

Draft under review**Gendered time-use patterns and effects on nutritional status of women and children in the semi-arid tropics: micro-level evidence from selected villages of India.**

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Extended Abstract

There is an increasing focus on studying and understanding the linkages between agriculture and human nutrition in order to identify nutrition-sensitive agricultural interventions. Literature identifies several pathways linking agriculture and nutrition and some of these pathways specifically address women's time use and nutrition in agriculture. Alongside these, a number of studies propose that increasing women's engagement and involvement in agriculture and allied activities contribute to women's own malnutrition (under or over nutrition) and child under-nutrition in a number of ways like less time to care for themselves and participate in the care economy of the household, improper infant and child feeding practices, cooking and providing water, health services to the households and energy expenditure due to long hours of working. However, there is limited empirical evidence to test as well as corroborate these linkages and this could be due to lack of micro-level data on nutritional status of women and children, women's time use in agriculture and domestic work. Such evidence assumes greater significance in the harsh, vulnerable environments such as the semi-arid tropics of India and Africa which are facing acute water shortage, continuous drought as well as a policy bias towards rain fed agriculture, and a prevalence of rigid gender, social and cultural norms dictating women.

The objective of this paper is to examine women's and men's time use patterns, maternal and child nutrition and the linkages between the two based on a sociological analysis of the data. The paper uses micro-level evidences from the longitudinal panel surveys carried out by ICRISAT's Village Dynamics Studies in South Asia (VDSA), formerly called as Village-level Studies (VLS), which has been running from 1975 to now, tracking the same households and individuals over time in selected villages of India.

The descriptive statistics and analysis of the data from the 6 villages of the semi-arid tropics (SAT) confirms the assumption and argument that women play multiple roles and spend time on several activities including productive work – both farm, non- and off-farm, domestic work and other reproductive work like child and family care. Compared to men, women spend four time more time on domestic activities and in the care economy – taking care of all the members of the household including children, the elderly as well as sick members. The analysis also indicates that the concept

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of leisure for women is expanding their knowledge in household care and family matters including nutrition of their households, knowledge about agriculture and government programs and benefits, participation in community, group and social activities and increasing or enhancing their social capital. Thus leisure activities are a gateway to women in knowledge society.

A focus on time spent in agriculture and related activities, the analysis informs us that women spend almost double the number of hours per hectare on agriculture activities either on their own farms or as paid labor. Sowing, weeding, harvesting continue to be the dominant activities for which women spend about 75-80% of their time in agriculture. The analysis also indicates that in the event of rising wages in the rural areas, women (especially family female) substitute for male labor and perform activities performed by men. The time-use analysis and the changing cropping patterns in the rural areas of the SAT confirm that activities performed by men are mechanized, freeing them from agriculture into other farm or non-farm activities, including migration to towns and cities. The activities that women perform dominantly on the crops that continue to be grown in these areas are not mechanized, women participate more in agriculture due to migration of the economically active men and sometimes women and hence there is seen a progressive feminization of agriculture in these regions.

Two indicators of nutrition are considered in this paper namely dietary diversity and Body Mass Index (BMI). Medium level diversity in diets of women was observed, wherein the diet included five food groups – domination of starchy staples and cereals, roots and tubers, followed by legumes, dark leafy green vegetables and milk and milk products. The nutritional status of women based on the BMI reveals both under nutrition and over nutrition in the study villages in selected districts. In the case of children under 5 years of age, dietary diversity scores revealed that their diets are more diverse compared to their mothers and included on an average five food groups which included eggs, dairy products, fruits. Despite medium or high diversity in diets of children, stunting prevalence or low height for age of children is observed. This could be either due to the insufficient quantities of food intake or presence of enteric infections especially water borne infections. Validating the descriptive analysis with statistical analysis, the results show that there is a negative or inconsistent linkage between women's BMI and time on productive work- especially agriculture work. The linkage between women time, their nutritional status and children's nutritional status was not clear.

The sociological analysis clearly points out that men and women have varied time use patterns and burdens. Time matters, especially for women who have a high burden in agriculture compared to men and also have a greater responsibility in domestic activities and child and family care. These include the poor women, women who are in child bearing age and the vulnerable. The analysis also confirms that time-use in agriculture especially by women varies by crop, production cycle, age and social group. There is diversity in women's roles and hence broad generalizations cannot be made. The sociological analysis presented in the paper conclude that time commitments – either increased or reduced – has an impact on the nutritional outcomes of women and children. The outcomes are varied and necessitate different sets of policies and innovative approaches to leverage agriculture for nutrition from a gender-responsive perspective. As opined by some authors, the context is important and policies must be based on sound data and gender analysis.

1. Introduction and background

It is now widely recognized and well accepted by the development community globally as well as regional, local organizations and governments that agriculture is an engine of growth for reducing poverty. Agriculture continues to be a dominant occupation in rural Asia and sub-Saharan Africa. Alongside this, there is also a growing recognition that women are now playing greater roles and making essential contributions to agricultural and rural economies in the developing countries. Women are often managing complex households and multiple livelihood strategies (FAO, 2011) in bringing about rural transformation in general and agricultural transformation in particular. However, their roles vary considerably between and within regions and are changing rapidly in many parts of the world, where economic and social forces are transforming the agricultural sector (FAO, 2011). Their activities are also spread along the continuum from producing agricultural crops, participating in the non-farm sector through wage employment and small entrepreneurs, livestock and allied activities, post harvest processing, marketing and trade, to collecting fuel and water, domestic activities like food preparation, participation in the care economy of the household as well as participation in community activities and group action. As reiterated in the FAO (2011) report, many of these activities are not defined as “economically active employment” in national accounts but they are essential to the wellbeing of rural households.

The Global Nutrition Reports (2014, 2015) state upfront that good nutrition is central to the sustainable development agenda taking shape in the form of the Sustainable Development Goals (SDGs). The reports also imply that over the course of the human lifespan, good nutrition leads to more effective learning at school, better-nourished mothers who give birth to better-nourished children and adults who are likelier to be productive and earn higher wages. It is also increasingly recognised that malnutrition, which is looking at the two ends of the continuum - from under nutrition to obesity – is a global challenge putting approximately more than one quarter of the world’s population at serious health risk. There is also an increasing focus on studying and understanding the linkages between agriculture and human nutrition in-order to identify nutrition-sensitive agricultural interventions. It is argued in the literature that such an approach can directly impact nutrition and food security both at the individual as well as household level. Alongside this understanding, consideration of the pathways most relevant to the value chain and an identification of the underlying causes of malnutrition is important for impact to be profound.

A number of studies propose that increasing women’s engagement and involvement in agriculture and allied activities contribute to child under-nutrition in a number of ways like less time to participate in the care economy of the household, improper infant and child feeding practices, cooking and providing water, health services to the households (Kadiyala et.al 2014, Heady et al 2011, World Bank 2008, Glick 200, Smith et al 2003). However, there is limited empirical evidence to test as well as corroborate these linkages and this could be due to lack of micro-level data on nutritional status of women and children, women’s time use in agriculture and domestic work. Such evidence assumes greater significance in the harsh, vulnerable environments such as the semi-arid tropics of India and Africa which are facing acute water shortage, continuous drought as well as a

policy bias towards rain fed agriculture, and a prevalence of rigid gender, social and cultural norms dictating women.

The objective of this paper is to examine women's and men's time use patterns, maternal and child nutrition and the linkages between the two based on a sociological analysis of the data. The qualitative analysis is complemented with statistical analysis. The paper is organized as follows: section 1 presents a brief introduction to the issues, section 2 provides a brief review of literature on time use agriculture and nutrition from a gender perspective and the corresponding conceptual framework; this is followed by a description of the methodology, and the data sources. The results and discussion are presented in section 4. The paper ends with conclusions and the references cited in the paper.

2. Literature review and conceptual framework

There are a number of studies in which have clearly demonstrated the linkages between agriculture and nutrition. Several pathways on this linkages have also been proposed in the literature. The current thinking in agriculture-nutrition- also health research has certainly evolved, with pathways linking agriculture and nutrition recognized as clearly gendered, although women-specific roles remain important in three of those pathways (Ruel and Alderman 2013; Kadiyala et al 2014; Komatsu et.al. 2015, Gillispie et.al. 2012), and they also specifically address women's time use and nutrition in agriculture . There has also been a systematic review of evidence on agriculture and nutrition pathways in India (Gillespie et.al. 2012), with one among the seven pathways having a focus on time-use by women, namely Pathway 6: Female Agricultural Labor and Childcare and Feeding. The pathway examines how the employment of women has a bearing on caring practices and capacity and thereby impacting the nutrition outcomes of themselves and the children. The authors reviewed about ten studies that identified the links between female employment, reduced caring capacity or health seeking, and nutrition and health outcomes (Agarwal 2001; Bennett 1992; Berman et al. 1997; Bhalotra 2010; De Walt 1993; Duvvury 1998; Kaur 2005; Rani and Rao 1995; von Braun and Kennedy 1986, 1994). Papers looked at the effect of agricultural work and the need for income on maternal nutrition, health knowledge, and health seeking behavior, and the effects of commercialization, structural adjustment, and development on these linkages (Gillespie et. al., 2012). On the issue of commercialization, there are arguments on increased female labor participation leading to detrimental effects on child nutrition (Bhalotra, 2010); or a compromise in maternal and child nutrition due to over engagement in agriculture (Rani and Rao, 1995) and withdrawal and or displacement of women from the labor force with commercialization, mechanization, and development (Kaur 2005; von Braun and Kennedy 1994; Agarwal 2001) resulting in more time by women for the household.

The most recent systematic review of evidence on agriculture, time use and nutrition in rural areas of many low and middle income countries was conducted by Johnston et.al. (2015). The evidence shows that women play a key role in agriculture, and this is reflected in their time commitments to these activities, whether as farmers or as farmworkers; it also reveals that women are important actors in the uptake and response to agricultural interventions and that agricultural interventions tend to increase women's, men's, and children's time burdens. However, Johnston et.al (2015) also

point out that the studies included in the review do not provide clear-cut evidence on the nutritional implications of agricultural practices and interventions, even when these result in increased time spent on agricultural activities. The authors infer that nutritional impacts are varied because households respond to increased time burden and workload in different ways. Responses are different due to a number of differentiating factors that include income and the possibility of purchasing food, household socio-economic status, household type and composition (in particular the presence of members who can take up domestic work), and the type of indicator used to assess food consumption, security, or nutrition.

A simple time use analysis might suggest that adding paid work outside of the home on top of the existing 'invisible' workload inside the home would pose a significant burden for women, particularly poor women, in the vulnerable and marginalized regions of the SAT. Therefore different sets of policies are needed to address specific forms of burden management, shouldered by households, individual household members, or both. Interventions should be directed at women and poorer and smaller households, identified as more vulnerable to time constraints.

Drawing from the corpus of literature from the TANDI initiative, Headey, Chiu, and Kadiyala (2011) found no prima facie evidence that women employed in agriculture spent less time on childcare. But they found that other relatively unskilled occupations—such as household, domestic, or service employee—tended to show even higher rates of preschoolers being cared for by other children or other adults (with the exception of unskilled manual workers). An interesting finding by the authors is an adverse impact on stunting (height-for-age) when care is provided by other children and no significant effects were found for wasting or weight-for-age. Citing this work a little more, the authors tentatively concluded that there is not much evidence that poor childcare practices are more prevalent or more important in agricultural households than in non-agricultural households. It can be concluded from the systematic review that more accurate time use data might give rather different results, and it is still likely that the labor burden of mothers in all unskilled occupations (agriculture, domestic work, unskilled manual labor, and other services) detracts from appropriate childcare practices.

Dietary diversity as an indicator of food security or diet quality is receiving a lot of interest and acceptance (Labadarios et al., 2011; Ruel 2002, Ruel 2003; Swindale and Bilinsky, 2005 and 2006; Kennedy, 2009; Hodinott, 2002; Styen et al., 2006; Hillbruner and Egan, 2008; Ajani, 2010). Literature suggests that there is a growing interest in understanding households and individual dietary diversity mainly because of its relevance in meeting nutrient requirements (Labadarios et al., 2011) and nutrient adequacy (Swindale and Bilinsky, 2005; Kennedy et al., 2009). Because of its simplicity in measurement and its reflection on key food security pillars, dietary diversity could be used as a practical proxy measure of household or individual food security (Thorne-Lyman et al., 2009; Vakili et al., 2013). It is also understood that several socio-economic factors (income, education, age) may therefore condition individuals' dietary diversity (Thiele and Weiss, 2003; Thorne-Lyman et al., 2009) worth understating for policy guidance and intervention targeting towards addressing food security (Taruvinga A. et.al. 2013)

Conceptual framework linking agriculture, nutrition, gender and time-use

This paper appeals to two conceptual frameworks towards understanding the linkages between agriculture, nutrition, gender and time use that are well documented and cited in the literature. The first framework is the empowerment pathway by Spring (2014). This pathway focuses on the importance of the women's empowerment as a pathway to improve nutritional outcomes through agricultural livelihoods, illustrated in blue in the figure 1. There are two other pathways in this figure – namely the productivity pathway and the income pathway and all these pathways are inter-related. Agricultural activities typically affect more than one pathway and interact with the enabling environment that includes policies, the natural resource base, and cultural practices, among other factors (Spring, 2014). The pathway from women's empowerment to improved nutrition is influenced by a number of factors, including social norms, knowledge, skills, and how decision-making power is shared within households. The pathway consists of three interrelated components: women's use of income for food and non-food expenditures, the ability of women to care for themselves and their families, and women's energy expenditure (Figure 1, Spring 2014).

