CAN FOOD AVAILABILITY AND ACCESSIBILITY RESULT IN BETTER FOOD UTILIZATION? A CROSS SECTIONAL STUDY ON FOOD SECURITY INDICATORS TO ADDRESS THE PERSISTENT UNDERNUTRITION IN RURAL VADODARA

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ABSTRACT: India could not solve the problem of chronic household food insecurity in about half of the population and it still has the second-highest estimated number of undernourished people in the world. Therefore this cross sectional study aimed to address the persistent undernutrition in rural Vadodara, western India by evaluating the association between various food security indicators. From *anganwadi centres* in four villages of Padra Taluka, rural Vadodara, all children (0-5y) with their mothers (n=160) were enrolled and status of household food security was assessed by personal interview of mothers using semi structured questionnaire and anthropometric measurement of mother-child pairs. Household dietary diversity was used as indicator of food availability, Income and road condition were used as indicators of food accessibility and nutritional status (height/age, weight/height, weight/age for children and BMI for mothers) was used as indicator of food utilization. Results revealed a poor picture of household food security due to low dietary diversity, less income, poor road condition and very high incidence of undernutrition. Statistical analysis in SPSS 23 software showed significant correlation between mothers' nutritional status and child's wasting. Household dietary diversity and family income significantly correlated with mother's nutritional status and child's weight for age but not with child's stunting and wasting. Therefore it can be concluded that improved food availability and accessibility can result in better food utilization. But other practices like child feeding, health care and hygiene need to be assessed which may affect the utilization of food even at better food availability and accessibility scenario.

Key words: Food security, dietary diversity, under nutrition, stunting, wasting

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INTRODUCTION

The National Family Health Survey (NFHS)-4 data for 15 States shows that 37 per cent of children under the age of five are stunted (low height for age); 22 per cent are wasted (low weight for height) while 34 per cent are under weight (low weight for age) (NFHS-4, 2014-15). Even though India has committed to meeting the Sustainable Development Goals (SDGs), children, who form a total of 36.6 per cent of India's total population, are left out in education, health, nutrition, safety and overall well-being due to the lack of emphasis on these particular sectors in the budget 2016-17. The Integrated Child Development Services (ICDS) scheme, the country's flagship intervention to improve child nutrition in India has seen a 7 per cent reduction in fund. A brief overview of the keywords in the finance minister's budget speech shows that while investment and growth were heavily mentioned, crucial aspects of development such as nutrition, ICDS (Integrated Child Development Services scheme), midday meals, the national food security act received no mention at all.

Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO policy brief, 2006). India was successful in achieving self-sufficiency by increasing its food production and improved its capacity to cope with year-to-year fluctuations in food production. But it could not solve the problem of chronic household food insecurity in about half of the population, particularly among the vulnerable groups of children, women and elderly from the lower half of the expenditure class (Reddy, 2002).

Dietary diversity is a qualitative measure of food consumption that reflects household access to a variety of foods, and is also a proxy for nutrient adequacy of the diet of individuals. Therefore dietary diversity can be an important indicator of household food availability (FAO, 2010). In case of household food accessibility physical and economic access to food can be assessed by family income, mother's individual income and road condition. Nutritional status of the population is the ideal measure of food utilization.

The aim of the present study was to address the persistent undernutrition of mothers and children by evaluating the association between various food security indicators in rural Vadodara.

Thus time to relook in holistic manner using indicators which are multifaceted. Status of food security need to be studied and relationship of the food security indicators need to be assessed in rural as well as urban areas to address the problem of undernutrition.

MATERIALS AND METHODS
Study setting and participants
It was a cross sectional study conducted for 6months at Ekalbara village of Padra taluka, rural Vadodara, western India. Four clusters of Ekalbara village were selected for the study location. All the children who were less than 5 years old along with their mothers were selected (N=160) as target group and enrolled in the study after giving consent.

Data collection and Processing
Data collection occurred in the year 2015 from July to December (6months duration). Mothers were interviewed personally using a pre-tested semi structured questionnaire to elicit data on food security.

