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# Nutritional Status and Dietary Diversity of Households in Vijayapura district of Karnataka

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***Abstract:***

*The recommendation to eat diverse types of foodstuffs is an internationally accepted recommendation for a healthy life. In this way, the study was conducted to assess the nutritional status and dietary diversity of the 160 rural and urban households in Vijayapur district of Karnataka using 24 hours recall method with a view to understanding the heterogeneity in food habits, quality of diet intake and the socioeconomic and demographic determinants of the dietary diversity in study area. There was significant disparity among the rural and urban areas in terms of food intake level across the income groups. The MPC consumption was higher in rural areas as compare to urban areas. However, the energy intake was higher in urban areas as against rural areas, since consumption of high value nutritious foods. By overall, the intake of energy and other nutrients was lower than ICMR- Recommended Dietary Allowance (RDA). Dietary diversity result indicates, urban households consume more diversed food items as compare to rural households. From a policy perspective, it is therefore important to focus interventions on improving dietary diversity and nutrition security with proper understanding of the socio-economic setting of the target area and its population.*

*Acknowledegment:*

**JEL Codes:** E21, C35

#2500

# Nutritional Status and Dietary Diversity of Households in Vijayapura district of Karnataka[1]


## Abstract

The recommendation to eat diverse types of foodstuffs is an internationally accepted recommendation for a healthy life. There is also a positive relationship between dietary diversity and the three pillars of food security viz., availability, access and utilization. In this way, the study was conducted to assess the nutritional status and dietary diversity of the 160 rural and urban households in Vijayapura district of Karnataka using 24 hours recall method with a view to understanding the heterogeneity in food habits, quality of diet intake and the socioeconomic and demographic determinants of the dietary diversity in study area. There was significant disparity among the rural and urban areas in terms of food intake level across the income groups. The MPC consumption was higher in rural areas as compare to urban areas. However, the energy intake was higher in urban areas as against rural areas, since consumption of high value nutritious foods. By overall, the intake of energy and other nutrients was lower than ICMR-Recommended Dietary Allowance (RDA). Dietary diversity result indicates, urban households consume more diversed food items as compare to rural households. From a policy perspective, it is therefore important to focus interventions on improving dietary diversity and nutrition security with proper understanding of the socio-economic setting of the target area and its population.



**Key words:** Nutritional Status, Dietary Diversity, rural-urban difference

**JEL Classification: I12, R0, E2**


[1] The paper is drawn partially from the thesis entitled 'A study on nutritional status and dietary diversity in Vijayapura district of Karnataka' submitted to the Tamil Nadu Agricultural University, Coimbatore

## Introduction

Ensuring food security is an issue of great importance for Asian countries including India. India represents almost 17.53 per cent of the world's population and it will surpass the China by 2030 with the population growth rate at 1.58 per cent. India is predicted to have more than 1.53 billion people by the end of 2030. Even though India has achieved food security by producing 265 million tonnes of food grains a year since to reach the growing population, it has to produce 350 million tonnes of food grains a year by around 2020. However, chronic lack of access to food has led to the prevalence of undernourishment among 1/8$^{th}$ of the population, in which Asia is home to 2/3$^{rd}$ of the undernourished people in the world (FAO, 2014). Nearly two billion people were food insecured and six million children die of hunger every year or 17,000 every day (FAO, 2012). The proportion of chronically hungry households (not getting enough to eat during any month of the year) at the all-India level was about 0.5 per cent in the rural areas and 0.1 per cent in the urban areas (NSSO, 2011-12). In particular, Karnataka state during 2005-06 had 42 per cent of children under-three years of age were chronically malnourished (stunted) which is unchanged from 1998-99 period. Anemia among women aged 15-49 years was higher in 2005-06 (52 %) as compared to 1998-99 (42%).

The dietary habits of people of a region have substantial implications for the quality of life of its population. Dietary diversity, which measures the number of different types of food items included in a food basket may be defined as the variety of foods across and within food groups capable of ensuring adequate intake of essential nutrients that can promote good health (WHO/FAO, 1996; Ruel, 2002). The level of diversity in household diets is an indirect measure of diet quality or the extent to which nutritional needs of the households are being met. Diets with greater variety of foods or food groups are associated with greater energy and nutrient

intake (Kant, 2004). Therefore, understanding household dietary diversity may be an alternative and easier pathway to assess household level food security (Taruvinga *et al*., 2013 and Headey and Ecker, 2013). The dietary diversity of people in a region is determined by a variety of factors including production diversity (Sibertu, 2015), income/expenditure levels of the households (Drescher *et al*., 2009) and demographic and socio-economic characteristics of households. To have food security and be adequately nurture, it is necessary to understand what constitutes an appropriate diet for healthy condition as well as the resources, skills and motivation to make good food choices. Developing policies and interventions to increase food security therefore requires an understanding of each of these factors, their inter-relationships and their relevance to particular groups of people. Therefore, this paper has studied nutritional status and dietary diversity of household with the following objectives: (i) to assess the dietary pattern and nutrient intake, (ii) to examine the income and consumption expenditure inequality and (iii) to analyse the factors determining the dietary diversity of the households.