An examination and analysis of the time use patterns of men, women, boys and girls in the rural areas allows us to understand the inequalities at the household level which could be social, cultural or economic as well. Johnston et.al (2015) put forth a reasonable argument for an investigation of time use as a relevant pathway to impact, impact being the nutritional outcomes. Their argument that although agriculture is considered important to improve nutritional outcomes, agricultural interventions and practices can have unintended negative consequences on nutritional status via time use outcomes because time is a critical factor for nutrition, especially for women, holds applicability in many cases but there is not much evidence to test this argument. However, it is also to be remembered that like women, men are also affected by time constraints and it is important to consider this in the analysis of time use and food consumption. The difference is that men perform one activity after another (sequential) whereas women perform more than one activity at the same time (multi-tasking, primary and secondary activities) For eg. Women may be cooking food for their family, at the same time they may also help get their children ready for school, and also be selling milk at home on a small scale or filling water from the tap nearby their house. Intra-household time use as well as intra-household distribution of food is another factor that shapes the nutritional status of women, children, and men (Johnston et.al, 2015). When agriculture is a primary source of employment and income for many women and men, then consideration for the time use outcomes of agricultural practices is to be an essential component of the study of nutritional outcomes (Johnston et.al, 2015). This is the second framework this paper appeals to, the theory of change linking agricultural practices, time use outcomes and nutritional outcomes compiled by Johnston et.al (2015). As can be seen from Figure 2, time allocation can vary with different agricultural practices or activities and this can have a bearing on child care, feeding and other nutritional outcomes. An important linkage that is indicated here is the role of gender, social and cultural norms that are prevailing in the region as well as intra-household decision making capacity which has a bearing on time allocation.

3. Methodology and data

This paper uses data collected as part of the ICRISAT Village-level Studies (VLS) now also called the Village Dynamics Studies in South Asia (VDSA). The longitudinal Village Level Studies of ICRISAT have

for over four decades provided profound insights into the social and economic changes in the village and household economies in the semi-arid tropics (SAT) of Asia and Africa. These studies were initiated by ICRISAT at six locations in Telangana (the then united Andhra Pradesh) and Maharashtra states of India in 1975 and are continuing till 2014. Two villages each were included from Mahbubnagar district of Telangana and Solapur and Akola districts of Maharashtra (see www.vdsa.org for more details)⁶. The 6 villages continue to track the same households and individuals as in 1975 and hence are also referred to as the Dynasty households. The sample households in each village included four types of households based on their land holdings and were classified as large-land holding households, medium land-holding household, small-land owning households and also the landless (who do not own land at all or have very little land). The sample size consists of total 407 households and 1929 individuals for nutrition indicators (See figure 3 for the locations and table 1 on the sample size).

In 2013-14, with additional funding support from a CGIAR RESEARCH PROGRAM on Policies, Institutions and Markets (CRP PIM), a special purpose survey was implemented in the 6 villages of the VLS, with a focus on nutrition and women's empowerment. Additional data was collected from the dynasty households on time use, dietary diversity, nutritional anthropometry, assets and 24-hour dietary recall (food intake) to understand the nutritional status of the men, women and children of these households as well as understanding of empowerment of men and women in the harsh, fragile environments of the SAT. The special purpose survey collected data on a quarterly basis (4 rounds in all) to capture seasonality. The important characteristic of the special purpose survey is the availability of time use information in each round for all the members of the households who are 14 years and older in age. Thus this covered adolescent boys and girls, the most active male and female members of the household, who were mostly the household head and his/her spouse as well as the elderly members of the family. Time use information was collected for all activities reported by the respondents at an interval of 15mins each. Additional information was also collected at the household level on access to drinking water and sanitation and hygiene facilities. Similarly data on dietary diversity was also collected every quarterly for all members in the household from age 2 years and above. Anthropometry data – height and weight for adult women and men was collected once during the survey year while for children under five years of age it was collected every quarter, including mid-upper arm circumference data.

Both quantitative and qualitative methods of data collection were employed in generating and validating this data. Questionnaire surveys were implemented and data was collected from the principal male and female members of the household (members who were involved in making decisions in the household). Focus group discussions and cooking demonstrations were used to collect additional information. Graduated picture charts and play dough was used to get the closest approximations of quantities of food consumed.

⁶ The data on socio-economic and agriculture characteristics have been collected at regular intervals (3 weekly interval) from 240 households since mid-1975-1985, called the first generation VLS data. The studies were resumed in 2001, with varied frequency of data collection, tracking the same households that were selected in 1975, including the split-off and spin-off households of the original panel. Starting 2009, the studies have been expanded from 6 villages to 42 villages covering 30 villages from 9 states in India and 12 villages in Bangladesh.

In this paper the authors use the following data for the analysis and interpretations:

- a. General household characteristics from the VDSA longitudinal panel and the special purpose gender and nutrition survey
- b. Household consumption expenditure data from the VDSA longitudinal panel (1975-2013)
- c. Income data from the VDSA longitudinal panel (1975-2013)
- d. Anthropometry data for adults from the VDSA longitudinal panel and the special purpose gender and nutrition survey
- e. Anthropometry data for children from the special purpose gender and nutrition survey
- f. Dietary Diversity data from the special purpose gender and nutrition survey
- g. Time use data from the special purpose gender and nutrition survey
- h. Labor participation data from the VDSA longitudinal panel (1975-2015)

Descriptive statistics and qualitative analysis from the above data is presented in the next section. The results and discussion presented are in two ways. Sometimes data from all the six villages is combined, analysed and interpreted. Sometime, to capture variation among and within the study location, the micro-level analysis is also presented based on the three different regions in the SAT: Drought prone region of Mahbubnagar; Assured rainfall region of Akola and Drought prone region of Solapur with access to canal irrigation (table 2). Time use and dietary diversity surveys were conducted every quarterly (4 rounds in all) in 2013-14 to capture seasonality and these correspond to the low, medium and high agricultural season intensity (table 3).

Along side the qualitative analysis, anova table and statistical analysis using two-stage least squares method is presented. Using the experience of Komatsu et.al. (2015), and given the possible endogeneity of time, Two Stage Least Squares (2SLS) is used by first estimating the log of women's time spent in activity j, and in the second stage, assessing the impact of women's time use on an activity j on women's BMI. The independent variable is the time use of women, the instrumental variables are age, education, income, social grouping, and marital status

4. Results and discussion: descriptive statistics and empirical results

The following results are presented in this section:

4.1 Time use patterns and labor participation in agriculture by gender and region

4.2 Nutritional status by gender and region

4.1 Time use and labor participation by gender and region

4.1.1 Time use patterns – by gender and regional differences

Time use is now increasingly used as transformative indicator of gender equality. Time use analysis are related to unpaid care and gender inequality and are also a reflection of how gender roles attributed to women and men, girls and boys, shape the division of labour within a household

(Ferrant, 2014), a community and in agricultural activities/operations. Gender and social norms within a community, or a cultural setting and context define many times certain activities as feminine and or masculine than others. This paper uses longitudinal data on participation in agriculture by men and women and provides an understanding how the social norms have changes with respect to feminine/women activities and masculine activities. This is an indication of empowerment of the communities as they are able to break away from the stereo-type roles performed by men and women and are able to challenge the societal norms towards this. Challenging the norms as a result of the changing external environment because of new technology, environmental changes and policy changes is a sign of empowerment.

Women, along with men, are involved in producing goods and services for household use, spending 6 and half hours a day on work, which includes farm work, livestock rearing and non-farm work. The farm and livestock work may be paid work or work in their own farms or taking care of their own livestock but most of this work supports the household. Women in the semi-arid tropics spend about 4 hours every day on household chores, including cooking, cleaning, fetching water, washing, and gathering firewood which is about 3 times more than men (Figures 4a and 4b). Caring, cleaning, cooking and fetching water and fuel wood are all unpaid tasks predominantly carried out by women, and to a lesser extent, children nowadays, especially girl children in these regions. The time-use data based on a 24-hour recall, clearly shows that men spend less than one hour per day on unpaid household work including care work while women almost four times as men. That leaves an additional burden on time for paid employment. Leisure, including sleeping and resting, takes away about 31-33 % of the time in a day. However, it is interesting to note is that men and women view leisure differently, in the different regions of the SAT. More description on the perceptions of leisure by men and women is provided in the next section where the regional differences are discussed.

An examination of the time use patterns by gender in the three different regions of the semi-arid tropics (as presented in table 2) reveal that in terms of the time spent on farm work, livestock rearing and non-farm work, there is no significant difference in the time spent by women and men across the three regions. The difference in time spent is in domestic work and leisure. (figure 5 – 5.1a, 5.1b and 5.1c) . On an average women spend everyday about 10-12 % of their time in doing household chores (2 hours 40 minutes to about 3 hours) while men spend about 2-4% of their time (about 45 minutes to one hour). A considerable chunk of time is spent on leisure by both women and men in the study villages, even if sleeping and resting time are separated. Women spend almost half the time (7-12 %) on leisure related activities compared to men which is about 10-15 % of their time. Even though there is not much difference in the leisure time by both men and women there is a considerable difference in what “leisure” means to men and women, in the different regions.

Leisure was interpreted as watching television, gossiping, discussing politics and participation in public political meetings by men in all the three regions – drought prone region of Mahbubnagar; the assured rainfall region of Akola and the region with access to canal irrigation of Solapur districts in the semi-arid tropics of India. For the men from the Telangana region, leisure meant two things - watching television/listening to radio and discussing politics. Majority of the men reported

participating in political meetings and discussing politics as the main leisure related activities. This is important because when this data was being collected, the then state of Andhra Pradesh where Mahbubnagar is located was in the process of undergoing a bifurcation into two states – Telangana (Mahbubnagar will belong to Telangana) and the residuary state of Andhra Pradesh. So discussing the political ploys and tactics in bifurcation of the state was the most common activity for men. The concept of leisure as perceived by women in the three regions is presented in table 4.

For women, leisure was a time to be happy, talk to other people, do activities which give them happiness and also strength and confidence. It is also an opportunity to network with other women in the community and enhance and improve their social capital.

Having discussed the time use patterns of men and women in the six villages in general, this paper also puts emphasis on the time use patterns of women between the age groups 18-49 years for interesting insights. As can be seen from Figure 6, women in the age group 18-49 years spend more time on all activities during the high agricultural intensity seasons (round 1 and round 4) except for activities under the 'other' category and 'non-farm' work. This is an interesting finding indicating that the time burdens on women in this age group are more during the high agriculture seasons, thereby women are more time constrained. Women reduce their 'other activities' during these periods. The 'other activities' include drinking local toddy, going to the market and running errands for the household.

When we compare the education levels and time burdens on women, our findings indicate that as the level of education increases women tend to spend more time on household chores which includes time spent on cooking, washing clothes and utensils, among others. On an average, as can be seen from the graph below (figure 7), compared to women with no education, women who have a graduate degree spend 40 mins more on domestic work, about one hour more on leisure activities and 40 mins more on family care. Illiterate women and women with no education beyond primary school spend less time cooking (& washing utensils). The data also reveals that even in the high agricultural season under time constraints, women do not cut down on child care time. Instead, they sacrifice about an hour of work outside the home and an hour of their leisure time.

Comparing income levels and time use patterns of women, our findings indicate that as income of the household increases women tend to spend more time on household chores which includes time spent on cooking, washing clothes and utensils; and on family care including personal care. On the contrary, women from both medium and high income groups spent less time on recreation and leisure activities (figure 8). As indicated earlier in the paper, leisure activities included participation in community and social events. Women from wealthier households (based on income) do not tend to participate in these activities because of the social status their households have in the community. Leisure and recreation to women from the high income class was restricted to watching television and gossiping with women within their families or kin and participation in their kinship activities.

When time use patterns of women are compared across the different farm size classifications – large land holding households, medium land holding household, small land holders and the landless category, it is clearly evident that land holdings do matter when it come to women's time. It is found that women from large- and medium land owning households spend more time on farming. Time spent on family care, domestic work and leisure activities are not affected by farm size (figure

9). When enquired about the role of women from large-and medium land holding groups in farming activities, it was revealed that women either work on their own farms especially during labor shortage and or are supervising the labor working in their fields.

Using social groups as a level of disaggregation, an analysis of the time use patterns of women from different groups reveals that women from the backward class tend to spend an additional one hour on non-farm activities, compared with other groups. Forward caste women tended to distribute their time equally among the work major activities – domestic work, farm and non farm work and family care (about 4 hours each) and the remaining time was spent on sleeping, resting, leisure and other activities. What is interesting to note is that women from Scheduled caste and tribes spent relatively more time on domestic work and family care as compared to farm and non-farm work (figure 10).

4.1.2 Gendered patterns of participation in agriculture

Labor participation data is one of the ways to understand and measure the amount of time spent by men and women on different tasks/activities/crops in agriculture. The analysis from the crop input and out-put module data from the VDSA villages since 1975-2014 reveals an interesting pattern. The descriptive analysis by presented village and region and is based on a flyer by Padmaja and Bantilan (2014) which describes the feminization of agriculture in the SAT.

