Households' Dietary Diversity: A Study of Rural Households in West Bengal, India

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Abstract:

The present study aimed to examine the determinants of dietary diversity in the rural provinces of West Bengal, India. This study used a cross-sectional data that covered a sample of 485 households collected from rural Bankura District in West Bengal. Dietary Diversity Score (DSS) was calculated to capture the diversity in diet and households are categorised into 'low dietary diversity'; 'medium dietary diversity' and 'high dietary diversity groups'. Bi-variate and multivariate analysis were applied. The study showed that 40 percent of the households reported a medium level dietary diversity, 39 percent reported low level of dietary diversity and only 21 percent households reported high level of dietary diversity. Result from ordinal logistic regression model showed that chances of having high level of dietary diversity versus combined middle and low level of dietary diversity is lower for female headed houses (OR:0.508; CL,0.228-1.134) compared to male headed houses. Odds of having high level of dietary diversity versus combined middle and low level of dietary diversity is increased with size of the households (OR:1.245; CL, 0.971-1.598), households belonging to General caste (OR:2.619; CL, 1.413-4.858), monthly per capita expenditure (OR:1.004; CL, 1.003-1.005) and livestock availability (OR: 1.596; CL, 1.024-2.489).Food diversity is very important in micro-nutrients point of view. Hence, there is a need to raise the importance of food diversity in food basket to ensure the proper nutrients for an active and healthy life.

Key words: dietary diversity, food security, micronutrient deficiencies.

Introduction:

A diversified food in the household is very vital to meet the essential nutritional requirement of the population. Low food diversity in the rural household is a major problem in the developing world, because their diets are mainly based on starchy staples and often include little or no animal products and locally grown few fruits and vegetables. Household's dietary diversity and nutritional adequacy are related to each other but they are different in their constructs. It is important to understand the similarities and differences between these two (Torheim et al., 2004). *Dietary diversity* can be defined as the number of different foods or food groups consumed over a given reference period. On the other hand, *nutritional adequacy* refers to the achievement of recommended intake of energy and other essential nutrients. Because of the importance of dietary diversity in the health and nutritional outcome, this indicator has become increasingly popular in the recent year (Martin-Prevel et al., 2012). Household's dietary diversity generally assessed using a measure called Household Dietary Diversity Score (HDDS).

Household dietary diversity often used as a proxy indicator for nutritional adequacy in the household. Torheim *et al.* (2004) showed that dietary diversity is useful as an indicator of nutrient adequacy and it is important to examine how various food groups contribute to the nutrient adequacy of the diet in rural area. Many studies have shown that an increase in dietary diversity score is related to increased nutrient adequacy of the diet. Dietary diversity scores have been positively correlated with increased mean micronutrient adequacy of complementary foods (Swindale and Bilinsky, 2006), micronutrient adequacy of the diet in adolescents

(Mirmiran et al., 2004), and adults (Ogle et al., 2001). Another study among adolescent (18-28 years) female in Iran showed that household energy intake is directly related with household's dietary diversity (Azadbakht and Esmaillzadeh, 2011). Household's access to diversified food showed a positive and significant associations with calorie consumption per capita. If a household systematically underestimates the amounts of food consumed, calorie consumption per capita will be underestimate as well (World Food Progmamme, 2008). In regards to the determinants of dietary diversity, many social economic and demographic characteristics are associated with the households' dietary diversity. Several studies showed a positive association with households' dietary diversity and income (Theil and Finke, 1983; Pollack, 2001; Rashid et al., 2006). A multi country study by Hoddinott and Yohannes showed that household dietary diversity is closely associated with the household's per capita consumption, a proxy indicator of income (Hoddinott and Yohannes, 2002). Not only income but also household size, age-sex composition, employment status and level of education are also important in determining the households' dietary diversity pattern (Thiele and Weiss, 2003). Torheim et al (2004) also showed that dietary diversity was associated with socioeconomic status, residence and age.

