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Asset Accumulation and Nutrition: Statistical Exploration of Village Level Studies

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Abstract

This paper has documented the empirical evidence that analyses the linkages between family based assets with individual based nutritional indicator, BMI. The paper is based on the dynasty dataset constructed based on Village Level Studies (VLS) dataset generated by International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) for the period 1975-84 (generation 1), 2001-2008 (generation 2) and Village Dynamics Studies in Asia (VDSA) dataset for the period 2009-2013. Analysis has been carried out by classifying the dynasty households into four groups, viz. low, medium, high and very high, based on the three year average of latest survey years (2011-2013) net assets value. The respondents in the VLS/VDSA study villages have experienced economic development by way of enhancement in income levels, assets and education levels. The analysis has revealed that though the absolute levels of all wealth indicators have gone up, the relative position of the people at the lowest level of asset distribution has remained same. Irrespective of the asset groups, around 51-58 per cent of the members were under-weight in the initial survey year 1975-76. The nutritional mobility measure indicates that only 15 per cent of parents' nutritional condition is transmitted to their children. Further research and strong evidence is required to explore the linkages between the asset accumulation and nutritional status.

Key words: Asset accumulation, village level studies, dynasty, semi-arid tropics

JEL Classification: I15, Q12

Introduction

Nutrition is one of the most important human capitals and an essential element of household welfare. Nutrition and health play a substantive role in economic growth. This growth can achieved through five types of capitals: natural, physical, human, financial and social. Education, knowledge, intelligence, health and nutrition can be classified under human capital. Some of the capitals are family based (for example, physical assets) and some are individual based (human capital like education, knowledge, skill, etc.). All the measurable capitals can be classified as assets. In other words, the natural, physical and financial capitals can be called as assets and can be measured in monetary values. Increase in assets results in higher income which can facilitate higher education, resulting in better health and nutrition. Education helps people to gain knowledge on nutrition and creates more awareness on the importance of nutrition and health care. Irrespective of country's food security status, nutrition has become a problem for many countries in the form of either under-nutrition (not eating enough) or *mal*nutrition (not eating well, or eating wrongly). Enhancing health and nutritional status is the most significant form of capital accumulation.

Headey (2013) has explored the role of some of the "non-nutrition" factors that might influence

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nutrition outcomes. UNICEF (1990) framework clearly emphasizes on both food and non-food determinants of nutrition, as well as different steps in the causal chain. At a proximate level, nutrition outcomes are determined by food intake (macro- and micro-nutrients), yet both appetite and absorption of nutrients are also substantially affected by the health status. Going one step deeper, the quality of diets and health outcomes are strongly influenced by the economic status, education, food habits, tastes, infrastructure, location, demographic factors (number of children, birth spacing, maternal age), provision of government services, and environmental factors. And going even further, these intermediate outcomes are affected by culture, institutions, and political economy factors.

Being able to access, control, and own, productive assets such as land, labour, finance, and social capital, enable the people to create stable and productive lives. Yet, relatively little is known about how agricultural development programs can effectively deliver these outcomes of well-being, empowerment, and higher income in a way that acknowledges differential access to and control over assets by men and women (Meinzen-Dick *et al*., 2011). The conceptual framework linking agriculture, health, and nutrition was developed by Hoddinott, (2014) with three components: settings, resources, and production processes.

Agriculture is the primary source of calories and essential nutrients and is a major source of income for 80 per cent of the world's poor (IFPRI and ILRI, 2010). The marginal farm community of semi-arid region, where dryland agriculture is the primary source of livelihood, depends on agricultural products for intake of calories. Studies in this area are scant and especially in the semi-arid tropics. Therefore, the present paper has explored the relationship between family-based asset accumulation and individual-based nutritional status of the members of a household in the semi-arid regions of India. The rural SAT region, which is the home for most of the poor, is based on the premise that highest proportion of their income is spent on food. The study has attempted to find the empirical evidence of the effect of socioeconomic factors, especially net asset value, in influencing body mass index (BMI) using the ICRISAT VLS/VDSA[1] household survey data (1975-2013). It is based on the evidence (Headey, 2013) that asset accumulation leads to higher income and improved income levels lead to more accumulation of assets. These improved income levels or better economic status leads to higher consumption levels and thereby, more nutrition-intake.

With the broad objective of understanding the effect of asset accumulation on nutritional status, the study has tested whether increase in asset accumulation leads to better nutritional status among the study households, looked into the trends in consumption expenditure with respect to their asset position and investigated the asset or wealth mobility and nutritional mobility of the households.

