratory health problems in children. This may be the reason why children from families having one room dwelling are found to have poor nutritional status against children from households having two or more rooms dwelling. The practice of open defecation by a vast majority of tribal populations and its consequent pollution and/or infections is also believed to contribute to the malnutrition status in children.

Apparently, no significant difference is observed in a child's chronic malnutrition with respect to household composition (nuclear or joint/extended) and family size. However, the wealth index of the household is observed to have positive effect on a child's nutritional status. Though the mother's educational qualification appears to have positive impact on short-term malnourishment, it has no effect on the child's chronic (long-term) malnutrition. *Ceteris paribus*, the paucity of food with poor or no access to basic amenities and healthcare services, mother's education (illiterate or studied up to or above primary school) appears to hardly make any impact on reducing a child's long-term malnutrition. The risk of child malnutrition is observed to be higher where mothers have poor nutritional levels. Due to the adverse impact of non-income factors, no significant difference among households having monthly per capita consumption expenditure above or below the state (rural Gujarat) poverty line was visible with respect to child malnutrition. As the food basket of tribal households is deficient in nutritionally rich food, child malnutrition appears to occur irrespective of their quantity of per capita cereals consumption.

Since these tribes have been living in the disadvantageous environment (pitiable housing and poor or no access to basic amenities and healthcare services) and in a state of malnutrition for long period, this is assumed to have adversely affected their growth and development. This clearly indicates that even though the state has done well with regard to poverty

reduction, this success has not been emphatically translated into the reduction of malnutrition and its effects among tribal children.

Based on these findings, the study presented here suggests the following. *First*, policies for providing more stable and higher income (through MGNREGA and other schemes), healthcare coverage, housing, safe drinking water with other basic amenities, provision of LPG connection and functioning of AWCs might be usefully reviewed in the context of tribal population to ensure childhood nutritional security. *Second,* since regular and adequate supply of nutritional supplement is found to have positive impact on child's nutritional status, an awareness campaign must be undertaken on a regular basis to enhance attendance of children in the AWC. *Third*, sharing of child's weight/growth chart with parents must be made compulsory and officially recorded as it is likely to create awareness among the parents and encourage them to take extra care to maintain nutritional status of their children. *Fourth*, adverse impact of partial or no immunization and maternal malnutrition during pregnancy as well as lactating stage must be brought to their attention. *Fifth*, making PDS more effective will help these tribes to procureat least ration items as per their entitlement. This will reduce tribal households' dependency on open market for food grains and the expenditure to that extent may be shifted to the consumption of non-grain items for better standard of living. S*ixth*, information on the extent of malnourishment among children, adolescent girls, pregnant women and lactating mothers should be made in public regularly and discussed in the press, communities and household levels for creating awareness about the issue, to bring about changes in their practices and to pressurise the state to deliver decent services.

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