Aurepalle village in Telangana, where the pathway of development is through diversification of agriculture and income sources

The time allocation of women and men in agriculture in Aurepalle clearly shows that women are spending more time in agriculture as measured by the number of hours per hectare (figure 11). The participation has increased three folds for women from 1975, when it was 258 hrs^{-ha} to 840 hrs^{-ha} in 2010. One of the reasons for this increased time of women in agriculture are the changes in the cropping pattern. Castor and sorghum were the dominant crops in 1975, which needed relatively less labor. However, starting 2001, these crops were gradually replaced by cotton which is a labor intensive crop, with more female labor requirement for harvesting/picking of cotton (Figure 12).

Dokur village in Telangana, where the pathway of development is through diversification of income sources, namely non-farm occupations including migration

Dokur is a village in Mahbubnagar district which was once upon a time flourishing in agriculture. The village experienced continuous dry spells and drought like conditions for a prolonged time (more than 8 years at a stretch). These conditions have led to farmers shifting from paddy, the dominant crop in the 1970s and 80s, to castor during the dry spell years. Alongside this, the village also has experienced migration of men and women to other towns and cities. The time allocation data and the cropping pattern data illustrate the declining participation of women in agriculture from 1975-2008/09. With good rains and the favourable environment post 2005, the data shows that paddy cultivation is increasing and thereby the roles of men and women in agriculture are also showing an upward trend (Figures 13 and 14).

Kanzara village in rainfall assured Akola, where the pathway of development is through intensification of agriculture

In Kanzara, which shows a promise in agriculture through intensification, the analysis clearly shows that both men and women participate equally in agriculture. This trend is observed in the time allocation of men and women during 1975-1984/85 (figure 15). During this period, diversification of agriculture is also seen (figure 16). Cotton which is grown from centuries in this region, is the dominant crop and the area under this was increasing till upto 2003/04. During this period the time use patterns of women show an increased share in agricultural work. Starting 2007, Soybean has started gradually replacing cotton. Soybean uses less labor and hence there is a drop in the time allocation of men and women (figures 15 and 16). Kanzara is also a village that uses more mechanization, which reflects more or less equal participation of men and women in agriculture.

To summarize, the sociological analysis from the long-term panel data from 1975 clearly points to evidence of a progressive increase in participation of women of agriculture in the rural areas, although the extent is varying across regions (Padmaja and Bantilan, 2014). The analysis and the insights reveal that in regions that have a promise in agriculture (eg. Village Kanzara), and favour sustained dependence in agriculture, men and women jointly participate in agriculture as they were doing so since the early 70's. The role of women in agriculture increased in these cases but to a lesser extent. However, in regions which have experienced shocks (such as the Mahabubnagar villages), women have a greater role and engagement in agriculture depending on the coping strategies the household adopts - changing cropping patterns and diversification ; working as paid labor on others farms and lastly male members of the household migrating to towns leaving the women to take care of the farms as well as participate in the care economy. This finding is also echoed by Binswanger-Mkhize (2012) in their analysis of the structural transformation in India. The analysis also shows that female time-use in agriculture varies by crop, production cycle, wealth (income and land holding status) and social group.

4.1.3 Operation wise participation in agriculture – by gender and type of labor

ICRISAT Village Level Surveys are one of the few surveys which have time-use data by agricultural operation, by gender over time. An examination of the operation wise participation of women and men in agriculture reveals that involvement of women has increased over time not only in terms of number of hours per hectare but also in the number of operations. In the early years (1975-76) women were involved mostly in sowing, weeding and harvesting operations but gradually over time, their role in land preparation, irrigation, plant protection and post harvest processing also became evident and there is an increase in the time burden of women (Figure 17). Men on the other hand continue to perform the same operations over time and there is in fact a fluctuation in terms of time use by men, which is declining. Even though the participation of women has increased in more number of activities, the overall labor burden of rural women is in three major operation – sowing operation; weeding and related operations and harvesting while that of men is mostly in land preparation and related operations and irrigation. Harvesting is also an activity that men are involved and spend about 41-60 hours per hectare (Figures 18a and 18b; data in circle is the total number of hours per ha for all operations put together). As can be seen from these two figures, women spend around 75-94% of their time on these three operations – sowing, weeding and harvesting - whereas men spend about 55-80 % of their time on the three most important operations – land preparation, irrigation and harvesting.

Continuing the examination of the labor participation in agriculture by analysing the type of labor – family and paid/hired labor presents an interesting story. In Aurepalle village, Mahbubnagar district there is an increase in female labor – both family female (FF) and hired female (HF) from 1975 to 2014. However the time by men – both family male (FM) and hired male (HM) is declining over the years, more so in the case of HM labor which has reduced drastically (figure 19). The cropping pattern changed from castor which was the dominant crop and is less labor intensive to Bt-cotton which is now the dominant crop and is labor intensive. This shift came about starting 2005 and this explains the increasing role of women in agriculture. The village has seen a good implementation of the Employment program by the Government – Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA). The rising wages in agriculture especially the male wages and the wage parity due to MGNREGA, this village is witnessing the deployment of family female labor into agriculture especially during the peak time of labor need – sowing, weeding and harvesting of cotton. Women are spending about 150-260 hours per hectare on their own farms, which has a burden on their time, which was earlier spent on domestic activities and family care. Their involvement in agriculture operations (against activities performed at home) also implies additional energy expenditure and this has a negative effect on their nutritional status.

The situation in Dokur is the opposite in terms of cropping pattern. Dokur has shifted from a labor intensive crop (Paddy) to castor which requires less labor. The shift is because of continuous drought experiences year after year and lack of irrigation facilitates. The continuous drought has also resulted in migration of men and women to nearby towns for about 10 months in a year. As can be seen from figure 19b, there is a decrease in the hired female use compared to 1975 but is still significant (close to 500 hours per hectare). Hired male labor use is on the decline. With regard to family labor – there is no major change in the family female labor use but there is a decline in the family male labor in agriculture. Married couples in the child bearing age (18-49 years) are migrating to the towns, leaving behind children, adolescents boys and girls, unmarried youth and the elderly in the village to perform agricultural tasks. Those left in the village prefer to work for MGNREGA activities as the wages are higher compared to agriculture wages. Hence there is seen a reduction in labor use especially male labor, both family and hired, and hiring of female labor as a substitute for the male labor which is becoming more expensive.

A similar analysis based on the data for the two villages in the assured rainfall region where the pathway of development is through intensification of agriculture (figure 19c and 19d) highlights an additional dimension. In these two villages overall there is a decrease in labor use in agriculture for all types of labor – family and hired – male and female even though there is intensification of agriculture. The cropping pattern in these villages has shifted from a labor intensive, long duration crop (cotton, which has been grown for centuries) to soybean which is less labor intensive and fits well in the cropping pattern for farmers to go in for a second crop in the post-rainy season. What is interesting to note here is that these two villages are mechanizing agriculture to meet the demands for the agriculture operations. However mechanization has benefitted the male labor mostly and the demand for female labor –hired continues to be high even though there is a sharp decline. Family female labor use is also on the decline. Mechanization can be seen to displace female labor from employment in agriculture.

The analysis of the data from the two villages of Solapur district illustrate another dimension – the availability of irrigation for agriculture and its impact on labor use. Figures 19e and 19f tell a story of increase in both family and hired female labor use in agriculture operations. Family male labor use is also increasing over the years but there is a decline in hiring male labor. These villages also have seen an increase in mechanization and also a shift from labor intensive crops to crops requiring less labor.

Summarizing, the time use analysis based on a 24-hour recall and participation in agriculture operations and activities add deeper insights into the heterogeneity in women’s contribution in agriculture (Sofa team and Doss C, 2011). The sociological and descriptive analysis clearly bring out the fact that female time-use in agriculture varies by crop, production cycle, mechanization, wealth status and social group. The findings corroborate the earlier findings by different authors that sowing, weeding and harvesting are predominantly female activities and women contribute more than 75% of their time and labor for these activities. In total, at an aggregate level, the labour burden of rural women exceeds that of men, and includes a significant proportion of family labor who have other household responsibilities related to preparing food, caring for the children and elderly and collecting fuel and water.

4.2 Nutritional status of women, men and children

This section attempts to examine and explore the nutrition outcomes as expressed in the BMIs of adult men and women and dietary patterns using the Dietary Diversity scores for women and children, along with an analysis of the consumption expenditure data.

4.2.1 Dietary composition of rural households based on the consumption expenditure patterns

The dietary composition of rural communities in the selected villages of the semi-arid tropics of India is presented using the consumption expenditures on food items by the rural households. VDSA has a longitudinal panel data on the monthly consumption expenditure on food and non-food items at the household level, starting 1975. This module captures both food purchased by the household as well as food from their own production. An analysis of the food expenditure patterns was undertaken to understand the composition of the diets of the people inhabiting these regions. Starchy staples and cereals continue to take a big share of the expenditure on food since 1975-2013, thereby accounting for most of the energy intake. In the 70’s and 80’s cereals dominated the food expenditure and very little was spent on other foods like legumes, oils and high value foods like milk, meat, vegetables and fruits. There is a noticeable shift in the dietary composition as can be seen from the data from 2009-13 (Figure 20), with cereals now comprising only about 30% of the monthly percapita expenditure. Households are increasing their spending on purchase of legumes, meat and eggs, gradually. Milk and milk products has seen a decline in all the villages since 2009. Dairy and livestock which was once a household activity, where women had control over the produce and the income earned from the sale of milk, milk was available at the household for consumption. With the setting up of milk cooperatives and milk collection centres in the village, all the milk is now deposited at the centre, leaving little quantities for home consumption, especially by children and nursing mothers. However fruits and vegetables continue to have a lower share in the expenditure. It is also important to note that expenditures on food eaten outside or cooked food purchased from

outside is quite noticeable. This clearly indicates that the changing preferences of the rural communities with respect to their diets and thereby the changes in the dietary patterns.

Summarizing from the figure 20, for almost a decade (1975-84), there have been no significant changes in the patterns of food diversity based on the expenditure data. This finding is corroborated by Ramachandran N (2014) who states that this has been the case even in the last the last 20 years in India. The average Indian diet remains largely deficient in green leafy vegetables, meat, fish, milk and milk products, leading to deficiency in some micro-nutrients such as Vitamin A, iodine, iron, zinc and calcium, also highlighted by Ramachandran N (2014) based on his analysis of the NSSO data for India and FAO (2010). Real incomes have risen in all the villages of the VDSA but this has not adequately translated into expenditures on high value commodities like meat, green leafy vegetables and fruits, thereby improving diet quality of the individuals.

4.2.2 Dietary Diversity

In the preceding section, the consumption expenditure analysis indicates that dietary patterns have changed to some extent even though cereals continue to dominate the food basket. Has this affected and improved the nutritional status of the members of the household, especially women and children? Two measures of nutritional status namely - BMI (for adults) and stunting and wasting (for children under 5 years of age) using anthropometric data) and Dietary Diversity Scores are analysed in this paper to understand the changes in the nutritional status.

Dietary diversity is now well recognised as an important dimension of dietary quality (Global Nutrition Report, 2015). The Dietary Diversity Score is the count of the number of food groups consumed over 24 hours, and this reflects the micronutrient density of infant/young child diets as well as micronutrient adequacy for women of reproductive age (Global Nutrition Report, 2015). In this paper, IDDS and WDDS is used as a predictor of the nutritional status of the individuals (see table 5 for classification of food groups for the calculation of the scores). While the individual dietary diversity score (IDDS and WDDS) is used as a proxy measure of the nutritional quality of an individual's diet, the Household Dietary Diversity Score (HDDS) is used as a proxy measure of the socio-economic level of the household.

A comparison of the dietary diversity scores following the FAO guidelines (Kennedy et.al, 2008) reveals that majority of the women have a medium level of diversity in their diets, indicating that they now consume food from about 4-5 food groups (Figure 21). This reflects the presence of micro-nutrient content in the diet. However, it also noted that about 50% of the women also are either under-nourished or over nourished. This implies that even though more number of food groups consumed, the diets are still largely depending on starchy staples and cereals and are lacking in the micro-nutrients due to small quantities of food taken from the other food groups. Cereals – especially rice and wheat form a bulk of the diet, are available at a subsidized price to the households and also are easy to cook and store.

An analysis of the dietary diversity scores of children (figure 22) indicates that the diet quality of children is better compared to mothers and on an average 40% of the children – boys and girls – have a high level of diversity in their diets. When compared with the incidences of stunting and underweight in children, this clearly reflects that though the diet quality is better, the quantities of food consumed may not be sufficient to show improvements in their nutritional status. Also stunting is a reflection of chronic condition.

4.2.3 BMI in adults in the three regions

There is now a recent research in the context of gender, nutrition and health in India which is drawing lot of interest and attention. It is the co-existence of population on the two ends of the nutrition continuum – under nutrition on one hand and over nutrition on the other hand, which is also referred to as the ‘double burden of nutrition’ (Griffiths and Bentley 2001, Subramanian et al. 2009, and Corsi et al. 2011, Kulkarni et.al, 2014, among others). India has one of the highest underweight burdens in the world (42%) now exhibiting rising obesity and over weight trends gradually and steadily increasing. While undernutrition – albeit declining – remains a concern, there is a new apprehension as reflected in the rising rates of overweight and obesity especially among women in the age groups of 18-49 years. While underweight presents challenges like protein-calorie malnutrition, low birth weight of children, stunting and wasting, overweight and obesity present different challenges related to the incidence of lifestyle disorders and chronic diseases, such as cardiovascular disease and diabetes.

Angan () in their assessments of the possible existence of the double burden of malnutrition in Indian society using NFHS-2 and NFHS-3 data conclude that in India, around half of the women are malnourished as the underweight problem seems to cut across all social and economic categories, whereas, the overweight/obesity problem seems to be more of a problem of wealthier, urban Women, however a trickling down of this phenomenon to the rural areas is also observed. Kulkarni et.al (2014) in a similar analysis of the IHDS data hypothesize that this finding may also hold true for rural women.