Data and Methodology

The study has utilized the unique dynasty dataset based on Village Level Studies (VLS) database generated by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) for the period 1975-1984 (generation 1), 2001-2008 (generation 2) and Village Dynamics Studies in Asia (VDSA) dataset for the period 2009-2013. The VLS/VDSA dataset was collected by ICRISAT's resident field investigators who lived in the villages to periodically revisit the same households over the years. This paper has used the dynasty data set of 6 SAT villages: Aurepalle and Dokur of Mahbubnagar district in Telangana; Shirapur and Kalman of Solapur district and Kanzara and Kinkhed of Akola district of Maharashtra (see Walker and Ryan, 1990, for more information about VLS database) for the years 1975-1984 and 2001-2013.

What is a Dynasty Household?

Dynasty household is a sequence of households considered as members of the same family. The term 'dynasty' refers to the set of households included in the subsequent rounds of the survey whose members belonged to the same household in the baseline survey. A dynasty is sometimes used interchangeably with 'extended family' or 'linked households'.

Construction of Dynasty Household Dataset

The sample households surveyed from 1975 to 2013 in six VLS survey villages including the split-offs, were considered for this analysis. Due to attrition, households were replaced with new households of similar characteristics or belonging to the same

[1] ICRISAT VDSA data: www.vdsa.icrisat.ac.in

landholding group. There were also some changes in the sample households and sample sizes over time. The respondents belonging to the same families or dynasties in the years 1975–1977, 2001–2013 for Dokur, Kalman and Kinkhed villages, and 1975–1984, 2001–2013 for Aurepalle, Shirapur and Kanzara villages were considered in this analysis. The respondents belonging to the same family tree, either parent, children or siblings were considered as belonging to the same dynasty. The base year for this analysis was considered as 2013 and families which were part of the survey in 2013 and also from 1975 to 2013 in the specific years either themselves or their parents, siblings, were part of this analysis. If a child becomes the head of household in a particular year, his parent's characteristics like per capita land ownership, assets position, income and credit were assigned to him in the years prior to his becoming the head of household. There are 23 such dynasty families in Aurepalle, 20 in Dokur, 26 in Shirapur, 29 in Kalman, 21 in Kanzara, 19 in Kinkhed which were considered for this paper. Hence, it is a panel database of 139 dynasties studied for 23 or 16 survey years.

The various components of assets considered in this paper were the value of the land owned by the farmer; buildings which included residential house, courtyard and cattle shed; consumer durables like television, furniture, etc.; stock inventory of cereals, pulses, cash crops, fodders, cattle feeds, fertilizers and manures; net value of financial assets and liabilities, livestock value, and farm implements used in the field for cultivation. The sum of savings and lending minus borrowings was considered as net financial assets. The total assets value included the sum of owned land, buildings, livestock, consumer durables, farm implements, stock inventory and net financial assets.

To understand the real trend in values, nominal values of all components of assets were converted to real values by adjusting for inflation using wholesale consumer price index with 2009 as base year. All monetary values in this paper were converted to per capita real rupees.

Analytical Framework

The sample households of the study were classified as low, medium, high, and very high asset ownership groups based on the 2011-2013 average total assets value. The dynasty households under 25 percentile or first quartiles were classified as "low", households between first and second quartiles were classified as "medium", those between second and third quartiles were "high" and those above third quartile were "very high". The analysis was carried out using this asset-based classification.

The body mass index (BMI) which is the accepted measure of overall health of a person was computed for all the members of respondent households in 1976, 2005-2007 and 2009-2013 for which the anthropometric data were available. In the present study, BMI of the persons the age group of (15 – 50) was only considered as per the accepted standard procedure. The average BMI of members in the classified asset groups was computed and trends over time were studied. Persons with BMI less than 18.5 were considered to be underweight. Persons with BMI in the range 18.5 to 24.9 were considered to be in the normal range or healthy. The BMI in the range of 25.0 – 29.9 was considered to be over-weight, and more than or equal to 30 was considered as obese (WHO, 2006).