## Data and Methodology

### Data

The study was mainly based on primary data with well structure and pre-tested interview schedule by personal interview method during the period 2015-16. The data on general information about the household, household size, age, education, occupation, income, expenditure along with menu and quantity of the food prepared, quantity of food consumed by each individual and such other details were recorded based on 24 hours recall method. To obtain the information, multi-stage sampling procedure was adopted for selecting households. In the first stage, Vijayapura district was selected purposively. In Vijayapura district, prevalence of underweight in children below five years was 73.10 per cent and child anemia was 69.30 per cent

(Achiro, 2015) and district falls under the lowest income (₹ 45,912) category of the state (GOK, 2015). At the second stage, one village was selected from each of the five taluks of Vijayapura district. Finally, 16 respondents were selected from each selected village making 80 rural respondents. For selecting urban respondents, the city or the taluk headquarter was chosen and 16 respondents were selected randomly from each taluk, making a total of 80 urban respondents. Thus, in all, the study sample consisted of 160 households (80 rural and 80 urban). The selected households were categorized into various income group based on level of per capita annual income. First, all households in a area possessing BPL card were classified as Poor. All the remaining households were categorized into tercile groups, each containing a third of the population. The bottom, middle and top tercile groups were referred as Low, Middle and High income group households.

**Economic Analysis**

**(a) Calculation of quantity of food and nutrients intake**

To assess the dietary pattern and nutrient intake, consumption of each food stuff was calculated in terms of nutrients per day using food composition tables in 'Nutritive value of Indian Foods' (Gopalan *et al*., 1991) and which was compared with the Recommended Dietary Allowance (RDA) by Indian Council of Medical Research-National Institute of Nutrition (ICMR-NIN, 2010). Quantum of nutrient and calorie intake by the household were calculated by using the formula,

Nutrient intake = Qt of food item X ICMR conversion factor

**(b) Inequality of income and consumption expenditure**

To examine the inequality among the households, Lorenz curve and Gini Concentration Index (GCI) were used. Lorenz curve was employ to portray graphically the extent to which the income and consumption expenditure were unequally distributed. In this study Lorenz curve was employed to represent graphically the pattern of distribution of

a) Per capita income

b) Per capita consumption expenditure.

Gini index summarizes the degree of concentration of a income and consumption expenditure. It is twice the area between Lorenz curve and egalitarian line. Here the range of this is 0 to 1. Hence, the more equal the income distribution, the closer is the ratio is to zero and greater the degree of inequality, the closer is the ratio to one.

$$\mathrm{GCI} = 1 - \sum_{n=1}^{\infty} \left( \frac{(Xj - Xj - 1)}{100} \mathrm{X} \frac{(Yj + Yj + 1)}{100} \right)$$

Where,

$X_j$= Cumulative proportion of households in the $j^{th}$ income group

$X_{j-1}$=Cumulative proportion of households in the $(j-1)^{th}$ income group

$Y_j$= Cumulative proportion of income in the $j^{th}$ household group

$Y_{j+1}$=Cumulative proportion of income in the $(j+1)^{th}$ household group

n=total number of groups

**(c) Measurement of household dietary diversity**

Simpson Index of Dietary Diversity (SIDD) were used to measure the household dietary diversity (Katanoda *et al*., 2006 and Shinoj *et al*., 2015). The diversity in terms of number as well as distribution of different food items in the consumption basket of the households were calculated. The index were calculated according to following formula:

$$SIDD = 1 - \sum_{i=1}^{n} S_i^2 ,$$

where, $S_i$ is the share of product $i^{th}$ in the total amount of food consumed by the household members. The index is bounded between 0 and 1, whose limit value approximates 1 if the number of foods (n) increases. If its 0 means that an individual consumes only few of food items. The separate scores of SIDD were obtained for households belonging to different income categories for comparison. To further understand the variation in diversity score across rural and urban households and to attribute this variation to different income group households, a multiple linear regression model was used as fallow;

$$SIDD_i = \alpha + \beta Z_i + \lambda E_i + \delta O_i + u_i$$

Where,

$SIDD_i$ = household dietary diversity score of the households

$Z_i$= vector of sociological and demographic characteristics of the household such as age, sex and education of the family head, household size, consumer market distance and food habit,

$E_i$= vector of economic status of the household such as per capita farm and non-farm income, expenditure.

$O_i$= vector of ownership of productive assets such as land, milking animals and production diversity

$u_i$ =error term and is assumed to be normally distributed.

**Results and Discussion**

**Dietary pattern of households across different income group**

The household diet consisting of foods from several food groups provides all the required nutrients in proper amounts. Cereals, millets and pulses are major sources of most nutrients. In this way, the dietary pattern of the households in terms of grams per day per consumption unit

(CU) across different income groups is analysed and presented in Table 1. Overall, total quantity consumption per day per consumption unit was 711.84 gm, which mainly constitutes cereals (296.50 gm) followed by milk and milk products (138.74 gm), vegetables (116.99 gm) and sugar and jaggery (35.89 gm). Across the income group, high income group consume more (752.21 gm) quantity of food followed by middle income group (714.46 gm), low income (700.03 gm) and poor family (689.65 gm). Among the food groups, most of the food groups except egg and meat are consumed more by high income group due to their high purchasing power and also it might be large household size. The per day per consumption unit of quantity food consumption gap was wider across the income groups.