The micro-level long term- panel data from VDSA panel confirms the hypothesis that indeed rural women (and men too) are experiencing a double burden of malnutrition. The results (Figures 23 and 24) show that in the Telangana and Maharashtra villages, the heartland of semi-arid tropics of India, underweight in women declined by about 50% from 1976/77 to 2013/14; however there has been observed tendencies towards overweight in women starting 2005 onwards, the proportion of women suffering from either form of nutritional ill-being is equal to that of women with normal BMI values in the study samples.

Table 6 indicates that the factors underlying this burden. It is seen that there is a socio-economic patterning of underweight and overweight women. Adolescent girls are more undernourished (65%)

and elderly women show tendencies toward overweight (about 14-25 percentage). There is a concentration of underweight women among those with a low and medium socio-economic status and of overweight women among high socio-economic status. Social groups also tend to be a factor influencing nutritional status. About 58% of women belonging to forward caste were normal nutritional status while women from scheduled caste and tribe tended to be more overweight (55%) As can be seen from Figure 25, underweight and overweight are present across class, caste and age categories.

Stunting, wasting and underweight in children in the three regions

A comparison of the nutritional status of children under five years of age across the three regions indicates that the percentage of children who are stunted are more in Akola region compared to the drought prone and the region with canal irrigation (Figure 26). Figure 27 presents an illustration of the different forms of malnutrition in children – wasting, stunting and underweight – in the three regions. Among the children who are malnourished, it can be seen that the prevalence of wasting is lowest in all the study sites, which indicates that children do not experience sudden or severe lack of food. This could be due to the availability, accessibility and affordability of food by the households as a result of two government programs – Public Distribution System (PDS) and mid-day meal /anganwadi feeding program. These two program ensures that hunger is no longer a concern in the rural areas. From the conversations of mother and Focus Group Discussion, it could be understood that the determinants of stunting and underweight (which is a combination of stunting and wasting) prevalence among children are many including repeated illness, continuing for long periods by children, poor dietary intake by children and pregnant and lactating mothers, infections in expectant mothers leading to poor intra-uterine growth, as well as diarrhoeal infections due to poor/lack of hygiene and sanitation.

When the data on stunting is disaggregated by gender, it is surprising to note that boys are stunted more than girls, even though the percentage is small (Figure 28). This finding is also observed in the analysis of the NSSO data in India and many studies in sub-Saharan Africa. There are not many studies which have systematically addressed differentials of sex with respect to nutritional and health inequalities in the early childhood period, two possible explanations stem from the FGD discussions. One, could be the behaviors shown towards girl and boy children - educated mothers do not show any bias towards boy and girl children, however in many cases, boys are given weaning foods much earlier than girls and could be a source of infection. Girls are solely breastfed while boys are breastfed and also giving supplementary foods, which could be a source of infection due to poor hygiene. A second explanation or an hypothesis could be a biological explanation – many epidemiological studies depict that repeated sickness, illness and even chronic/severe sickness which could be fatal are reported in boys over girls, suggesting that boys are generally more vulnerable. These may partly explain our findings, however they are not conclusive evidences of the nutritionally advantaged position of female over male children.

On the issue of sanitation and hygiene, open defaecation is observed in all the study villages (figure 29) and this can be a cause for the undernutrition. The reasons for open defaecation despite several efforts by the Government of India, is mainly related to water scarcity in the semi-arid tropics. The non-availability of sufficient water for use at the households is a major determinant why toilets are not used by both adults and children. The findings from the qualitative surveys however have to be confirmed using statistical analysis, which is beyond the scope of this paper.

The above descriptive analysis indicates there is now a need in India to focus on this co-existence of both under and over nutrition and appropriate program and policies to tackle this issue are needed. Food-based programs may have to be modified and implemented more rigorously. Health and medical needs have to also be considered to tackle this – overweight and obese people and severely undernourished people. It is hence important from a health policy perspective to understand better the reasons underlying the prevalence of underweight and obesity among women and why the latter is likely to rise. Behaviour change communications and campaigns has to become an integral part of the effort to minimise these effects. Healthy eating patterns, the importance of the various nutrients in the diet, and the role of good hygiene and sanitation in the promotion of good nutrition especially for women and children is very much the need of the hour.

Statistical analysis – ANOVA and two state least square regression analysis

As can be seen from table 7, leisure time is the only category of activity which is significant across different levels of education and even between the rounds. This finding confirm the descriptive analysis that women view leisure differently than men, and even among women, it changes with some socio-economic variables, here in this case education. Income does not contribute to significant difference among and between groups but education seems to paly a role in the time use patterns of women. Time spent on productive work – farm, including livestock and non-farm varies significantly between the rounds - high intensity agricultural work, medium intensity, and low intensity, but there is no significant difference by education levels of women.

From the two stage least square estimation parameter estimates (table 8) it can be validated that there is no positive linkage between women nutritional status (BMI) and time allocation on agriculture work and other productive activities. Other variables such as women age, caste, marital status, and education also affect the changes in nutritional status of women.

5. Conclusions

The descriptive analysis brings out several findings related to women's work and their overall time use, including care giving activities. Women are equally engaged in productive work, reproductive work and resting. The reproductive activities which are in the form of unpaid labor on their own homes and these activities tend to not be accounted for, even by women themselves. Family and personal care is all taken together as time spent only for child care is difficult to account for by the women themselves. Women are engaged in the care of not just the children but also other members of the family like the elderly and the sick. Also sometimes there are multiple child care providers and women also multi-task child care with their other activities, a finding which is very similar to Jain () in Bangladesh. This micro-level insights indicate that women do not reduce their time in cooking and household chores even there is high demands on their time due to the agricultural intensity. Instead they cut down their time on other activities which can be substituted by other members of the household and family.

Social groups and income does have an influence on the way women spend their time, including the leisure time. Time spent by women outside the home either for paid work or unpaid work does not affect the food consumption of themselves and their children. In some ways it improves the diversity in the diet as they now are more aware of their eating patterns and habits. The insights from the field do not support the hypothesis put forward by literature, that the child care practices and or dietary quality are constrained by the time women spend on preparing food or their overall work outside home.

This paper also brings out evidence that in fact India – including rural India is also facing with the double burden of nutrition. This is because of the continued dependence of starchy cereals and staples to meet their energy, protein and micro-nutrient needs. Diets have to become more diverse both in terms of quality and quantity; decreasing the consumption of carbohydrate rich foods but increasing the consumption of protein and micro-nutrient rich foods. These includes high value commodities like green leafy vegetables, fruits, other vegetables, milk, meat and other livestock products. Health sector also needs to be cognizant of this fact and thus respond to the problems associated with both under-nutrition and over weight.

Good sanitation is important for the absorption of nutrients by the body. A behaviour change campaign and education is the need of the hour to bring about this awareness of healthy eating and good sanitation practices. Government programs and policies should target the provision of nutrient-rich cereals through the PDS as well as provide incentives to grow such crops like sorghum, millets, legumes. Empowering women by giving them more information as well as control over household income will enable women to make the decisions for efficient time use, food consumption, sanitation and healthy practices.

The sociological analysis clearly points out that men and women have varied time use patterns and burdens. Time matters, especially for women who are involved in agriculture and also are the care economy of the household, and these include the poor women, women who are in child bearing age and the vulnerable. Ultimately, the paper concludes that time commitments – either increased or reduced – has a complex impact on the nutritional outcomes of women and children. The varied outcomes necessitate different sets of policies and innovative approaches to leverage agriculture for nutrition from a gender-responsive perspective.

6. Acknowledgements

7. References

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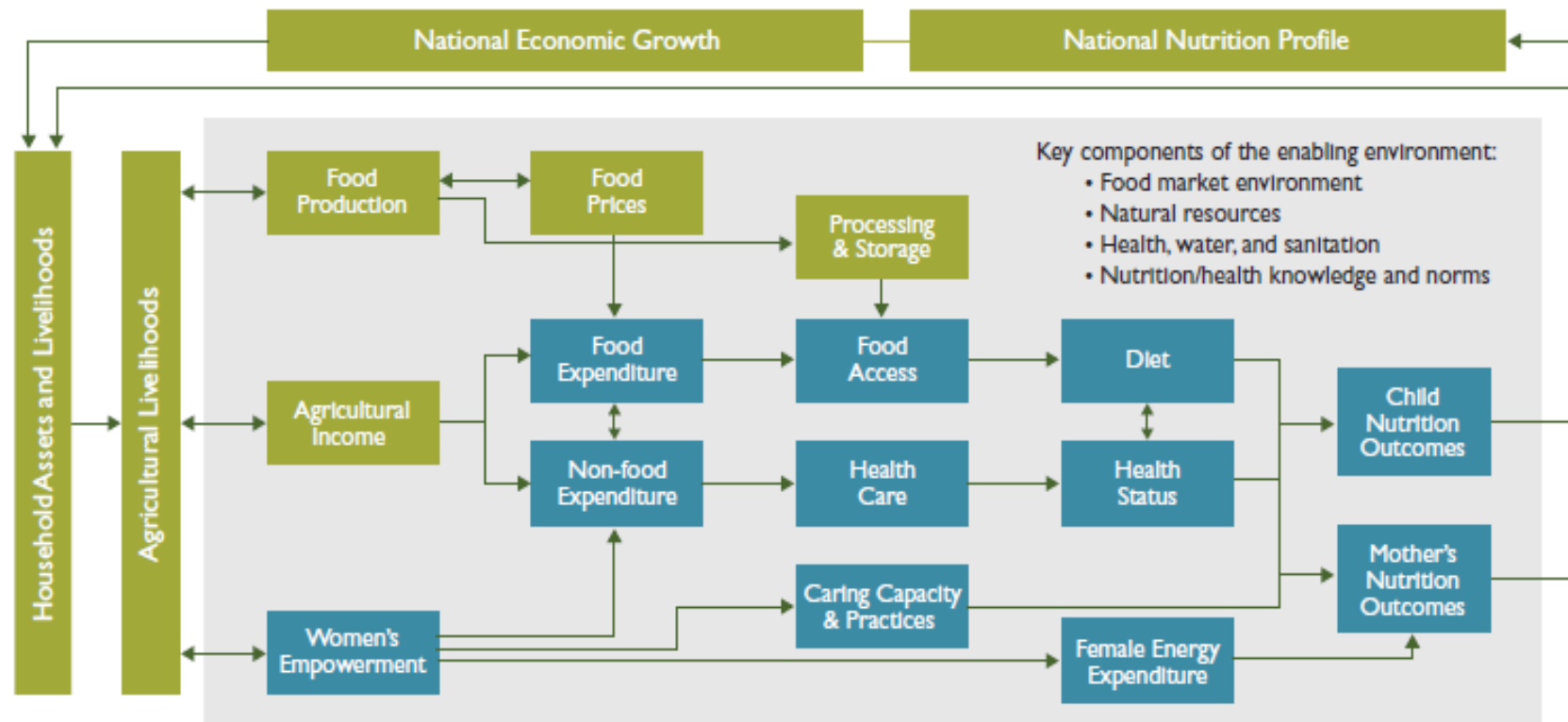
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8. Figures and tables

Figures 1- 29

Figure 2. Theory of Change linking agriculture, time use and nutritional outcomes

Figure 1. Linking agriculture and nutrition via the women's empowerment pathway

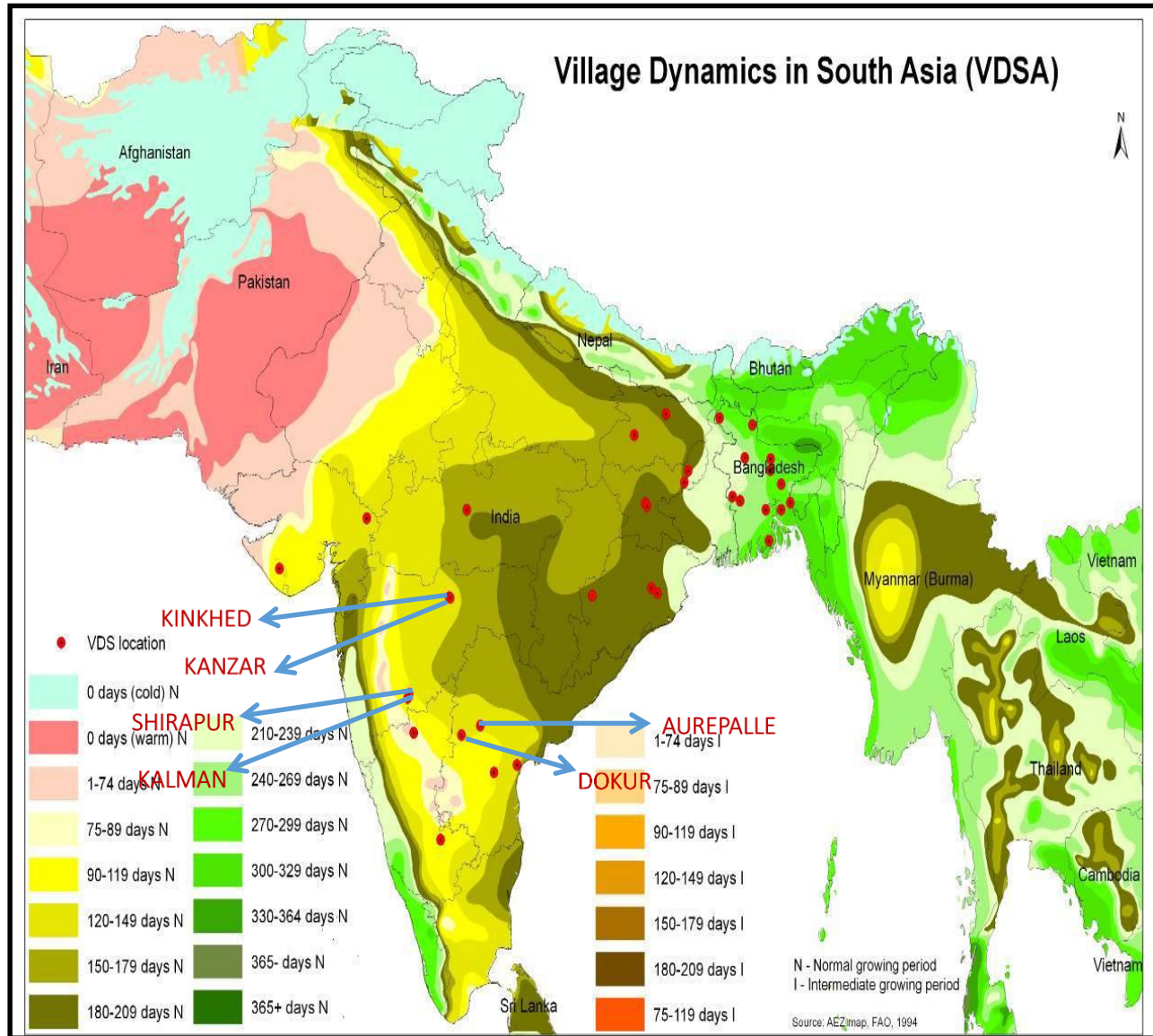


Women's Empowerment Pathway is highlighted in blue
 Source: Herforth and Harris, 2014.