The log likelihood estimation method (Gujarati, 2009) of tobit regression model (with 0-100 limits) was used for econometric estimation of the socioeconomic factors affecting individual's nutritional status. The model used was as follows:

$$Y_i = \beta_1 + \beta_2 X_1 + \beta_2 X_2 + \beta_2 X_3 + \beta_2 D_1 + \beta_2 D_2 + \beta_2 D_3 + u_i \quad \ldots (1)$$

where,

Y_i = The percentage of persons in the family with BMI in normal nutritional range (18.5 – 24.9)

X_1 = Total number of female literates, having at least primary education,

X_2 = Age of household-head (in years),

X_3 = Percapita real income (in ₹),

D_1 = Dummy of high asset group,

D_2 = Dummy of medium asset group,

D_3 = Dummy of very high asset group, and the low asset group was used as the base.

Asset Mobility

Based on the quartile distribution of average household net asset levels of 1975-1977, dynasty

households were also grouped into low (first quartile), medium (between first and second quartiles), high (between second and third quartiles) and very high (above third quartile). An attempt has been made to explore whether households remained in the same quartile or mobility has happened and if so, to what extent.

Nutritional Mobility or Mobility of Health Condition

VLS/VDSA is a rich panel dataset with intergenerational information and ideal to study the mobility indices. An attempt is made to compute the absolute health mobility index on similar lines of income mobility. An effort has been made to explore whether children BMI has any relation with parents' BMI or the degree to which parents' health condition is transmitted to children. The mobility was measured by the association between parents' and adult children socioeconomic standing, where higher association means less mobility. Intergenerational correlation was the degree of intergenerational mobility or its complement.

Nutritional mobility was measured on the similar lines of income mobility and was measured as elasticity. Following the method described in (Linda *et al*., 2011), life-cycle differences were usually handled by incorporating the age (Z) and squared age of the parent and the adult child in the analysis.

$$\ln(Y_{child}) = \alpha + \beta_1 \ln(Y_{parent}) + \beta_2 Z_{child} + \beta_3 Z^2_{child} + \beta_4 Z_{parent} + \beta_5 Z^2_{parent} + \varepsilon \quad \ldots(2)$$

where, Y_{child} is the BMI of the child in 2013, Y_{parent} is the BMI of the parent in 1976, and β_1 is the estimated nutritional mobility.

Results and Discussion

The preliminary analysis of the dynasty data was carried out and some of the economic indicators, especially the asset indicators, are tabulated in Table 1 as per the designed asset classification. The most evident factor is the enhancement of all capitals, irrespective of the asset groups, with only exception being the per capita land ownership which has gone down but not in landlords group. A comparison of the latest survey year values with initial survey years

Table 1. Basic economic indicators of sample dynasty households in selected villages of India: 1975-77 and 2011-13

Indicators	Low		Medium		High		Very high	
	1975-1977	2011-2013	1975-1977	2011-2013	1975-1977	2011-2013	1975-1977	2011-2013
Age of household-head (years)	43	47	45	51	46	49	47	52
Years of education of household-head	2	5	1	4	2	5	3	6
Own total area per capita (acres)	0.5	0.2	1.3	0.7	1.4	1.0	2.0	2.3
Land value	8197	20566	16613	100010	19840	185929	35259	647734
Livestock value	1304	1642	2557	4494	3890	7040	5874	13193
Stock inventory value	545	813	834	1462	1158	1706	2165	3745
Building value	4695	26094	4367	28917	5581	40429	10982	68444
Consumer durables value	1388	10421	1761	17394	1820	26943	4478	53442
Savings	229	2901	85	3183	148	9084	1408	14262
Lendings	176	461	37	879	101	2263	285	6845
Borrowings	1467	4612	2666	7233	2219	16800	4169	23894
Agricultural capital	10535	23728	20830	108210	26526	203123	46557	680890
Non-agricultural capital	431	3237	-1412	7658	446	14785	1688	23330
Non-land assets	33876	50708	48228	64426	8952	90103	17464	139364
Total capital	41930	71274	64841	164437	28792	276033	52723	788783
Net financial assets	-1062	-1250	-2544	-3171	-1969	-5453	-2476	-2787

Note: All monetary values are per capita real values in ₹
Source: Authors' calculations, based on VDSA Database

Table 2. Results of tobit regression model

Dependent variable= Percentage of normal BMI persons in the family

Variable		Coefficient	Significance
Constant term		76.89	**
Number of female literates in the family		4.26	**
Age of household-head (in years)		-0.59	**
Total per capita income (real ₹)		0.00016	**
Dummy of high asset group		-7.59	*
Dummy of medium asset group		2.50	
Dummy of very high asset group		-9.98	**
Number of observations	2484		
log likelihood	-9064.635		
Pseudo R^2	0.0044		

Note: * and ** indicate significance at 5 per cent and 1 per cent levels, respectively.
Source: Authors' calculations, based on VDSA Database

indicated the following important points: education levels have increased; land ownership has gone down, except in landlords of very high asset level; all physical assets have increased multifold; farmers have inculcated savings as part of their expenditure pattern; with the widespread availability of agricultural credit system in India, per capita borrowings have also increased; the net financial assets are always negative, irrespective of the asset group, indicating that the respondents are net borrowers.