Across rural and urban area, the total quantity food per day per consumption unit was high in rural area (715.08 gm) as compare urban area (708.60 gm). It mainly due to high consumption of cereals, pulses, sugar and jaggery and milk and milk products in rural area against the urban area. It was observed that, the per day consumption of cereals was ranged across the income group from 288.39 to 322.07 gm in rural area and from 301.35 to 282.78 gm in urban area. It was less than ICMR norms *i.e.* 400 gm. The consumption of pulses high in middle income group of rural area and low in middle income group of urban area. In general, pulse consumption was high in rural (34.84 gm) against the urban (32.83gm) area but lower than the ICMR norms *i.e.* 80 gm in both the area and across the income group. Across rural and urban area, urban (28.78gm) households consume more edible oil than the rural (25.29 gm) households. Consumption of edible oil was high (32.18 gm) in high income households of urban area and low (24.33 gm) in middle income households of rural area. In overall, which was less than the ICMR norms *i.e.* 30 gm. Daily consumption of milk and milk products varied from 134.11 gm to 159.57 gm and from 113.32 to 141.51 gm in rural and urban areas across income

groups. It was higher in rural (144.15 gm) as compare to urban area (133.33 gm), which was lesser than the ICMR recommendation i.e.300 gm. The consumption of vegetable in rural area was (114.37 gm) which is lesser than the urban area (119.60 gm).In general, the consumption of vegetable was lesser than the ICMR recommendation i.e. 300gm. The consumption of fruits and nuts ranges between 8.72 gm to 22.09 gm in rural areas and it was 22.76 gm to 32.52 gm in urban areas of across income groups. Which conforms that consumption of fruits and nuts in urban area was almost double (28.35 gm) than the rural area (14.73 gm) but lesser than the ICMR recommendation i.e. 120 gm in both rural and urban areas. Consumption of sugar and jaggery was higher in rural area (36.32 gm) than the urban area (35.47 gm). Across the income groups, sugar and jaggery consume less by poor family (33.14 gm) as compare to high income family (42.59 gm) of rural area, while in urban area consumption was almost similar among the income groups. Compare to rural (9.33 gm) area, urban households consume more (11.53 gm) of spices across the income group the consumption of spices was high in high income households in both rural and urban areas. With respect to egg and meat consumption, poor households consume more in both rural (14.83 gm) and urban (15.36 gm) areas. The consumption was high in urban areas (12.11 gm) as compare to rural (11.33 gm) area. In general, consumption of almost all food items per day per consumption unit was found to be less than the ICMR recommendation. It could confirm that, the per day consumption of all food items increased with increased income groups.

**Table 1. Dietary pattern of households across different income** **(Grams/CU/day)**

| Food items | Rural | | | | | Urban | | | | | Overall | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | P | L | M | H | O | P | L | M | H | O | P | L | M | H | O |
| **Cereals** | 288.39 | 296.56 | 314.77 | 322.07 | 305.45 | 301.35 | 288.67 | 277.44 | 282.78 | 287.56 | 294.87 | 292.615 | 296.105 | 302.425 | 296.50 |
| **Pulses** | 35.33 | 32.17 | 36.45 | 35.42 | 34.84 | 32.46 | 32.89 | 31.13 | 34.83 | 32.83 | 33.895 | 32.53 | 33.79 | 35.125 | 33.84 |
| **Oilseeds** | 17.6 | 18.64 | 18.92 | 21.99 | 19.29 | 16.56 | 18.36 | 19.57 | 21.66 | 19.04 | 17.08 | 18.5 | 19.245 | 21.825 | 19.16 |
| **Edible oil** | 24.33 | 24.67 | 23.3 | 28.84 | 25.29 | 27.02 | 25.22 | 30.71 | 32.18 | 28.78 | 25.675 | 24.945 | 27.005 | 30.51 | 27.03 |
| **Sugar and jaggery** | 33.14 | 33.29 | 36.24 | 42.59 | 36.32 | 35.87 | 36.18 | 35.34 | 34.47 | 35.47 | 34.505 | 34.735 | 35.79 | 38.53 | 35.89 |
| **Spices** | 8.83 | 8.62 | 9.59 | 10.27 | 9.33 | 9.49 | 9.49 | 12.37 | 14.78 | 11.53 | 9.16 | 9.055 | 10.98 | 12.525 | 10.43 |
| **Milk and milk products** | 134.11 | 136.96 | 145.95 | 159.57 | 144.15 | 113.32 | 141.38 | 137.09 | 141.51 | 133.33 | 123.715 | 139.17 | 141.52 | 150.54 | 138.74 |
| **Egg and meat** | 14.83 | 12.18 | 12.91 | 5.38 | 11.33 | 15.36 | 9.25 | 10.82 | 13.01 | 12.11 | 15.095 | 10.715 | 11.865 | 9.195 | 11.72 |
| **Vegetables** | 106.12 | 113.69 | 110.54 | 127.14 | 114.37 | 115.7 | 123.99 | 117.4 | 121.32 | 119.60 | 110.91 | 118.84 | 113.97 | 124.23 | 116.99 |
| **Fruits and nuts** | 8.72 | 10.6 | 17.5 | 22.09 | 14.73 | 22.76 | 27.25 | 30.88 | 32.52 | 28.35 | 15.74 | 18.925 | 24.19 | 27.305 | 21.54 |
| **Total quantity** | 671.4 | 687.38 | 726.17 | 775.36 | 715.08 | 689.89 | 712.68 | 702.75 | 729.06 | 708.60 | 680.65 | 700.03 | 714.46 | 752.21 | 711.84 |