Source: Spring, 2014

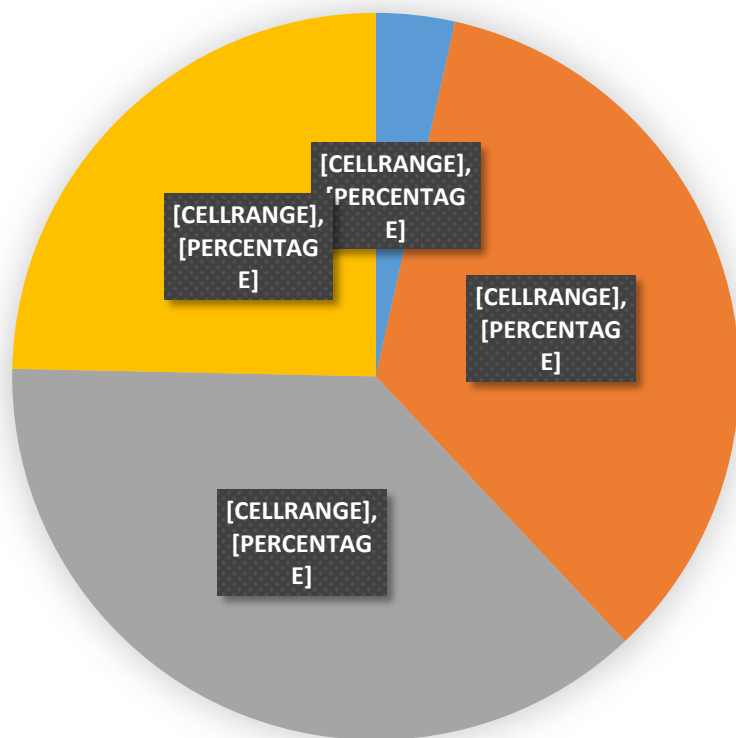
Source: Johnston et.al, 2015

Figure 3. Location of the study villages



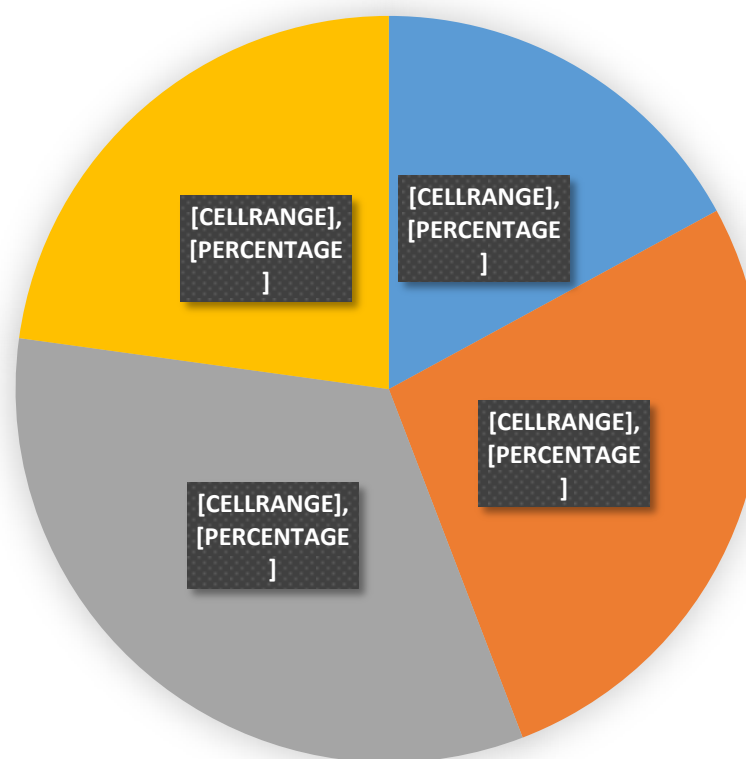
Source: ICRISAT VDSA 2009-2015

Figure 4a. Time use of men in the selected villages of the semi-arid tropics, India, 2013-14



- HH chores
- Farm and non-farm work
- Leisure, sleeping, resting
- others

Figure 4b. Time use of women in the selected villages of the semi-arid tropics, India, 2013-14



- HH chores
- Farm and non-farm work
- Leisure, sleeping, resting
- others

Figure 5. Time use patterns of women and men in the semi-arid tropics of India, 2013-2014

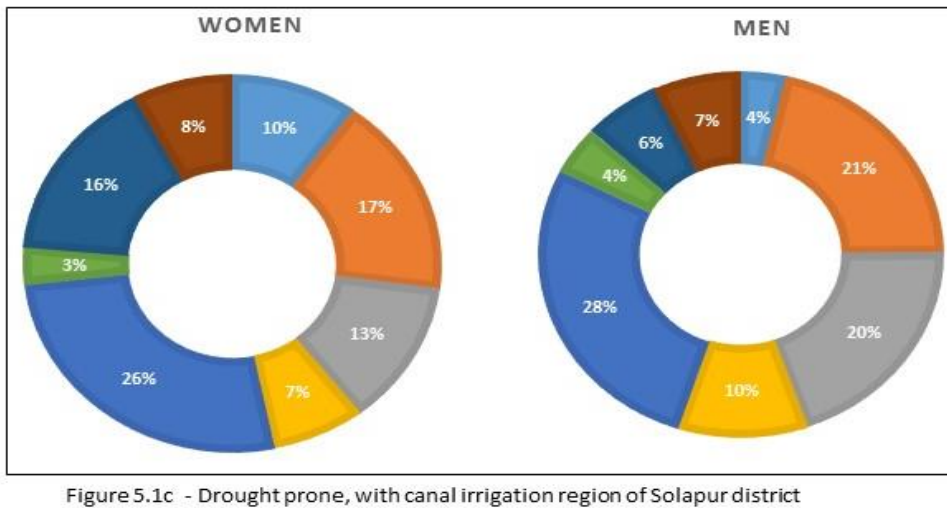
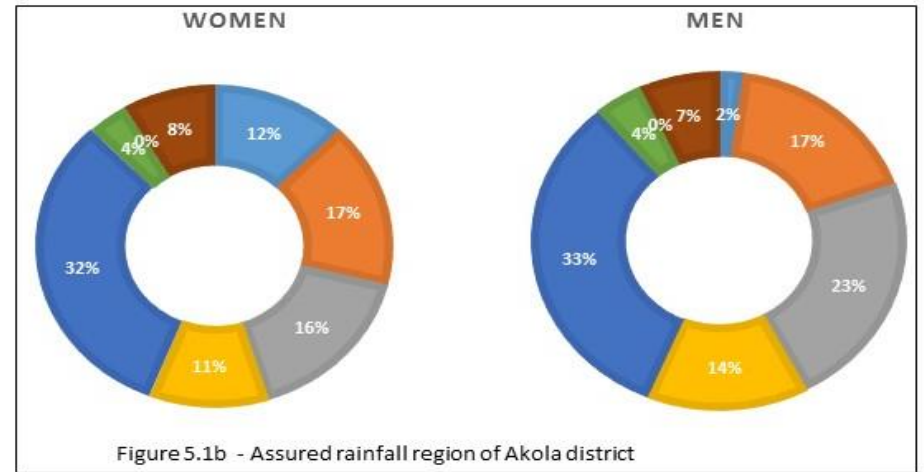
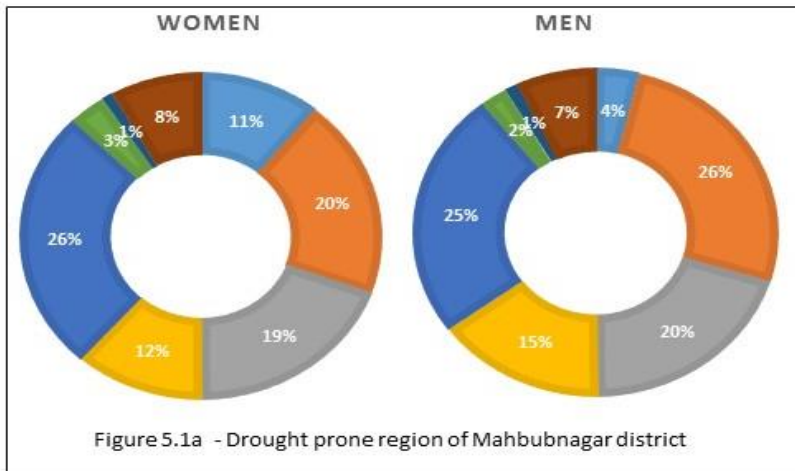


Figure 6. Time use patterns of women between the ages 18-49 years, India, 2013-2014

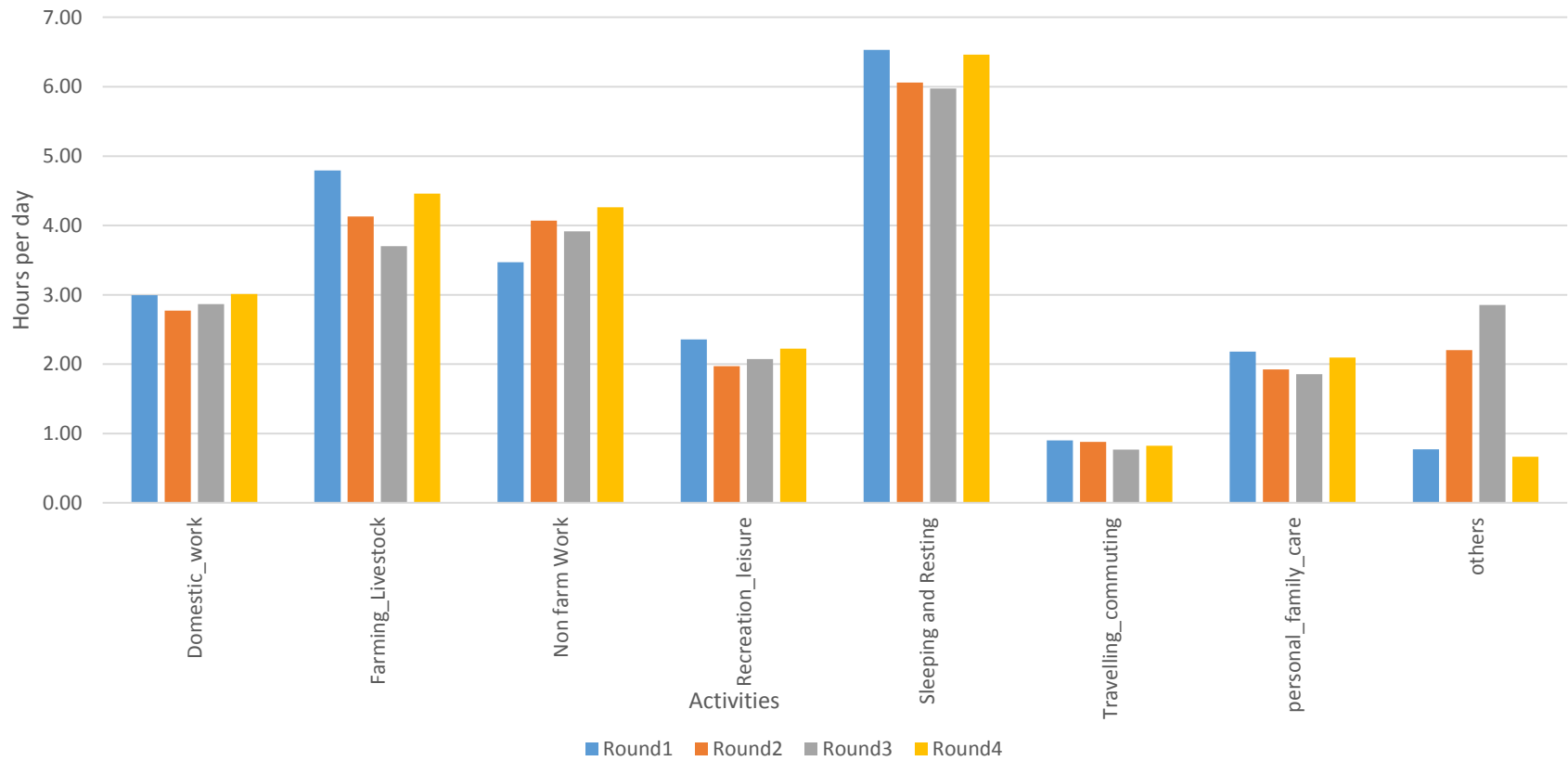


Figure 7. Time spent by women on household chores, family care and leisure, by education, 2013-2014