Econometric Estimation

Behrman and Wolfe (1984) had observed that maternal education, including secondary and tertiary schooling, tends to be associated with better nutrition outcomes. In the present study, estimation of the model of percentage of normal BMI persons (Table 2) has revealed that literate or educated female adults who cook and take care of food requirements of the family, use their knowledge on healthy habits and ensure that family members maintain their BMI in the normal range. The age of household-head has a negative effect that can be interpreted as younger generation has more health awareness and related knowledge and can result in more normal BMI persons in the family. In the wealthier families, there is a natural tendency to consume more than requirement and lead sedentary life-styles, resulting in more overweight or obese persons in the family. The persons of high and very high asset groups are expected to have a lesser percentage of normal BMI persons compared to low asset group, indicating negative and significant values of two asset group dummies. The medium asset group is expected to have more normal BMI persons compared to the low asset group. But this value is not significant.

Many studies have found the economic growth as a strong predictor of nutritional performance (Headey, 2013, Haddad *et al*., 2003). Some studies have also found that larger asset ownership, improved access to health services, higher rates of female secondary level education, and lower fertility rates, are all strong predictors of improvements in family nutrition (Headey, 2013). The increase in incomes raise the expenditure levels on food, thereby increasing the quality and quantity of diets (Headey, 2013). It was also found that household's economic status—measured either as household income, expenditure, or assets—quite typically emerges as a robust cross-sectional correlate of nutrition outcomes. However, there are several potential linkages between income, agricultural production, and nutrition outcomes (Headey *et al*., 2012; Hoddinott, 2011). Some economic studies have also suggested that agricultural income is important for the world poor, most of whom are rural (Bezemer and Headey, 2008; World Bank, 2008). The present analysis has observed that respondents in the VLS/VDSA study villages have experienced economic development by way of enhancement of income levels (Deb *et al*., 2014). The per capita real income (₹ 2009-