Food availability status assessment
They were enquired about frequency of various foods consumption using a food frequency questionnaire to assess food availability. In the food frequency questionnaire 11 food groups (cereals; pulses and legumes; roots and tubers; green leafy vegetables; other vegetables; fruits; nuts and oilseeds; milk and milk products; non vegetarian foods; fats and oil; and sugar) were included, each containing more than one food item. Mothers were asked about how frequently they consume each food item and marked accordingly. Food, which was consumed daily, twice a week or weekly considered as frequently consumed and rest not frequently consumed.HDDS was calculated for each mother-child pair using a revised version of FAO guidelines (FAO, 2010) which describe how to adapt and use the dietary diversity questionnaire and how to calculate each of the scores. The households who consume half or more than half of the foods frequently in each food group scored as 1 and others scored as 0. Household dietary diversity of Mother Child pair scoring ≥4 was considered positive and <4 was considered negative.

Food accessibility status assessment
Data regarding family income, mother's individual income and road condition of the village were collected to assess food accessibility (Both economical and physical access).

Food utilization status assessment
To assess food utilization anthropometric measurement (Height and weight) was taken for both mothers and children, BMI(Body Mass Index) of mothers were calculated and categorized using standard methods (WHO global database on BMI) and in case of children z-scores were calculated for weight/age, height/age and weight/height using WHO Anthro software (WHO, 2006).

Data management and Analysis
Collected and calculated data was entered in excel 2010 datasheet and SPSS23 datasheet and analysed to determine the survey results as per the objectives. Graphs and tables were made to show the results clearly for better understanding.

Ethical review
Ethical approval was obtained from the ethical committee of the Food and Nutrition Department of the university (Approval No: IECHR/2015/16). Local community leaders were informed about the aim and procedures of the study. All study participants gave their verbal consent to participate after the study objectives were explained to them.

RESULTS
Status of food security
Food availability: Among 160 mother-child pairs, 61% scored negative HDDS and only 38% scored positive which indicates majority of them did not frequently consume variety of foods from at least 4 food groups. Cereals (majorly bajra, rice and wheat), pulses (majorly tuver and mug) and some common vegetables (Potato, tomato, and onion) were mostly consumed by the population. Majority of the population were vegetarian consuming only basic staple foods along with very low and unsatisfactory consumption of milk products, green leafy vegetables, fruits, nuts and oilseeds. Frequent consumption of Green leafy vegetables recorded for only 34.4% households, frequent vegetable (other than GLVs) consumption was there at 68.8% households, and milk and milk products were frequently consumed by only 50% households. Therefore food availability in the form of quality and variety was not satisfactory in the area which needs to be improved through promotion of agriculture and dietary diversity.

Food accessibility: Family income of 55% mother-child pairs was less than or equal to 5000 Rupees which was responsible for poor food affordability. Mothers' individual income was also very low as only 8.8% mothers had some amount of income working as agricultural labour which ranges between 500-3000 and not at all sufficient. Road condition of all 4 villages was very poor, paved road was not available in most of the area which was an obstacle for physical access to food. Therefore, food accessibility of the area in the form of physical and economic access was very poor and needs to be improved through livelihood promotion, empowerment of women, income generation by collaborating with various NGOs and organizations as well as infrastructure development of the village.

Food utilization: In the study area 87 out of 160 mothers (54%) were underweight (as per WHO global database on BMI) (Table 6) whereas among 160 children 36% were wasted, 60% were stunted and 59% were underweight (as per WHO new child growth standards, 2006 with z score <-2SD). The poor nutritional status of mothers and children revealed that food is not getting utilized properly may be because of poor food availability and accessibility or may be due to some other factors which need to be assessed further.

Relationship between food security indicators
Dietary diversity and mother's nutritional status correlated significantly ($p<0.01$) as mothers who scored positive HDDS, among them only 12.5% were underweight, but who scored negative HDDS, among them 41.9% were underweight. Dietary diversity and child's weight for age also correlated significantly ($p<0.01$) whereas child's wasting and stunting did not show any significant correlation with dietary diversity (Table 1).

When individually frequency of vegetables and milk and milk products consumption were associated with nutritional status of mothers and children, vegetable consumption did not show any significant correlation with mother's and child's nutritional status (Table 2). But milk and milk products consumption showed significant correlation with mother's nutritional status and child' weight for age but not with child's stunting or wasting status (Table 3).

Mother's individual income significantly correlated with child's underweight(weight for age) and wasting (weight for height) status but it did not significantly correlated with mother's nutritional status (Table 4). This result reveals that if mothers started earning it will increase their economic access to food which will result in better nourishment of their children.Family income also showed significant correlation with child's weight for age (figure 1) but child's stunting and wasting status did not show any significant correlation with family income.