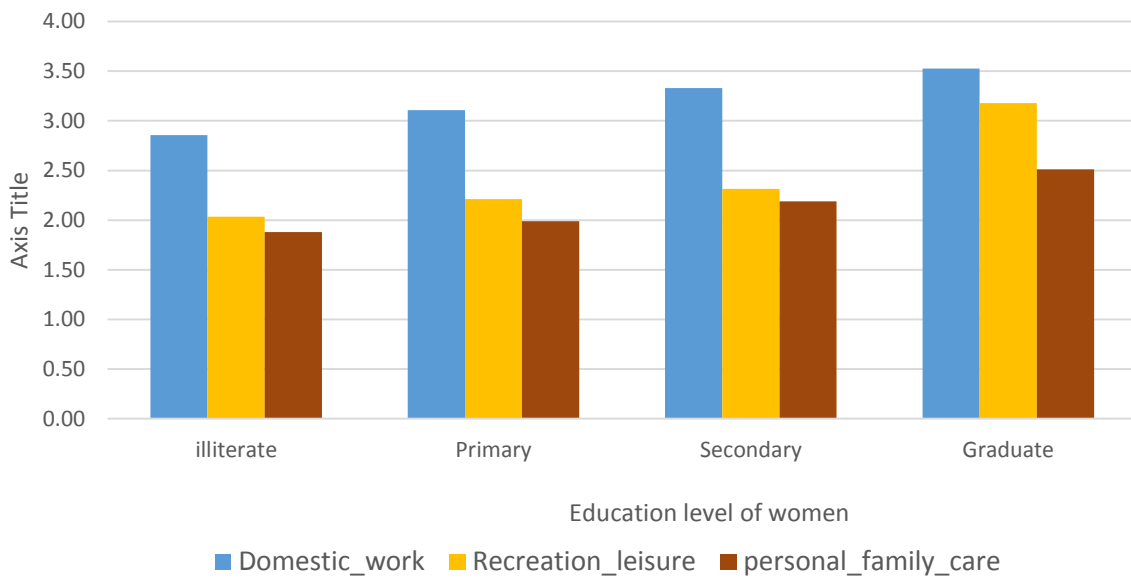


Figure 8. Difference in time spent by women, by income status, 2013-2014

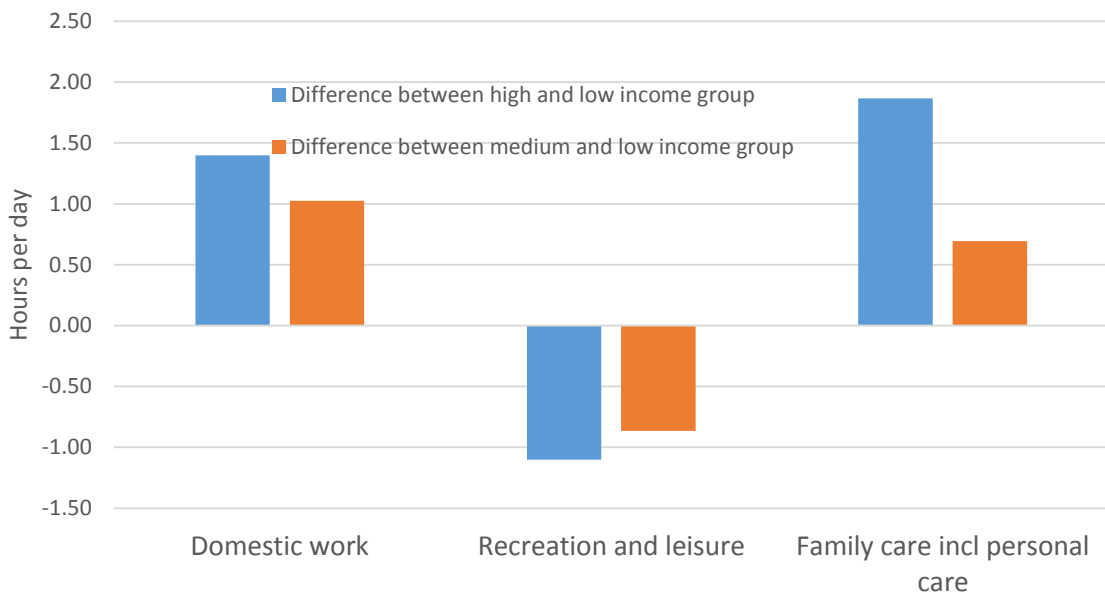


Figure 9. Time use patterns of women, by farm size categories, 2013-2014

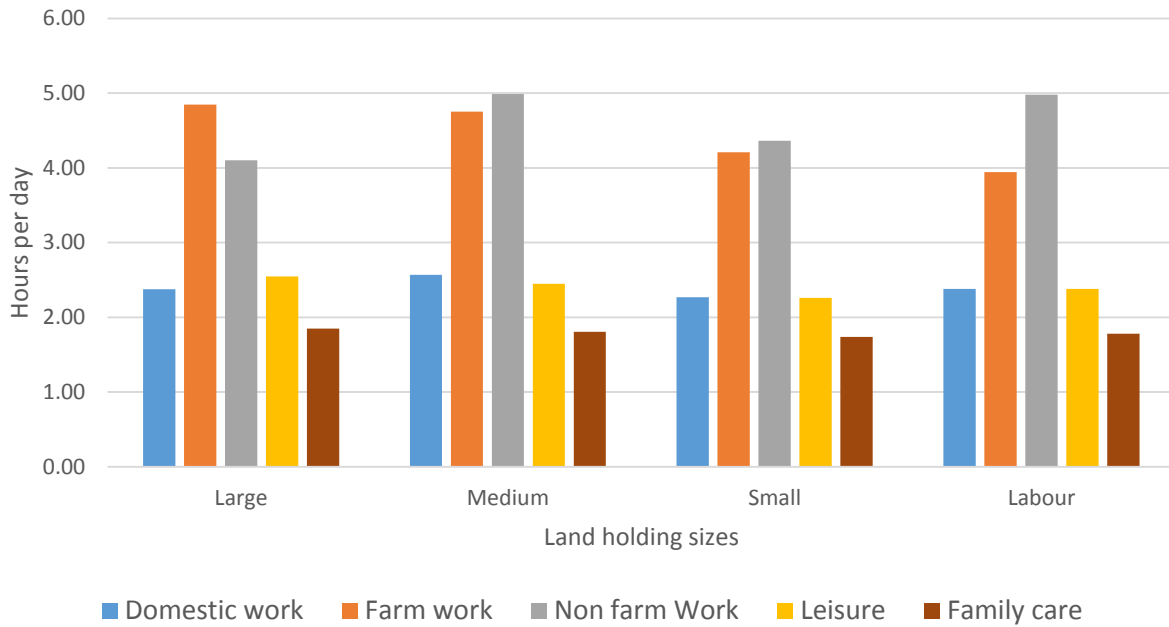


Figure 10. Differences in time use by women from different caste (social) groups, 2013-14

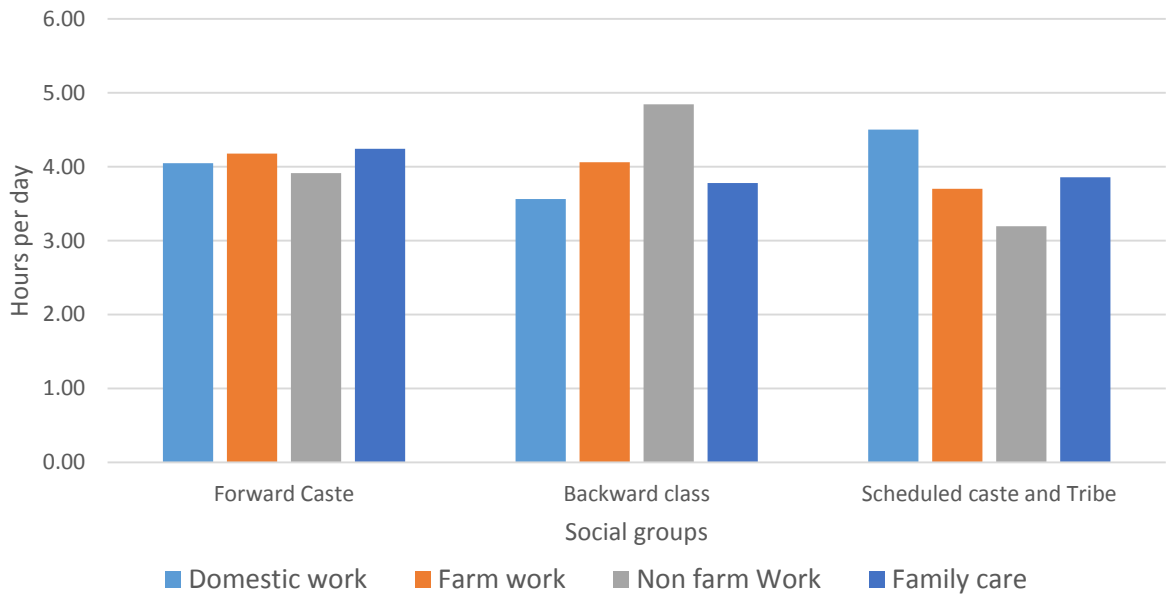


Figure 11. Time allocation of Women and Men in Aurepalle village 1975-2010

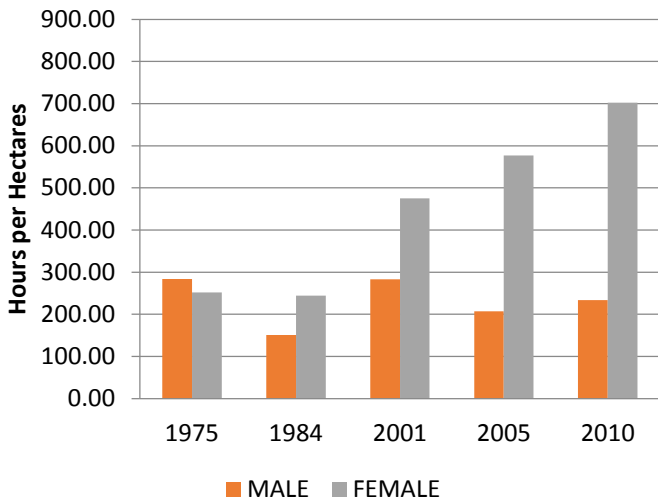


Figure 12. Percentage area to total for major crops, Aurepalle, 1975-2010

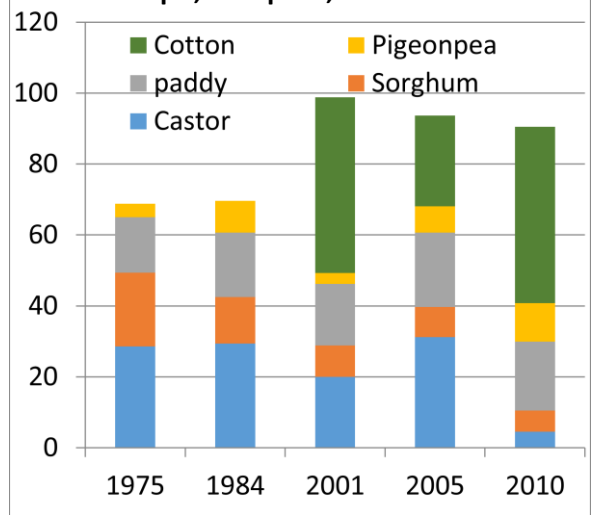


Figure 13. Time allocation of women and men Dokur, 1975-2010

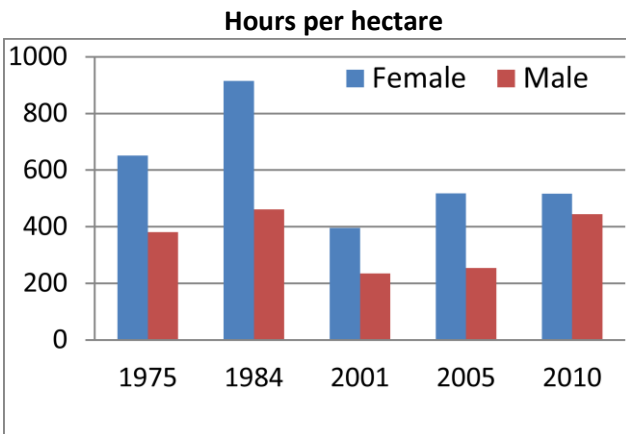
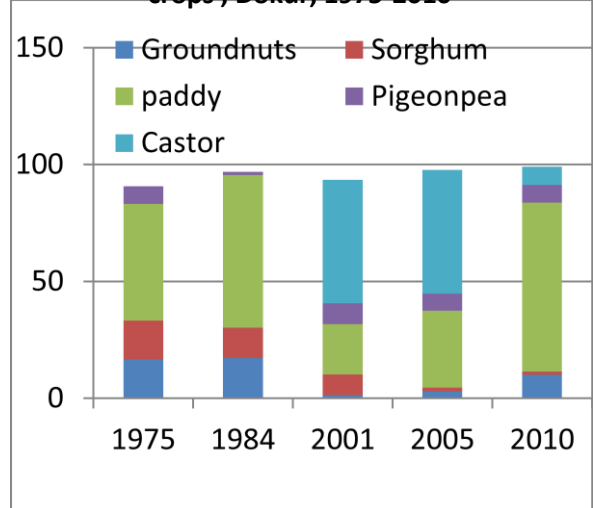