**Note: P-Poor, L-Low, M-Middle and H-High**

**Availability of nutrients across different income groups**

In nutrients required for human metabolism namely energy, protein, fat, calcium, iron, carotene, thiamine, riboflavin and folic acid. The RDA per consumption unit(CU) per day under Indian conditions have been well defined and recommended by ICMR and the results were presented in Table 2.

The overall energy intake in the study area was 2274 kcal, which was lower than the RDA of 2730 kcal. The total calorie intake (kcal) was highest in high income group (2467.78 kcal), followed by middle (2307.28 kcal), poor (2163.73 kcal) and BPL (2159.51 kcal). Thus, it could be observed that, income and energy intake were positively related. Similar association could be observed in rural and urban with an exception of poor income category in rural area. The energy intake was higher in urban (2297.48 kcal) as compare to rural area (2251.67 kcal). Overall protein intake was 72.66 gm/, which is higher than RDA i.e. 60 gm, rural (67.10 gm) and urban (78.23 gm) areas. The intake of protein increases with increase in income across the income groups in rural and urban area except low income group in urban area. Overall intake of fat was 74.12 gm, which is higher than the 30 gm of RDA. Across the income group, all income group intake more than double of the recommended intake of fat. The total intake of calcium was lower than the RDA (600 mg) in rural (577.23 mg), urban (583.91 mg) and overall (580.57 mg) which is 96.21 per cent, 97.32 per cent and 96.76 per cent of the RDA. Across the income group, intake of calcium ranged from 417.92 mg to 707.21 mg in rural area and 445.98 mg to 745.67 mg in urban areas. The gap between low to high intake of calcium was about 48 per cent in rural area and 50 per cent urban areas. In overall, the intake of iron was lower (16.47 mg) than RDA i.e.17 mg. In total, iron intake was similar in poor and low income about 15 mg, which is lower than the RDA and middle and high income group of about 17 mg higher than the RDA. In the study area, the intake of carotene was lower (3487.28 mg) than the RDA i.e. 4800 mg, which is 72.65 per cent of the

recommendation. Total carotene intake was highest in high income group (3819.92 mg) and lowest in middle income group (3344.73 mg). The difference among the income group was about 10 per cent. In the sample area, overall intake of thiamine was 1.42 mg, which is higher than the RDA i.e. 1.40 mg. The total thiamine intake was more in both high and middle income group (1.51 mg), followed by low income group (1.47 mg) higher than the RDA while in poor income group (1.20 mg) was lower than the RDA. Across rural and urban area, urban households intake high (1.49 mg) which is higher than the RDA as compare to rural area (1.36 mg) which is lower than RDA. The overall intake of riboflavin in the study area was lower (1.47 mg) than the RDA (1.60 mg). The total riboflavin intake was high in urban area (1.63 mg) as compare to rural area (1.31 mg) is lower than the RDA. The intake was highest in high income group (2.00 mg) of urban area and lowest in poor income group of rural area (1.07 mg). The intake of niacin was almost similar in rural (15.40 mg), urban (15.62 mg) and overall (15.51 mg) but less than RDA i.e. 18 mg. About 135.83 µg of folic acid was consumed by households in overall. Across the income group, the intake ranged from 130.55µg to 144.71µg. In comparison to rural and urban households, urban households slightly intake more (136.60 µg) than the rural households (135.05µg).In overall the intake of folic acid was lower than the RDA i.e.200 µg/day. The actual intake of the nutrients was less than RDA in case of energy, calcium, iron, carotene, riboflavin, niacin and folic acid, while it was higher than the RDA in case of fat, protein and thiamine. Across the rural and urban area, the intake of thiamine and riboflavin are more than the RDA in urban area as compare to the rural area. These gap between actual intake and RDA was due less intake of fruits and nuts, vegetables, egg and meat etc., since non consumption of these items in rural area due expensive as well as non-availability.