Table-1: Association between household dietary diversity and nutritional status

S. No	Nutritional status	Positive HDDS		Negative HDDS		*P* Chi-Square test
		N	%	N	%	
1	**Mother's nutritional status**					
a)	Not Underweight	41	25.6%	32	20.0%	0.000**
b)	Underweight	20	12.5%	67	41.9%	
2	**Child's weight for age**					
a)	Not underweight	34	21.3%	31	19.4%	0.002 **
b)	Underweight	27	16.9%	68	42.5%	
3	**Child's wasting**					
a)	Not wasted	41	25.6%	20	37.5%	0.400 NS
b)	Wasted	60	12.5%	39	24.4%	
4	**Child's stunting**					
a)	Not Stunted	29	18.1%	34	21.3%	0.097 NS
b)	Stunted	32	20.0%	65	40.6%	

NS Non significant ($p>0.05$). * indicates $p<0.05$ (significant); ** indicates $p<0.01$ (highly significant); *** indicates $p<0.001$ (very highly significant)

Table-2: Association between vegetables consumption and nutritional status

S. No	Nutritional status	Frequent Vegetable consumption		Non frequent vegetable consumption		P Chi-Square test
		N	%	N	%	
1	**Mother's nutritional status**					
a)	Not Underweight	51	31.9%	22	13.8%	0.781 NS
b)	Underweight	59	36.9%	28	17.5%	
2	**Child's weight for age**					
a)	Not underweight	42	26.3%	23	14.4%	0.351 NS
b)	Underweight	68	42.5%	27	16.9%	
3	**Child's wasting**					
a)	Not wasted	66	41.3%	35	21.9%	0.224 NS
b)	Wasted	44	27.5%	15	9.4%	
4	**Child's stunting**					
a)	Not Stunted	44	27.5%	19	11.9%	0.810 NS
b)	Stunted	66	41.3%	31	19.4%	

NS Non significant (p>0.05). * indicates p<0.05 (significant); ** indicates p<0.01 (highly significant); *** indicates p<0.001 (very highly significant)

Table-3: Association between milk and milk products consumption and nutritional status of mothers and children

S. No	Nutritional status	Frequent milk and milk products consumption		Non frequent milk and milk products consumption		P Chi-Square test
		N	%	N	%	
1	**Mother's nutritional status**					
a)	Not Underweight	50	31.3%	23	14.4%	0.000**
b)	Underweight	30	18.8%	57	35.6%	
2	**Child's weight for age**					
a)	Not underweight	44	27.5%	21	13.1%	0.000 **
b)	Underweight	36	22.5%	59	36.9%	
3	**Child's wasting**					
a)	Not wasted	56	35.0%	45	28.1%	0.071 NS
b)	Wasted	24	15.0%	35	21.9%	
4	**Child's stunting**					
a)	Not Stunted	34	21.3%	29	18.1%	0.418 NS
b)	Stunted	46	28.8%	51	31.9%	

NS Non significant (p>0.05). * indicates p<0.05 (significant); ** indicates p<0.01 (highly significant); *** indicates p<0.001 (very highly significant)

Table-4: Association between Mother's individual income and nutritional status

S. No	Nutritional status	Mother's individual income		No individual income of mother		*P* Chi-Square test
		N	%	N	%	
1	**Mother's nutritional status**					
a)	Not Underweight	5	3.1%	68	42.5%	0.436NS
b)	Underweight	9	5.6%	78	48.8%	
2	**Child's weight for age**					
a)	Not underweight	1	0.6%	64	40.0%	0.008**
b)	Underweight	13	8.1%	82	51.3%	
3	**Child's wasting**					
a)	Not wasted	5	3.1%	96	60.0%	0.026*
b)	Wasted	9	5.6%	50	31.3%	
4	**Child's stunting**					
a)	Not Stunted	3	1.9%	60	37.5%	0.150NS
b)	Stunted	11	6.9%	86	53.8%	