Figure 14. Percentage area to total for major crops, Dokur, 1975-2010



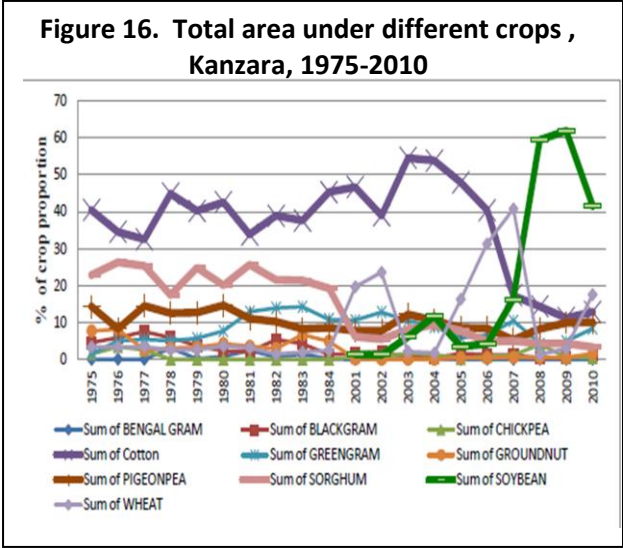
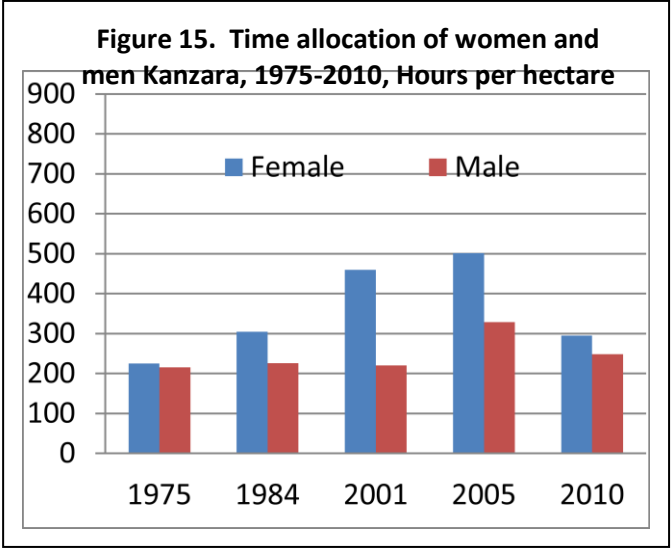


Figure 17. Operation wise labor participation, selected SAT villages 1975-2014

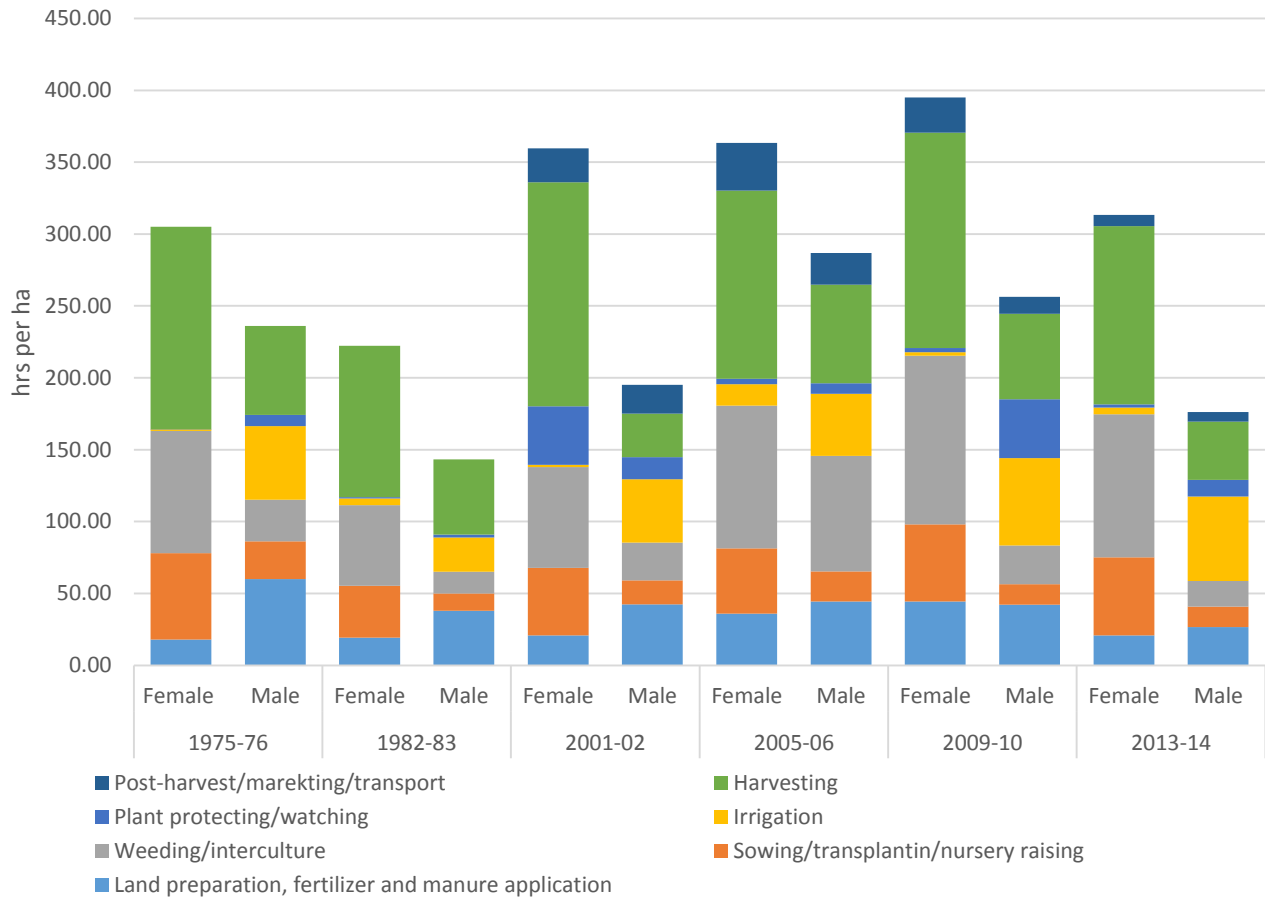


Figure 18a. Agricultural operations performed by women, SAT villages, 1975-2014

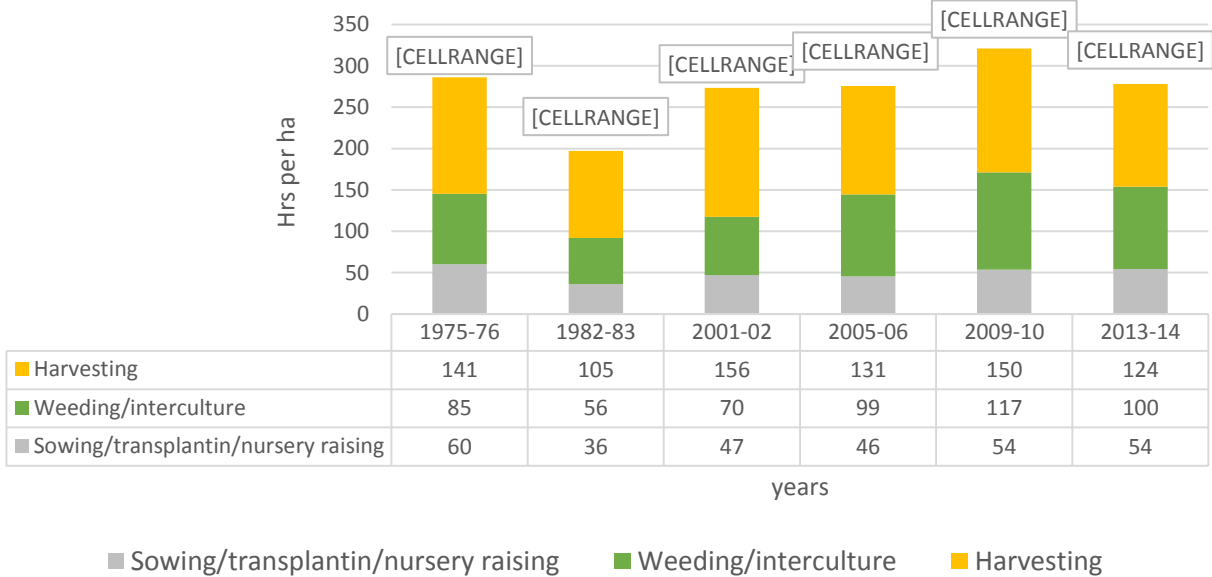


Figure 18b. Agricultural operations performed by men, SAT villages, 1975-2014

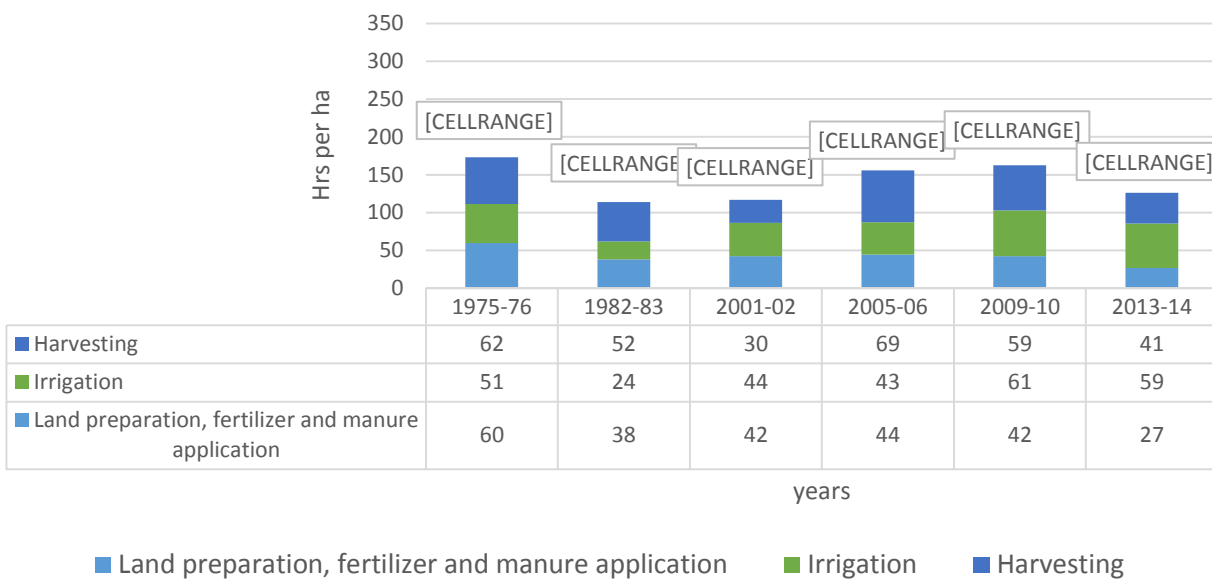


Figure 19a. Labor use by operation and type of labor, Aurepalle village, Mahbubnagar district, 1975-2014