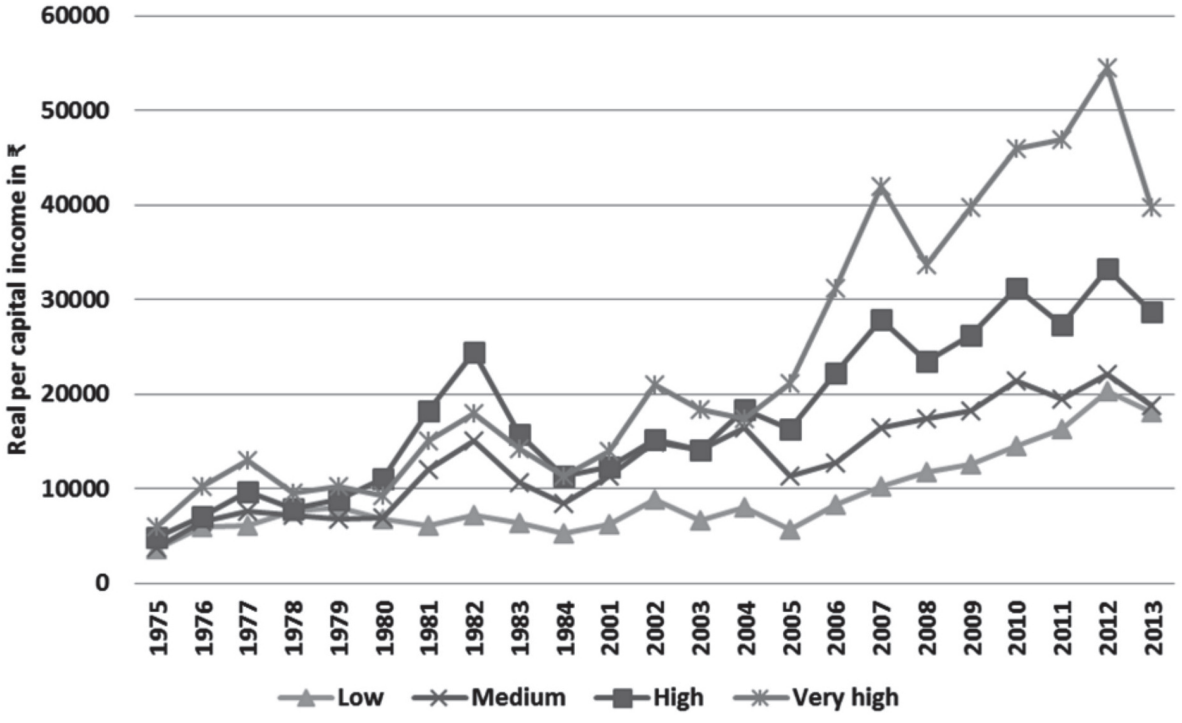

Figure 1. Trends in real per capita incomes ([1]) by asset groups in VDSA dynasty households

Source: Authors' calculation, based on VDSA Database

10 equivalent) has increased substantially over time for all asset groups (Figure 1). A comparison of per capita real annual income during mid-1970s (1975-76 to 1977-78) and in early-2010s (2011-12 to 2013-14) has revealed that it has increased to 2.5-times for low, 2.4-times for medium, 3-times for high and 4-times for very high asset group respondents.

The analysis of body mass index (BMI) of the members of the dynasty respondent households by the asset groups over time has provided several interesting results (Table 3). Irrespective of the asset group, around 51-58 per cent of the members were under-weight in initial survey year 1975-76 and 39-47 per cent were in the normal health range. Over time, the health position of the members has improved and percentage of underweight persons has gone down to 27-35 per cent and of over-weight or obese members has increased from almost nil to 9-13 per cent. The percentage of persons in the normal health range has also increased. This shows that the health status of both men and women of the respondent households has improved over time.

To probe further, the expenditure on food by household members grouped by their BMI levels, viz. underweight, normal, overweight and obese, was studied (Table 4). It may be noted that due to lack of availability of data on individual member's food expenditure, it was assumed that all the members of a household receive the same quantity and quality of food, and hence food expenditure of all the members was taken as same and per capita food expenditure of the household was used for this purpose. Some of the observations included (i) over time, food expenditure is on the rise continuously, (ii) food expenditure of wealthier asset group is always higher compared to lower asset group of the same BMI group persons, (iii) in most cases, the underweight persons spend less than normal weight persons for food, and (iv) except in low asset group, the overweight persons incur more food expenditure compared to normal persons of the same asset group.

Literature shows that nutrition outcome is determined by not only food intake (macro and micronutrients), but also appetite, absorption of nutrients, economic status, education, food habits, tastes, infrastructure, location, demographic factors (number of children, birth spacing, maternal age), provision of government services, and environmental

Table 3. Percentage of persons in BMI categories by asset groups

(in per cent)

Year	Asset group															
	Low				Medium				High				Very high			
	Under-weight	Normal	Over-weight	Obese	Under-weight	Normal	Over-weight	Obese	Under-weight	Normal	Over-weight	Obese	Under-weight	Normal	Over-weight	Obese
1976	53	47	0	0	54	46	0	0	58	39	3	0	51	47	1	0
2005	46	48	5	0	42	53	5	1	39	49	10	1	43	49	8	0
2006	53	42	5	0	45	51	3	1	43	47	8	2	43	50	7	0
2007	51	44	5	0	41	53	5	1	40	49	9	2	40	54	6	0
2009	47	47	6	0	38	54	8	1	34	57	8	1	34	58	8	0
2010	40	54	6	0	32	58	9	1	33	55	10	2	30	59	9	1
2011	37	56	7	0	30	60	8	1	35	52	10	2	31	60	8	1
2012	36	56	9	0	33	58	8	1	36	50	12	2	28	62	10	0
2013	33	59	8	1	35	54	10	2	35	52	12	1	27	62	11	0

Source: Authors' calculations, based on VDSA Database

Table 4. Average real per capita food expenditure across different asset groups

(real ₹)