NS Non significant ($p>0.05$). * indicates $p<0.05$ (significant); ** indicates $p<0.01$ (highly significant); *** indicates $p<0.001$ (very highly significant)
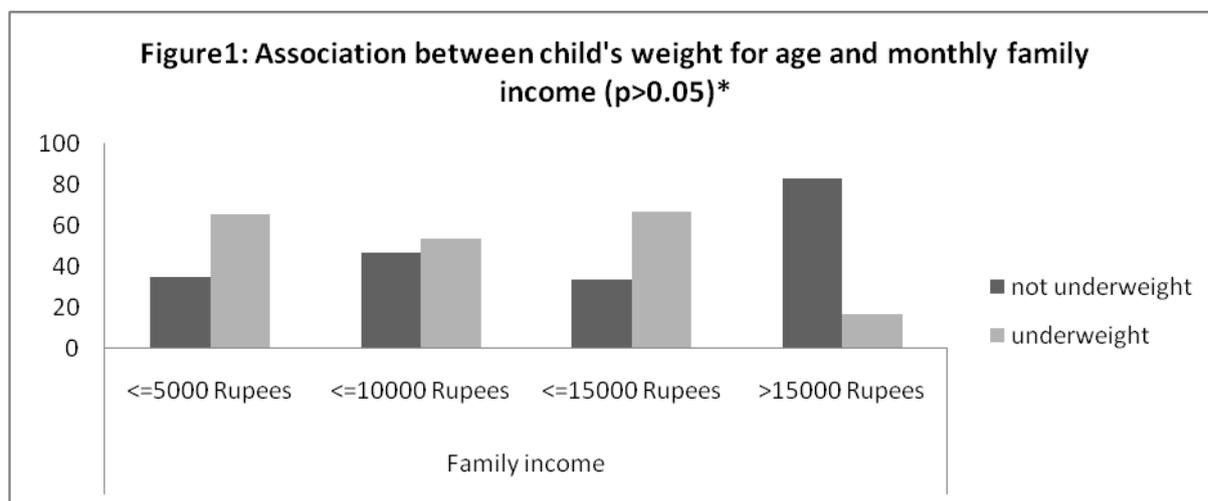
Figure-1: Association between child's weight for age and monthly family income ($p>0.05$)*

DISCUSSION

Present study indicated the need to improve food availability and accessibility to reduce the child undernutrition. However, the study highlights that though there can be adequate food purchasing power, awareness about dietary diversity for mother and child needs to be created. Several studies have highlighted the negative associations between food inflation and poor growth and mortality among neonates and young children (Fledderjohann et al, 2016), and positive associations between dietary diversity and child nutrition (Hatloy et al,2000). However, additional research is required to confirm and clarify relations between various dietary diversity indicators and nutrient intake, adequacy, and density, for children with differing dietary patterns (Arimond&Ruel, 2016).McDonald et al (2015) reported that the risk of maternal thinness, but not child undernutrition, increased as the severity of household food insecurity increased unlike the present study. Saaka& Osman (2013), recorded that the challenge to enhance dietary diversity can be met by improving nutritional security. Mishra & Raveendran,stated that the most important challenge is to increase the energy intake of the bottom 30% of the population and at the same time facilitate diet diversification to meet micronutrient deficiency. The food gap can be met from the existing food grain stocks in the medium term and by increasing their purchasing power in the long run through increasing job opportunities and can be rectified through supplementary nutrition and supply of fortified food by various food schemes initiated by the government. In the present study wasting and stunting did not show any significant correlation with food availability and accessibility.

Therefore, child care and feeding practices need to be assessed EBF for 6 months (Léon-Carvaet et al.2002), and continued for more than 1y was associated with a greater height-for-age Z score, and breast-feeding for > 18 months, in which food was introduced late in infancy, was associated with improved nutritional status as measured by standard anthropometric indicators. Therefore, nutrition-specific interventions, targeting immediate causes of undernutrition (inadequate dietary intake, poor feeding practices and high burden of disease) such as breastfeeding, complimentary feeding, micronutrient supplementation and home fortification, disease management, treatment of acute malnutrition and nutrition in emergencies need to be promoted. Along with this it is important that for these rural communities adequate leveraging of agriculture (nutrition specific), is also important for improving nutrition and health (IFPRI, 2015). Introducing several locally available foods such as moringa (Nambiar et al, 2003) along with nutrition communication (NC) is also beneficial (Imran et al, 2014). A positive deviant approach (Marsh & Schroeder, 2002; Sethi et al, 2003; (Nambiar & Desai, 2012)) can be used too, as these are workable in limited resources within similar setups in a community. In setups with meagre resources, a public private partnership (PPP) can also be a choice as it contributes to ownership along with development (IFAD and PPP, 2013).

CONCLUSION
Rural communities (mother-child pairs) are amidst plenty, yet poverty. Thus efforts to coordinate and netweork between several nutriton specific interventions need to be done in order to enhance their domestic production, dietary diversity, frequency of healthy food consumption, road condition, family income, and unawareness regarding proper food utilization which were majorly responsible for the poor undernutrition status. A large scale Agri-Nutri-Health promotion individually and through existing government programme is the need of the hour to improve food security in respect to address the persistent undernutrition.

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