**Table 2. Availability of nutrients across different income groups** **(CU/day)**

| Nutrients | RDA for moderate man | Rural | | | | | Urban | | | | | Overall | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | P | L | M | H | O | P | L | M | H | O | P | L | M | H | O |
| Energy intake | 2730 Kcal | 2181.26 | 2125.45 | 2255.85 | 2444.1 | 2251.67 | 2137.75 | 2202.00 | 2358.71 | 2491.46 | 2297.48 | 2159.51 | 2163.73 | 2307.28 | 2467.78 | 2274.57 |
| Protein | 60 gm | 58.73 | 63.53 | 72.92 | 73.22 | 67.10 | 75.29 | 66.94 | 84.39 | 86.29 | 78.23 | 67.01 | 65.24 | 78.66 | 79.76 | 72.66 |
| Fat | 30 gm | 56.65 | 69.13 | 65.99 | 89.67 | 70.36 | 62.97 | 75.15 | 83.53 | 89.89 | 77.89 | 59.81 | 72.14 | 74.76 | 89.78 | 74.12 |
| Calcium | 600 mg | 417.92 | 516.2 | 667.59 | 707.21 | 577.23 | 445.98 | 502.12 | 641.88 | 745.67 | 583.91 | 431.95 | 509.16 | 654.74 | 726.44 | 580.57 |
| Iron | 17 mg | 15.59 | 16.21 | 16.54 | 17.5 | 16.46 | 15.36 | 14.96 | 18.4 | 17.18 | 16.48 | 15.475 | 15.59 | 17.47 | 17.34 | 16.47 |
| Carotene | 4800 mg | 3468.44 | 3311.87 | 3531.98 | 3599.95 | 3478.06 | 3249.87 | 3538.77 | 3157.48 | 4039.89 | 3496.50 | 3359.16 | 3425.32 | 3344.73 | 3819.92 | 3487.28 |
| Thiamine | 1.40 mg | 1.2 | 1.29 | 1.50 | 1.45 | 1.36 | 1.20 | 1.65 | 1.52 | 1.57 | 1.49 | 1.20 | 1.47 | 1.51 | 1.51 | 1.42 |
| Riboflavin | 1.60 mg | 1.07 | 1.29 | 1.43 | 1.45 | 1.31 | 1.47 | 1.27 | 1.78 | 2.00 | 1.63 | 1.27 | 1.28 | 1.605 | 1.73 | 1.47 |
| Niacin | 18 mg | 14.56 | 14.30 | 15.58 | 17.16 | 15.40 | 14.17 | 13.43 | 16.40 | 18.47 | 15.62 | 14.37 | 13.87 | 15.99 | 17.82 | 15.51 |
| Folic acid | 200 µg | 129.42 | 133.94 | 137.22 | 139.61 | 135.05 | 131.67 | 129.3 | 135.64 | 149.8 | 136.60 | 130.55 | 131.62 | 136.43 | 144.71 | 135.83 |

**Short fall in energy intake of respondents as per the Recommended Dietary Allowance**

The comparison of energy intake of respondents across different income groups with the Recommended Dietary Allowance (RDA) is presented in Table 3. The analysis of energy intake among different income groups revealed that high income group realised for the highest proportion of the RDA met from their diet (90.39 %), followed by middle income group (84.52%), low family (79.26 %) and poor family (79.26 %).

Across different income groups, it was noticed that, the energy intake of rural area was found highest in high income group (89.53 %) followed by middle income group (82.63 %), poor (79.90 %) and low family (77.86 %) of RDA. Similarly, in urban area, households of high income family met nearly 91.26 per cent of RDA, followed by middle income (86.40 %), low (80.66 %) and poor family (78.31 %). About 30 per cent of households consume less than 70 per cent of energy requirements. The diets of children under the age of five years of age are more inadequate than those of adults and are well below the recommended dietary allowances. Woefully inadequate consumption of protective foods like pulses, green leafy vegetables, and milk and milk products. Dietary micronutrient deficiency, particularly with respect to vitamin A and iron is wide spread. About 80 per cent of the individuals consume diets, which provide less than half of the RDA for these micronutrients (NNMB, 2000).

**Distribution of respondents across nutritional security**

The nutritional security status of the sample households was analysed in terms of "Security Ratio", which is computed in terms of ratio of energy intake to RDA. The household securing a ratio of greater than or equal to one was termed as "Secure", while the household securing a ratio of less than one was termed "Insecure". The insecure households were further classified into "Moderately insecure", "Mildly insecure" and " Severely insecure" based on value of the security ratio, which is falling in the range of 0.80 to 0.99, 0.50 to 0.79 and less than 0.50, respectively (Kiresur *et al*., 2015).

Overall, nearly 15.63 per cent of the respondents were found to be “nutritionally secure”, while the remaining (84.37 %) were “nutritionally insecure” to a varied degree (Table 4). Amongst nutritionally insecure households, 33.75 per cent were “moderately insecure”, followed by “mildly insecure” (43.75 %). It was quite interesting to note that there was hardly a case of severe nutritional insecurity in the study area. A similar situation existed in both rural and urban areas. Similar result by Ijarotimi and Oyeneyin (2005) have observed in Nigeria that 17.9 per cent of the households were food secure, 26.6 per cent were moderately food insecure and 55.5 per cent were severely food insecure. Across income group, nutritional security as expected was observed maximum in the high income households. Even in the poor households, 6.25 per cent of the respondents were found to be nutritionally secure and in low (13.95 %), middle (19.44 %) and high (27.27 %) income groups. The moderate insecurity was observed maximum in high (36.36 %), followed by middle (33.3 %), poor (35.42 %) and low (30.23 %) income groups. Mild nutritional insecurity was maximum in poor (47.92 %) category, followed by middle, low and high income groups. By and large, a similar pattern was observed individually in rural and urban areas under each income group. Since nutritional security varies across different income group, policies with different strategies should be evolved for different income group.