Materials and Methods:

The present study utilises data from the primary survey. A cross-sectional study was conducted on selected rural households from Bankura district in West Bengal of India during January- May, 2013. Total samples of 485 households were collected. The respondents were either head of the family or any adult women who were involved in cooking and distribution of food in the household. The present study collected information on various food consumption in the household based on 24 hours recall period, along with the social

and demographic characteristics of the household. To understand the household's dietary diversity pattern the present study uses a scale, which called as Dietary Diversity Score scale. Household Dietary Diversity (HDD) Score is a simple count of food groups consumed over a determined period. This study uses 24 hours recall period. The recall period of 24 hours was chosen by FAO as it is less subject to recall bias, less cumbersome for the respondent and also conforms to the recall time period and used in many dietary diversity studies (Kennedy et al., 2007; Ruel et al., 2004; Savy et al., 2005; Steyn et al., 2006). The tool inquired about 12 food groups. These are: cereals, roots and tubers, vegetables, fruits, meat-poultry, eggs, fish and seafood, pulses-legumes-nuts, milk and milk products, oil-fat, sugar-honey, miscellaneous. The score is a simple sum of food groups consumed by any household member from the total of twelve food groups. A single point was awarded to each of the food groups consumed over the reference period giving a maximum sum total dietary diversity score of 12 points to each of the household. Thereafter, households are categorised into three mutually exclusive dietary diversity categories into: low dietary diversity (score <=6); medium dietary diversity (score 7-8) ; and high dietary diversity (score => 9).

Model fitting:

To understand the determinants of household dietary diversity an ordinal logit model is applied. Ordinal logit model is suitable because the outcome variable is in the ordered from. It assumes that the coefficients that describe the relationship between, say, the lowest versus all higher categories of the response variable are the same as those that describe the relationship between the next lowest category and all higher categories, etc. This is called the proportional odds assumption or the parallel regression assumption (McCullagh, 1980). In this model, the outcome variable is household dietary diversity pattern, which is categorised into ordered form i.e 0 for 'low dietary diversity';

1 for 'medium dietary diversity'; and 2 for 'high dietary diversity'. In order to investigate whether the proportional odds assumption is violated or not, two separate tests were employed. Both the *omodel* and *brant* tests were carried out and give non-significant results, which signify the validity in use of this model. A set of predictor variables are included in the model. These are age, sex and education status of head of the households; religion, caste, and major source of income, currently employed members, economic dependency ratio, MPCE, size of landholding, and livestock in the households. The likelihood ratio chi-square of 321.58 with a p-value of 0.000 tells that the model as a whole is statistically significant. The mathematical equation of this model can be defined in following way:

$$\lambda_j(\vec{x}) = ln\left\{\frac{\sum_1^j \Pr(y=j|\vec{x})}{\sum_{j+1}^k \Pr(y=j|\vec{x})}\right\} = \propto_j + (\beta_1 x_1 + \beta_2 x_2 + \dots\dots\dots\dots + \beta_p x_p),$$

Here,

j=1, 2,………..k-1

y= response variable, $\vec{x}$ = vector of explanatory variables = $(x_1, x_2, \dots, x_p)$

Result:

Frequency of Food Consumption Pattern in the Household:

Fig 1 represents the frequency of food consumption in the last 24 hours in the household. It gives a snapshot of current food diversity pattern in the households. Result shows that consumption of needed foods like cereals, spice, oil etc are universal. But very low consumption is reported for fruits, meat and vitamin A rich vegetables in the last 24 hours. Consumption of fat and protein rich food are also not very satisfactory level. Only 16 percent household reported to eat eggs and 31 percent have reported to eat milk and milk product in the last 24 hours. How ever fish consumption is found little

higher (40 percent) compared to others protein and fat rich food. Consumption of vegetables and legumes are also come as the second ordered preferred food group in the rural household.
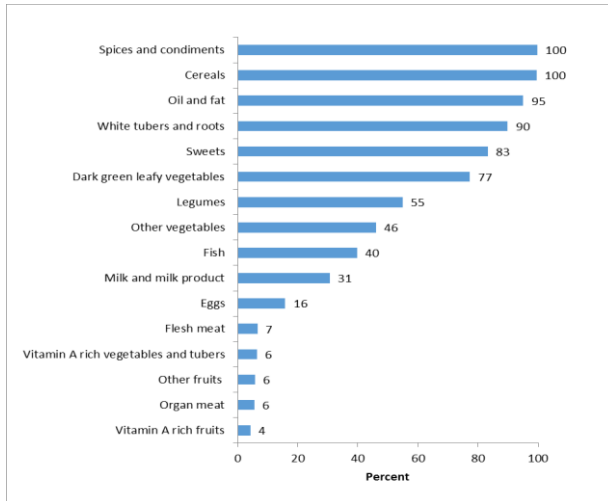
Fig 1: Frequency of Food Consumption in the Last 24 hours