Year	Asset group																			
	Low					Medium					High					Very high				
	Under weight	Normal weight	Over weight	Obese	Overall	Under weight	Normal weight	Over weight	Obese	Overall	Under weight	Normal weight	Over weight	Obese	Overall	Under weight	Normal weight	Over weight	Obese	Overall
1976	2525	2502			2475	2072	2267			2227	2443	1959	2159		2147	2483	2482	2985		2451
2005	3869	3781	3432		3803	4434	4443	5195	5805	4486	4713	4488	5711	5809	4716	5609	5338	5643	3786	5473
2006	4546	4738	4037		4600	5101	4807	5759	4662	4969	5528	5447	7347	6740	5655	6410	6236	6584	4233	6325
2007	4909	4849	3920		4833	5456	5493	6444	5586	5530	5934	5769	9080	8343	6172	6587	6573	7352		6625
2009	5220	5248	4793		5209	5638	6210	6780	10032	6066	6156	6437	9776	7633	6624	7450	7608	8810	8649	7651
2010	5885	6117	5967		6014	6166	6658	7218	10187	6590	6919	7419	8798	10675	7465	8211	8170	9166	7354	8269
2011	6396	6658	5780		6498	6322	7165	6873	10143	6921	7755	8252	9750	12017	8319	9376	9318	10574	11045	9455
2012	6381	6699	5752		6503	6452	7067	6654	9122	6858	7555	8206	10932	14123	8431	9257	9249	11312	11639	9458
2013	6827	6937	6863	3065	6870	7258	7674	7289	9417	7523	7983	8332	11195	15931	8610	8898	9433	11578	11439	9529

Source: Authors' calculations, based on VDSA Database

Table 5. Asset mobility of households in 2011-2013 with reference to 1975-1977

(%)

	Households (%)	Asset group in 2013			
		Low	Medium	High	Very high
Asset group in 1975	Low	95	5		
	Medium	31	42	13	15
	High	4	38	42	16
	Very high	0	10	21	69
	Total	20	21	20	39

Source: Authors' calculations, based on VDSA Database

factors (Headey, 2013). In this study, it can be noted that the food expenditure patterns do not strictly follow a particular pattern. Also, since it is the per capita household food expenditure used in place of individual food expenditure, it is difficult to come to any concrete conclusion. It can only be concluded that not only the money spent on food, but many other factors like food quality, family history, body nature, physical activity, health conditions are all contributors to the BMI.

Asset Mobility

The mobility of households from their original position in mid-1970s to latest survey year was studied (Table 5). The examination of mobility of households from original asset groups in initial years to present group in latest year revealed important insights. It was observed that asset mobility was extremely low in the lowest asset group. This indicated that the respondents who were at the lowest end of the asset distribution, remained so even after nearly four decades. Though their absolute levels of income, assets and other wealth indicators had gone up many-fold, their relative position remained the same. High mobility (58%) was observed in the medium and high asset groups and lower mobility in very high asset group. This indicated that households in the medium and high asset groups were very mobile wherein some of them moved up the ladder and others moved down. It could also be observed that mobility to a lower level was very common in this group than to a higher level.

Health Mobility

An elasticity value of 0.149 was estimated using the children BMI in 2013 and parents' BMI in 1976. This indicated that only 15 per cent of the parents' nutritional condition was transmitted to children. In other words, this showed that a person's health or BMI has very low dependency on the parents' BMI.

Conclusions

This study has explored the relation between household asset accumulation, using the VLS/VDSA dynasty data, and individual member's nutritional status, as indicated by their BMI levels. It has been observed that irrespective of the asset group, around 51-58 per cent of the members were under-weight 39-47 per cent were in the normal levels in initial survey year 1975-76. Over time, the nutritional status of members has improved and the percentage of underweight persons has declined to 27-35 per cent and of over-weight or obese persons has increased from almost nullity to 9-13 per cent. The real per capita food expenditure is on continuous rise in all the households, irrespective of their wealth status. However, it has been concluded that in addition to the money spent on food, there are many other factors like food quality, family history, body nature, physical activity, health conditions, etc. that contribute to the overall nutritional status. The empirical evidence has indicated that only 15 per cent of parents' nutritional condition is transmitted to their children. The study has observed that asset mobility is extremely low in the lowest asset group. This indicates that respondents who were at the lowest end of the asset distribution, remained so even after nearly four decades. Though their absolute levels of income, assets and other wealth indicators have gone up many-fold, their relative position has remained the same and its effect on the nutritional status is yet to be

unraveled. More in-depth research is needed to understand the relation further.

Future Roadmap

Along with dissemination of advanced technologies in improving the agricultural productivity in the SAT region, conducting nutrition awareness campaigns in the rural areas, whereby educating the rural poor on importance of nutrition and generating awareness about the nutritional value of different agricultural commodities grown and consumed in their region, may help alleviate the problem of malnutrition to some extent. Behavioural change, communication on nutrition and health across all strata of the community, especially in the rural semi-arid tropics is recommended to help reduce malnutrition in the area.

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