**Table 3. Short fall in energy intake distribution of respondents across nutritional status**

| Area | Income group | Shortfall in energy intake (RDA, 2730kcal/day) | | | Nutritional security status | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Present Energy Intake(Kcal/CU/day) | Percent of RDA | Difference (Kcal/CU/day) | Secure (>1) | Moderately Insecure (0.80-0.99) | Midly insecure (0.50-0.79) | Severely insecure(<0.50) | Total households |
| Rural | P | 2178.29 | 79.79 | 551.71 | 1(4.35) | 8(34.78) | 11(47.83) | 3(13.04) | 23 |
| | L | 2218.83 | 81.28 | 511.17 | 3(15.00) | 5(25.00) | 10(50.00) | 2(10.00) | 20 |
| | M | 2280.51 | 83.54 | 449.49 | 5(26.32) | 4(21.05) | 9(47.37) | 1(5.26) | 19 |
| | H | 2328.98 | 85.31 | 401.02 | 5(27.78) | 6(33.33) | 7(38.89) | 0(0.00) | 18 |
| | O | 2251.65 | 82.48 | 478.35 | 14(17.50) | 23(28.75) | 37(46.25) | 6(7.50) | 80 |
| Urban | P | 2230.18 | 81.69 | 499.82 | 2(8.00) | 9(36.00) | 12(48.00) | 2(8.00) | 25 |
| | L | 2227.92 | 81.61 | 502.08 | 3(13.04) | 8(34.78) | 9(39.13) | 3(13.04) | 23 |
| | M | 2331.14 | 85.39 | 398.86 | 2(11.76) | 8(47.06) | 7(41.18) | 0(0.00) | 17 |
| | H | 2400.60 | 87.93 | 329.40 | 4(26.67) | 6(40.00) | 5(33.33) | 0(0.00) | 15 |
| | O | 2297.46 | 84.16 | 432.54 | 11(13.75) | 31(38.75) | 33(41.25) | 5(6.25) | 80 |
| Overall | P | 2159.53 | 79.1 | 570.47 | 3(6.25) | 17(35.42) | 23(47.92) | 5(10.42) | 48 |
| | L | 2163.74 | 79.26 | 566.26 | 6(13.95) | 13(30.23) | 19(44.19) | 5(11.63) | 43 |
| | M | 2307.30 | 84.52 | 422.70 | 7(19.44) | 12(33.33) | 16 (44.44) | 1(2.78) | 36 |
| | H | 2467.81 | 90.40 | 262.19 | 9(27.27) | 12(36.36) | 12 (36.36) | 0(0.00) | 33 |
| | O | 2274.60 | 83.32 | 455.40 | 25(15.63) | 54(33.75) | 70 (43.75) | 11(6.88) | 160 |

Note: Figures in parentheses indicate percentage to the total

**Household dietary diversity across rural and urban area**

Dietary diversity can serve as a proxy measure for nutritional adequacy (Jones *et al*., 2014). In the present study, there was an almost perfect positive linear relationship between dietary diversity and household per capita income. Higher levels of household income allowed access to more food groups, increasing dietary diversity. The SIDD score for rural and urban areas is presented in the Table 4. In overall, SIDD score was 0.79, whereas in rural area it was 0.78 and in urban area it was 0.80. When compare to rural area, the number of food items consumed by the households was high in urban area. Across the different income groups, the high income group consume more variety of food items as compare to other income groups in rural and urban areas. The SIDD score of food groups constituted different food items in rural area ranged from 0.76 to 0.79 and 0.79 to 0.81 in urban area. It could be conclude that, the range of food items consumed by lower and higher income household was wider in rural area as compare to urban area. However, urban households consume more diversed food items compare to rural households. It indicated that, urban households can access variety of food items as compare to rural households, it may be due to the easy and regular market accessibility and also regular and high income of the households.

**Table 4. Calculated scores of SIDD across rural and urban areas**

| Income group | Rural | Urban | Overall |
|---|---|---|---|
| Poor | 0.76 | 0.79 | 0.78 |
| Low | 0.78 | 0.80 | 0.79 |
| Middle | 0.77 | 0.80 | 0.78 |
| High | 0.79 | 0.81 | 0.80 |

| | | | |
|---|---|---|---|
| Overall | 0.78 | 0.80 | 0.79 |

**Factors influencing the dietary diversity of household in rural and urban area**

To study the influence of different factors on dietary diversity, the SIDD score used as dependent variable and socio-demographic, ownership of assets and economic factors were used as independent variables. The parametric estimates of dietary diversity with respect rural, urban and overall were estimated by using multiple linear regression model with and presented in Table 5.