Socio-Economic and demographic Differential of Dietary Diversity in the Household:

Table 1 depicts the dietary diversity pattern in the rural household by the social and caste groups. Result finds that among Hindu dietary diversity is lower than the Muslims. Among Hindu, highest proportion (41 percent) have reported low dietary diversity pattern whereas among Muslims, highest proportion (43 percent) have reported medium dietary diversity pattern. Average dietary diversity score is also higher for Muslims (7.3) than Hindus (7.1). Caste wise differentials are also found in the dietary diversity pattern. Among Scheduled Caste, majority of the houses reported low dietary diversity (45 percent) and medium dietary diversity (45 percent) and only nine percent of Scheduled caste (SC) houses reported a high dietary diversity. Same scenario found among Scheduled Tribe (ST) houses as well. Among Scheduled Tribe houses, 65 percent reported low dietary diversity pattern. Among Other Backward

Caste , majority of the household (42 percent) reported medium dietary diversity pattern. Among General Caste people, majority of the houses reported high or medium dietary diversity pattern in the household. Average dietary diversity score is also found to be lowest to Scheduled Tribe families (6.2) whereas it is highest (7.8) to the General Caste houses.

Table 1: Dietary Diversity pattern in the households by the social and caste groups

Social groups	Percent households			Average Dietary Diversity Score	Numbers of Households (N)
	Low Dietary Diversity	Medium Dietary Diversity	High Dietary Diversity		
Religion					
Hindu	40.77	38.57	20.66	7.1	363
Muslim	33.61	43.44	22.95	7.3	122
Pearson chi2 = 1.9736; Pr= 0.373					
Caste					
SC	45.32	45.32	9.35	6.8	139
ST	65.00	33.00	2.00	6.2	100
OBC	34.00	42.00	24.00	7.3	50
General	22.45	38.78	38.78	7.8	196
Pearson chi2 = 90.4505; Pr= 0.000					
Total	38.97	39.79	21.24	7.1	485

SC= Scheduled Caste; ST= Scheduled Tribe; OBC= Other Backward Caste.

Household dietary diversity also varies with the characteristics of head of the households. Table 2 shows that average dietary diversity score is higher (7.1) to the male headed household than the female headed (6.8) houses. Majority of the male headed household reported higher proportion of medium and high dietary diversity compared to female headed household. Low dietary diversity is found higher to female headed household compared to male headed household. As age of the household head is concern, average dietary diversity score is found higher (7.4) to the houses where age of head of the household is more than 60 years of old compared to the houses where age of the head of the house is less than 30 years (6.6). Majority of the houses where head of the house are either more than 60 years of old or between 31-60 years reported medium dietary diversity in the households. And about half of the

houses (51 percent) among houses where age of head of the house are less than 30 years reported low dietary diversity in the household. Household dietary diversity is significantly better to the houses where head of the household completed more than 10th standard of schooling compared to the houses where head of the households are uneducated or having no formal schooling.

Table 2: Dietary Diversity pattern in the households by the characteristics of the head of the households

Characteristics of head of the households	Percent households			Average Dietary Diversity Score	Numbers of Households (N)
	Low Dietary Diversity	Medium Dietary Diversity	High Dietary Diversity		
Sex of the Household Head					
Male	38.22	40.00	21.78	7.1	450
Female	48.57	37.14	14.29	6.8	35
Pearson chi2 = 1.8175; Pr= 0.403					
Age of the Household Head					
Up to 30 years old	51.26	36.13	12.61	6.6	119
31 to 60 years old	36.94	40.67	22.39	7.2	268
> 60 years old	29.59	41.84	28.57	7.4	98
Pearson chi2 = 14.4877; Pr= 0.006					
Marital Status of the Household Head					
Currently Married	39.68	39.44	20.88	7.1	431
Currently Not Married	33.33	42.59	24.07	7.2	54
Pearson chi2 = 0.8452; Pr= 0.655					
Education of the Household Head					
Uneducated	47.40	39.79	12.80	6.8	289
Up to 5th Standard	27.12	45.76	27.12	7.5	59
6th to 10th Standard	30.63	37.84	31.53	7.5	111
>10 standard	7.69	34.62	57.69	8.5	26
Pearson chi2 = 49.1721; Pr= 0.000					
Total	38.97	39.79	21.24	7.1	485