The variation in the dietary diversity could be explained up to 85 per cent, 65 per cent and 53 per cent in rural ,urban and overall by the independent variables included in the model. The F value 29.94, 10.57 and 13.05 for rural, urban and overall was found statistically significant. The household category exerted positive and significant influence on the household dietary diversity in rural, urban and overall. It shows that with higher income households would access more number of variety of items in their consumption basket as compare to low income households. However, food habit of the households was negative for all categories of income but it is significant only in the urban area. It indicated that, the vegetarian households would have less varieties of foods as compare to non-vegetarian households. The gender status of the household head was found to be insignificant, which indicated that gender does not have any influence on the household dietary diversity. The impact of household size on SIDD was positive and statistically significant for($P<0.01$),urban ($P<0.1$) and over ($P<0.1$), this implies that, the size of the household increase by one unit, would increase SIDD score by 0.3320, 0.0738 and 0.0657 in rural, urban and overall, similar result found by Shinoj *et al.* (2015). Age of the household head has also positive impact on determining the dietary diversity, which was significant at one per cent level. It indicated that, age of the household head have better knowledge and experience

of nutrient content of different food groups and nutrient requirement for healthy life. However, Shinoj *et al.* (2015) found that age has no apparent causality on dietary diversity. Similarly, education of the household head was significant and positive in determining the dietary basket. Ample literature is in line with this result as education not only improves knowledge of health and nutrition but also lowers the cognitive cost associated with consuming variety (Liu *et al*., 2014 and Shinoj *et al*., 2015). The market distance was negative and significant in rural area. It shows that, larger distance of market means worse market access, which in turn affect the food basket and frequency of consumption of different food items. Similar result were found by Liu *et al*., 2014 and Sibhatu *et al*., 2015. But it was not a case in the urban area due to narrow distance of market.

It was found that, possession of milking animals also has positive impact on SIDD score. It was statistically significant for rural ($P<0.01$) and insignificant for urban and overall. this implies that, the possession of milking animal increase by one unit, would increase SIDD score by 0.0502 in rural. The farm size does not have any significant coefficient to the dietary diversity. However the production diversity have positive and significant effect on the dietary diversity in rural and overall but it was insignificant in urban areas. This implies that, number of crop grown increase by one unit, would increase SIDD score by 0.3381, 0.3348 for rural and overall at 10 and 1 per cent level of significant. It indicated that, diversified production would fulfill the food basket with variety of items, which was in the conformity of the results of Sibhatu *et al*., 2015.

The monthly farm income has positive and significant influence on dietary diversity in rural but it was insignificant in urban and overall. It was due to, the main source of income in rural area is from farm. Similarly, monthly off-farm income has positive and significant impact

on SIDD score in rural, urban and overall. It indicated that in rural area both farm and off farm are income sources but in urban area, the households mainly depends on off farm income for their expenditure. As every rupee spent on food items would increase the dietary diversity by 0.27, 0.19 and 0.21 unit in rural, urban and overall respectively. Findings are similar with the previous literature (Liu *et al*., 2014; Jones *et al*., 2014 and Shinoj *et al*., 2015).

It could be conclude that, household category, household size, age, education, milking animals, production diversity, monthly farm, non farm income and food expenditure of the households has positive and significant influence on dietary diversity in rural and urban areas. On contrarily, market distance and food habit of the households has negative and significant influence on the dietary diversity of the households.

**Table 5. Factors influencing the dietary diversity of household in rural and urban area**

| Variable code | Variable name | Rural | Urban | Overall |
|---|---|---|---|---|
| $a_0$ | Intercept | 1.3486**<br>( 0.0179) | −0.5664*<br>( −1.912) | −0.2878<br>(−1.093) |
| HHCAT | Household cat | 0.0759**<br>( 2.600) | 0.0111*<br>( 1.678 ) | 0.0219**<br>(2.113) |
| FH | Food habit (Dummy) | −0.0064<br>( −0.4030) | −0.0317**<br>( −2.036) | −0.0063<br>(−0.6569) |
| GEN | Gender of the household head (Dummy) | 0.015<br>( 0.1716) | 0.026<br>( 0.3084) | 0.0126<br>(0.5548) |
| HHSIZE | Household size (No.) | 0.3320***<br>( 4.107) | 0.0738*<br>( 1.006) | 0.0657*<br>(0.9613) |
| AGE | Age of the household head (Year) | −0.6477*** | 0.4176*** | 0.2323** |

| | | | | |
|---|---|---|---|---|
| | | ( −4.106) | ( 3.105) | (2.122) |
| EDU | Education of household head (Year) | 0.0445*<br>( 1.795) | 0.1079***<br>( 7.155) | 0.0479***<br>(2.833) |
| MKTDIST | Distance to market (Km) | −0.0051*<br>( −0.06252) | −0.0253<br>(−1.001) | −0.0943***<br>(−3.944) |
| LIVESTOCK | Ownership of milking animals (No.) | 0.0502***<br>( 2.731) | 0.0657<br>(2.068) | 0.0161<br>(1.015) |
| FSIZE | Farm Size (ha) | −0.0523<br>( −1.542) | −0.0089<br>( −0.3387) | 0.0492<br>(1.980) |
| PD | Production diversity (No.) | 0.3381*<br>( 1.884) | 0.0434<br>(0.2254) | 0.3348***<br>(2.852) |
| FINCOME | Monthly farm income (Rs./month) | 0.0386***<br>( 3.585) | 0.0038<br>(0.4168) | 0.0100<br>(1.405) |
| NFINCOME | Monthly non-farm income (Rs./month) | 0.0106*<br>( 1.806) | 0.0117**<br>(2.154) | 0.0214<br>(0.6064) |
| FOODEXP | Monthly Food Expenditure (Rs./month) | 0.2742**<br>( 2.472) | 0.1904***<br>(3.168) | 0.2132***<br>(3.748) |
| | **Adjusted $R^2$** | **0.85** | **0.65** | **0.53** |
| | **F value** | **29.94** | **10.57** | **13.05** |

Note: ***, **, * indicated Significance at 1, 5 and 10 per cent level, respectively.