Household dietary diversity also varies with the types of family and size of the households. Table 3 indicates that average dietary diversity score is highest to joint family (7.3) and it is lowest to the nuclear families (6.8). Both the high dietary diversity (26 percent) and medium dietary diversity (40 percent) are found to be highest for Joint family compared to other types of families. Highest percentage of nuclear families (47 percent) reported low dietary diversity. Average dietary diversity score is highest (8.4) to the household which constitute

with eight members or more but it is comparatively low (6.8) to the houses where household size constitute with four or less members. Households where household size constitute with more than eight members, among them majority of the family reported high dietary diversity in the household. Households, which constitute with five to eight members, among them majority of the houses reported medium dietary diversity in the household. Low dietary diversity is found highest to the houses where family size constitutes with four or less members.

Table 3: Dietary Diversity pattern in the households by types of the family and size of the households

Characteristics	Percent households			Average Dietary Diversity Score	Numbers of Households (N)
	Low Dietary Diversity	Medium Dietary Diversity	High Dietary Diversity		
Type of the Family					
Joint Family	33.57	40.43	25.99	7.3	277
Nuclear Family	46.96	38.12	14.92	6.8	181
Extended Family	40.74	44.44	14.81	6.9	27
Pearson chi2 = 12.2385; Pr= 0.016					
Size of the Household					
Four persons and less	45.16	39.35	15.48	6.8	155
5 to 8 Persons	40.21	41.99	17.79	7.1	281
More than 8 Persons	12.24	28.57	59.18	8.4	49
Pearson chi2 = 49.7250; Pr= 0.000					
Total	38.97	39.79	21.24	7.1	485

Household dietary diversity is significantly associated with the household's economic resource endowments (table 4). Average dietary diversity score is found highest to the service holder houses (8.8) and followed by houses where main source of income is "agriculture"(7.8). Among 'service' holder household, majority (70 percent) of the houses reported a high dietary diversity in the food consumption. In the households where main source of income is agriculture, among them majority (49 percent) of the families reported medium dietary diversity pattern in food consumption. On the other hand low dietary diversity is mainly concentrated to the households where main

source of income are agricultural labour (63 percent) or other labour (58 percent). Household dietary diversity is higher to the houses where more than four members are currently employed but it is lower to the houses where currently employed member is one or two in the household. Household economic dependency ratio is also related with the dietary diversity. Household average dietary diversity score is found highest (7.3) to the houses where economic dependency ratio is 1: 3 but it is lowest (6.7) to the houses where this ratio is 1: 2 or less. There are significant differential in dietary diversity among poor and rich households. Average dietary diversity score is found highest (8.4) to the rich wealth index classed household but it is found lowest (5.9) to the poor wealth index classed households.

Table 4: Dietary Diversity pattern in the households by household's economic resource endowments

Households Economic Characteristics	Percent households			Average Dietary Diversity Score	Numbers of Households (N)
	Low Dietary Diversity	Medium Dietary Diversity	High Dietary Diversity		
Major Source of Income					
Agriculture	16.97	49.09	33.94	7.8	165
Agricultural Labour	63.04	34.06	2.90	6.2	138
Other Labour	58.49	35.85	5.66	6.4	106
Services	3.03	27.27	69.70	8.8	33
Hawker/others	25.58	41.86	32.56	7.7	43
Pearson chi2 = 156.3686; Pr= 0.000					
Currently Employed Members in the Household					
1	42.02	40.76	17.23	7.0	238
2	40.14	40.82	19.05	7.0	147
3	32.84	37.31	29.85	7.4	67
>4	24.24	33.33	42.42	8.0	33
Pearson chi2 = 15.0958; Pr= 0.020					
Households Economic Dependency Ratio					
1 : 2 or less	51.22	34.15	14.63	6.7	82
1 : 3	34.19	41.29	24.52	7.3	155
1 : 4	34.88	42.64	22.48	7.1	129
1 : 5 or more	41.18	38.66	20.17	7.1	119
Pearson chi2 = 8.4374; Pr= 0.208					
Wealth Index					
Poor	77.02	22.98	0.00	5.9	161
Middle	33.33	58.64	8.02	7.0	162
Rich	6.79	37.65	55.56	8.4	162
Pearson chi2 = 267.6150; Pr= 0.000					
Total	38.97	39.79	21.24	7.1	485

Table 5 represents the relationship between household household's assets and dietary diversity. A positive association is found with household land holding status and household dietary diversity, as size of land holding of the household increases household's dietary diversity score also increases. Nearly 74 percent of large landholding (4.1 – 15 acre) households and about 50 percent of medium land holding (2.1 - 4 acre) households reported higher dietary diversity in the household. On the other hand, among landless households (<0.5 acre) almost 55 percent families reported low dietary diversity in the food consumption. Availability of livestock in the household also increases the dietary diversity in the households. Households dietary diversity is found to be higher to the households which have caw, buffalo and poultry etc compared to the households where do not have any livestock.

Table 5: Dietary Diversity pattern in the households by household's landholding status and livestock

Households Landholding Size and Livestock	Percent households			Average Dietary Diversity Score	Numbers of Households (N)
	Low Dietary Diversity	Medium Dietary Diversity	High Dietary Diversity		
Size of Landholding in the Household / in Acre					
0 - 0.5	55.33	37.46	7.22	6.5	291
0.51 - 2.0	16.53	51.24	32.23	7.8	121
2.1 - 4.0	15.22	34.78	50.00	8.2	46
4.1 - 15	3.70	22.22	74.07	8.9	27
Pearson chi2 = 144.8954; Pr= 0.000					
Livestock in the Household / in numbers					
Cow					
No	52.80	36.80	10.40	6.6	250
1 - 7	31.03	46.90	22.07	7.3	145
> 7	13.33	36.67	50.00	8.2	90
Pearson chi2 = 81.3477; Pr= 0.000					
Buffalo and Horse					
No	40.62	39.51	19.87	7.0	453
Yes	15.63	43.75	40.63	8.1	32
Pearson chi2 = 10.9898; Pr= 0.004					
Goats and Others					
No	45.63	38.13	16.25	6.9	320
Yes	26.06	43.03	30.91	7.6	165
Pearson chi2 = 22.3671; Pr= 0.000					
Poultry / Chickens					
No	42.32	37.93	19.75	7.0	319
1 - 7	36.97	42.86	20.17	7.2	119
> 7	21.28	44.68	34.04	7.9	47
Pearson chi2 = 9.6823; Pr=					

0.046					
Total	38.97	39.79	21.24	7.1	485

Determinants of Household Dietary Diversity:

Table 6 presents the odds of ordinal logistic regression to understand the determinants of household's dietary diversity. Result indicates that chances of having high level of dietary diversity versus combined middle and low level of dietary diversity is 0.5 time lower for female headed houses compared to male headed houses, given that all other variables are held constant in the model. Likewise, odds of combined middle and high level of dietary diversity versus low level of dietary diversity is 0.5 times lower for female headed houses than male headed houses. Household size is also found as a significant predictor to determine the household dietary diversity. Odds of high level of dietary diversity versus combined middle and low level of dietary diversity is found 1.24 times greater because of the one member increase in the household. Households which belong to general caste category, odds of high level of dietary diversity versus combined middle and low level of dietary diversity is found 2.61 times greater than a house belonging to scheduled caste category. In regard to source of income, odds of high level of dietary diversity versus combined middle and low level of dietary diversity is 3.18 times higher for the households where main source of income is 'service' compared to the houses where main source of income is 'agriculture'. Household's monthly per capita income and availability of livestock are also found as a significant predictor in explaining the households dietary diversity. For one unit increase in monthly per capita expenditure in the household, the odds of high level of dietary diversity versus combined middle and low level of dietary diversity is 1.0 time greater, when all other variables are held constant in the model. Chances of high level of dietary diversity versus combined middle and low level of dietary diversity is

1.59 times higher for the households having livestock compared to the households with no livestock.

Table 6: Ordinal logistic regression model showing the odds ratio of dietary diversity pattern in the households by the background characteristics