Figures in parenthesis indicated the t statistics

**Conclusions**

The socio-economic characteristics of low and high income households in the study areas would reveal that income is a major factor influencing dietary pattern and nutritional status of the households. More than half of the respondents have been found nutritionally insecure in the study area. Further, a large population in poor family has been noted “mildly insecure” as against “moderately insecure” in other income groups. It calls for immediate policy formulation aiming at achieving nutritional security and should have different strategies for different income groups. The production diversity, income and education could enhance dietary diversity, which intern enhance the nutritional status of the households, while the consumer market distance should reduce. The diversified food basket would provide food security and improve the quality of life by adding to the nutritional security. From a policy perspective, it is therefore important to focus interventions on improving dietary diversity and nutrition security with proper understanding of the socio-economic setting of the target area and its population.

**References**

Benson, T.D. (2004) Africa's food and nutrition security situation: Where are we and how did we get here?. International Food Policy Research Institute, **37**.

Bonkalwar, N.R., Sanap, D.J. and Babar, A.P. (2014) Consumption patterns of rural household in Nanded district. *International Journal of Commerce and Business Management*, **7**(2):269-276.

Drescher, L. S., Thiele, S., Roosen, J., and Mensink, G. B. (2009) Consumer demand for healthy eating considering diversity – an economic approach for German individuals. *International Journal of Consumer Studies*, **33**:684–696.

FAO. (2009) The state of food insecurity in the world: Economic crises – Impacts and lessons learned. Food and Agriculture Organisation, Rome.

FAO. (2012) The state of food insecurity in the World 2012: Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition. FAO, Rome.

Gopalan, C., Rama Satri, B. V. and Balasubramanian, S. C. (1991) Nutritive value of Indian foods. Revised and updated by Narasinga, Roa., Deosthale, Y. G, and Pant, K.C., National Institute of Nutrition of Indian Council of Medical Research, Hydrabad,pp.9.

Headey, D., & Ecker, O. (2013) Rethinking the measurement of food security: from first principles to best practice. *Food Security*, **5**(3):327–343.

ICMR. (2010) Revised RDA for Indians. Report of the Expert Group of the Indian Council of Medical Research-NIN, Hyderabad (India).

Jenkins, J.C. and S,J. Scanlan. (2001) Food security in less developed countries, 1970 to 1990. *American Sociological Review*,: 718-744.

Kant, A. K. (2004) Dietary patterns and health outcomes. *Journal of American Dietetic Association*, **104**:615–635.

Katanoda K, Kim H-S, Matsumura Y. (2006) New quantitative index for dietary diversity (QUANTIDD) and its annual changes in the Japanese. *Nutrition*, **22**:283–287.

Kiresur, V.R. (2015) Nutrient intake optimization in Karnataka: A linear programming approach. *Agricultural Economics Research Review*, **28** (1):147-156.

Liu, J., Shively, E. and James, K.B. (2014) Access to variety contributes to dietary diversity in China. *Food Policy*, **49**: 323–331.

Nandakumar, T.G., K.Sharma, P. and Gulati, A. (2010) Food and nutrition security status in India: Opportunities for investment partnerships, Manila: Asian Development Bank.

NNMB-National Nutrition Monitoring Bureau. (2000) Dynamic data base on diet and nutrition, National Institute of Nutrition-Indian Council of Medical Research, Hyderabad (India).

Ruel, M. (2002) Is dietary diversity an indicator of food security or dietary quality? A review of measurement and research needs. FCND Discussion Paper No. 140. Washington D.C.: International Food Policy Research Institute.

Saxena, N. (2002) Food assistance programmes and their role in alleviating poverty and hunger in India, Delhi:1-9.

Shinoj. P, Anjani, K., Bantilan, M.C.S. and Joshi, P.K. (2015) Food consumption patterns and dietary diversity in eastern India: Evidence from village level studies (VLS). *Food Sec*.

Sibhatu, K.T., Krishna, V.V. and Matin, Q. (2015) Production diversity and dietary diversity in smallholder farm households. *PNAS*, **112**(34):10657-10662.

Taruvinga, A., Muchenje, V. and Mushunje, A. (2013) Determinants of rural household dietary diversity: the case of Amatole and Nyandeni districts, South Africa. *International Journal of Development and Sustainability*, **2**(4):2168-8662.

WHO/FAO (World Health Organization /Food and Agriculture Organisation of the United Nations) (1996) Preparation and use of food-based dietary guidelines. Geneva: Nutrition Programme, World Health Organisation.