Demographic, Social and Economic Characteristics of the Households	Odds Ratio	95 % CL	
		Lower Level	Upper Level
Age of the household's head	1.008	0.992	1.025
Sex of the Household Head			
Male			
Female	0.508***	0.228	1.134
Education of the Household Head			
Uneducated			
Up to 5th Standard	1.122	0.586	2.149
6th to 10th Standard	1.301	0.762	2.222
>10 standard	0.953	0.321	2.823
Size of the Households	1.245***	0.971	1.598
Religion			
Hindu			
Muslim	0.716	0.395	1.298
Caste			
SC			
ST	0.811	0.456	1.443
OBC	0.796	0.365	1.734
General	2.619*	1.413	4.858
Major Source of Income			
Agriculture			
Agricultural Labour	0.610	0.293	1.271
Other Labour	0.716	0.336	1.527
Services	3.180**	1.076	9.400
Hawker/others	1.400	0.605	3.236
Currently Employed Members in the Household			
1			
2	0.962	0.354	2.613
3	0.822	0.142	4.777
>4	0.626	0.062	6.305
Households Economic Dependency Ratio			
1 : 2 or less			
1 : 3	0.737	0.285	1.901
1 : 4	0.827	0.223	3.067
1 : 5 or more	0.845	0.162	4.400
Monthly Per Capita Expenditure (MPCE)	1.004*	1.003	1.005
Size of Landholding in the Household / in Acre			
0 - 0.5			
0.51 - 2.0	1.381	0.701	2.720
2.1 - 4.0	0.768	0.283	2.086
4.1 - 15	1.436	0.379	5.442
Livestock in the Household			
No			
Yes	1.596**	1.024	2.489

Model summary: LR chi2 = 321.58; p-value=0.000; pseudo R^2 = 0.311.

Note : ® = Reference category; *p <0.01; **p<0.05; ***p<0.10;

Outcome variable is Dietary diversity in the households, which is categorised in ordered forms i.e 1. Low dietary diversity; 2. Medium diversity; 3. High Diversity.

Discussion and Conclusion:

The study pertains to understand the household's dietary diversity. Result shows that the most common consumed food groups are cereals, roots and tubers, oil-fat, and sugar-spice etc. Most of the houses show average dietary pattern, which constitute with seven-eight food groups in a day. Though dietary diversity constitute with seven-eight food groups but most of them are very cheap in quality and locally grown foods. On the other hand consumption of expensive and nutrias foods like meat, fruits, eggs, milk and milk products etc are very low because of the low purchasing power capacity as well as lack of availability. Households' dietary diversity varies significantly with the social and economic strata in the rural households. Food diversity is very low to the families from socially backward classes like Scheduled Tribe (ST) and Scheduled Caste (SC) compared to the General Caste families because of the low level of education, low nutritional knowledge and economical inability. Age of the household head shows a significant positive association with the dietary diversity. This finding is very similar with many other studies (Moon et al., 2002; Moursi et al., 2008; Drescher et al., 2006; Drescher et al., 2007). Educational level is also found significantly associated with dietary diversity. Households' dietary diversity increases with the highest level of education of the head of the households (Moon et al., 2002; Variyam et al., 1998). It may be that educated people are more concerned about their nutritional balance and diets and hence, dietary diversity will increase in their household. Another important factor is household's size. Household's dietary diversity increases with the household's

size (Lee and Brown, 1989). It is expected that larger household consumes a more varied diets. Household's land holding status plays an important role in determining the dietary diversity. High level of dietary diversity is found highest to the household, which have largest farm size. Sing et al (2002) also finds that dietary diversity increases with an increase in farm size . Role of occupation in dietary diversity is also found important. Households, where main source of income is 'service', show highest level of high dietary diversity. It may be that service holder houses are economically well-to-do and educated which make them capable in access of diversified diets. Dietary diversity in the agricultural houses is better than the houses where main income depends on agricultural labour and other labour. It may be that households who have their own agricultural land might choose a diversified crop to grow and thus their home grown crops increase the food diversity. But others might lack access to diverse food items due to lack of time to purchase or minimum availability far away location from market. Another most important determinants of dietary diversity is income. Several studies showed a positive association with households dietary diversity and income (Theil and Finke, 1983; Pollack 2001; Rashid et al., 2006). A multi country study by Hoddinott and Yohannes showed that household dietary diversity is closely associated with the household's per capita consumption, a proxy indicator of income . Our finding also suggests that dietary diversity in the households increases with the increased level of income. Households with highest wealth index shows higher level of dietary diversity compared to the houses belonging to lowest wealth indexed.

Food diversity is an important component of food security and very important in micro-nutrients point of view. Existing evidence shows that there has been a rise in micronutrient deficiencies in the country over time. This calls for the focus of food security programs to be not only on the

consumption of cereals but a diverse food basket. Not only quantity but nutritional aspects of various foods are also important. Though the present National Food Security Bill recognizes the importance of sanitation and hygiene in improving the nutritional outcome of children but it focuses only on the quantity aspect of food security. Hence, there is a need to rise the importance of food diversity in food basket to ensure the proper nutrients for an active and healthy life.

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