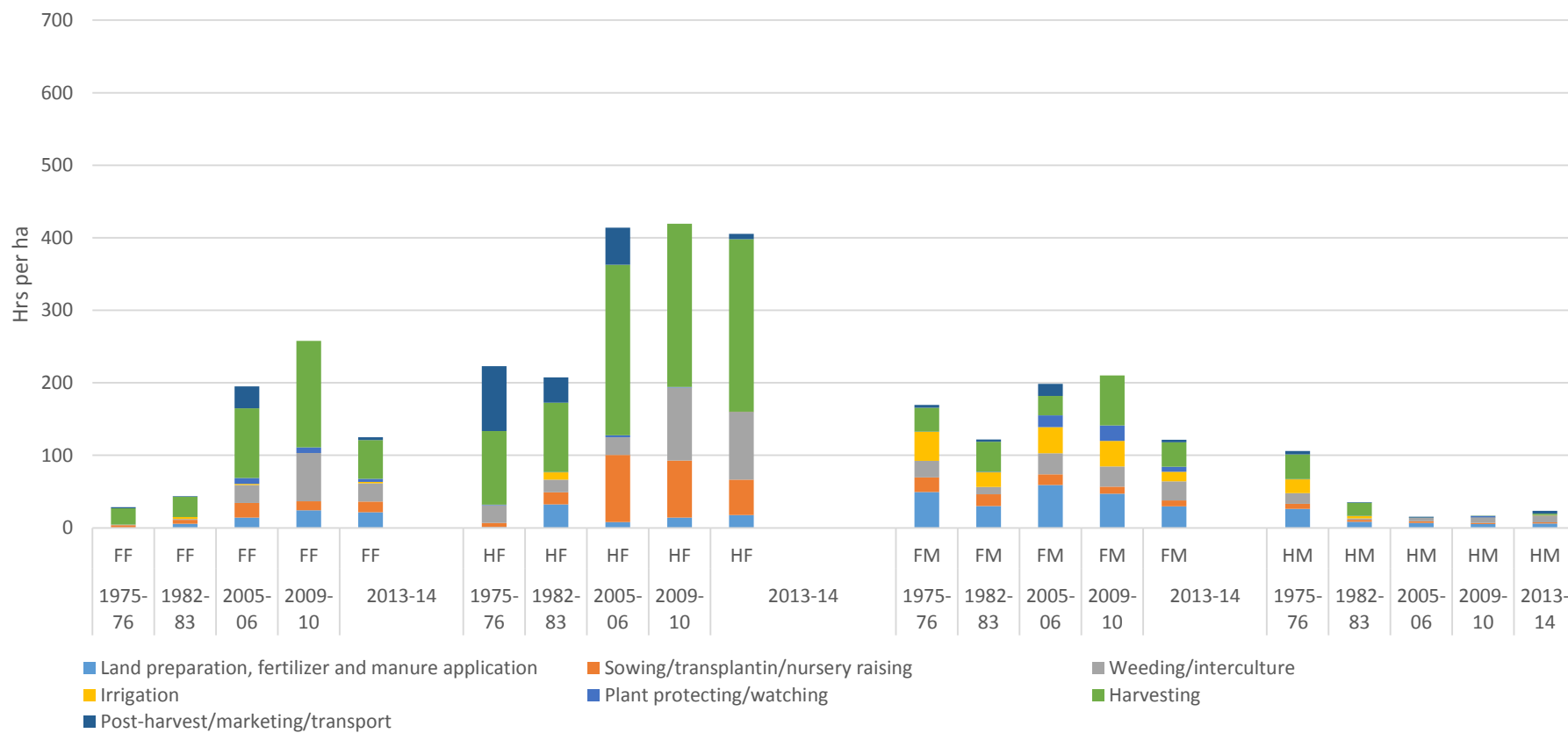


Figure 19b. Labor use by operation and type of labor, Dokur village, Mahbubnagar district, 1975-2014

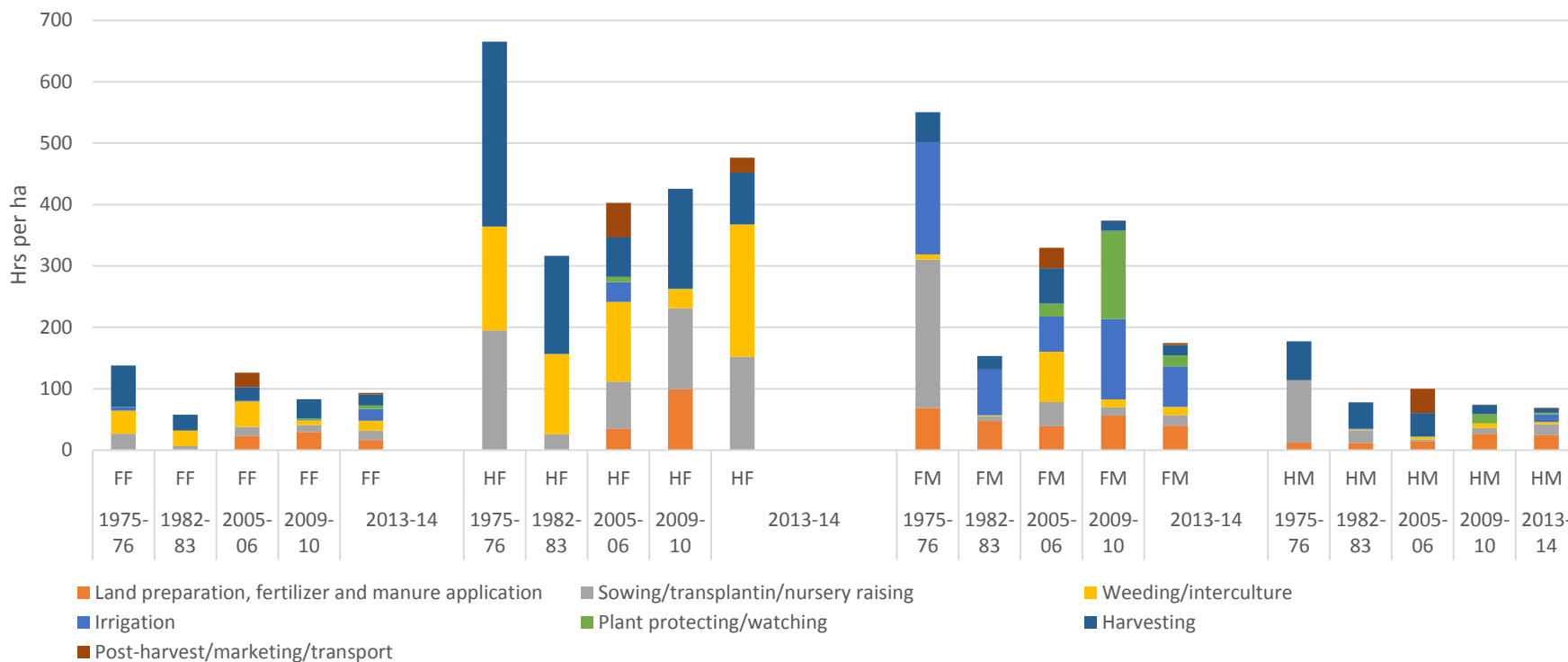


Figure 19c. Labor use by operation and type of labor, Kanzara village, Akola district, 1975-2014

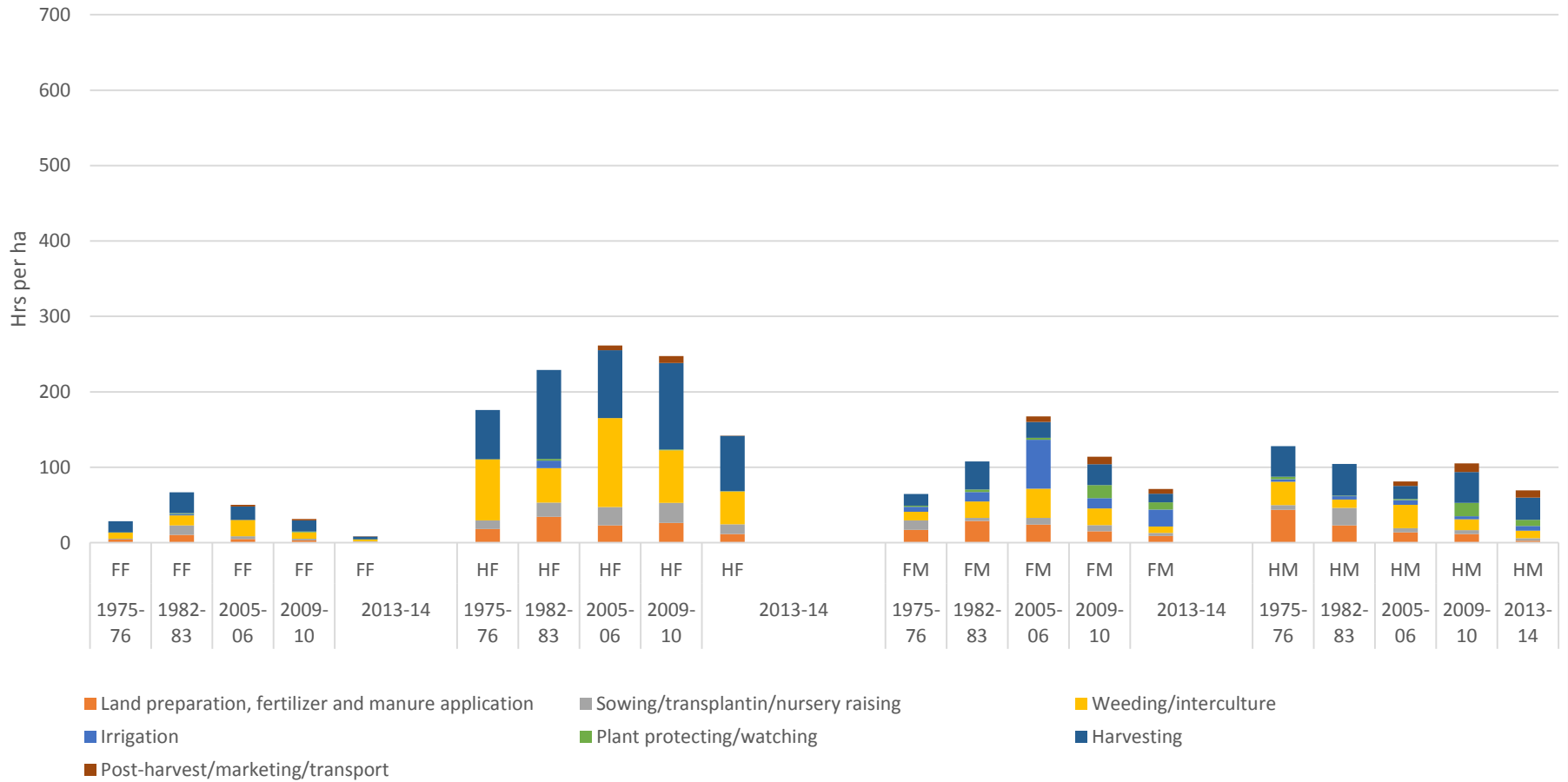


Figure 19d. Labor use by operation and type of labor, Kinkheda village, Akola district, 1975-2014

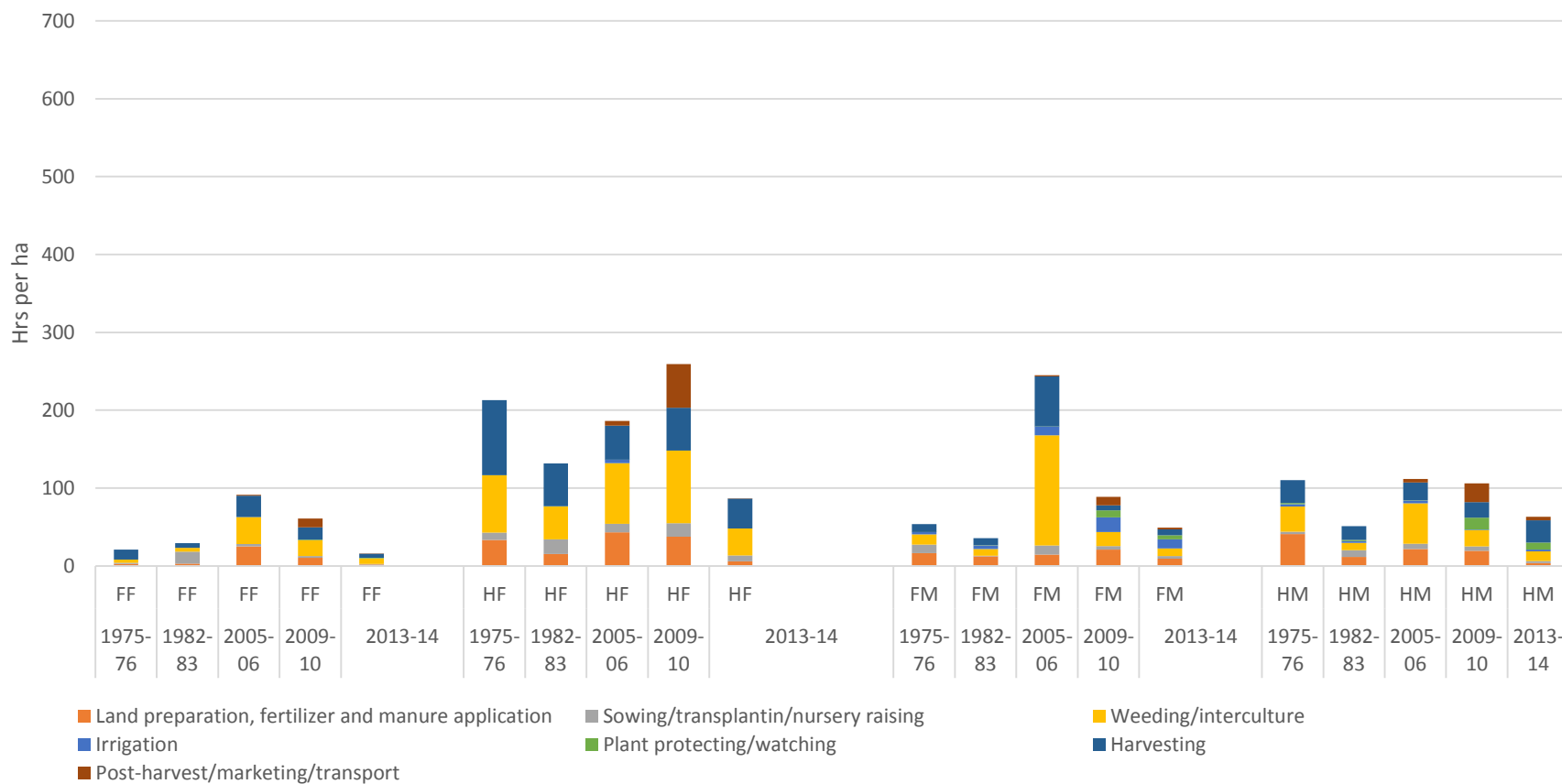


Figure 19e. Labor use by operation and type of labor, Kalman village, Solapur district, 1975-2014

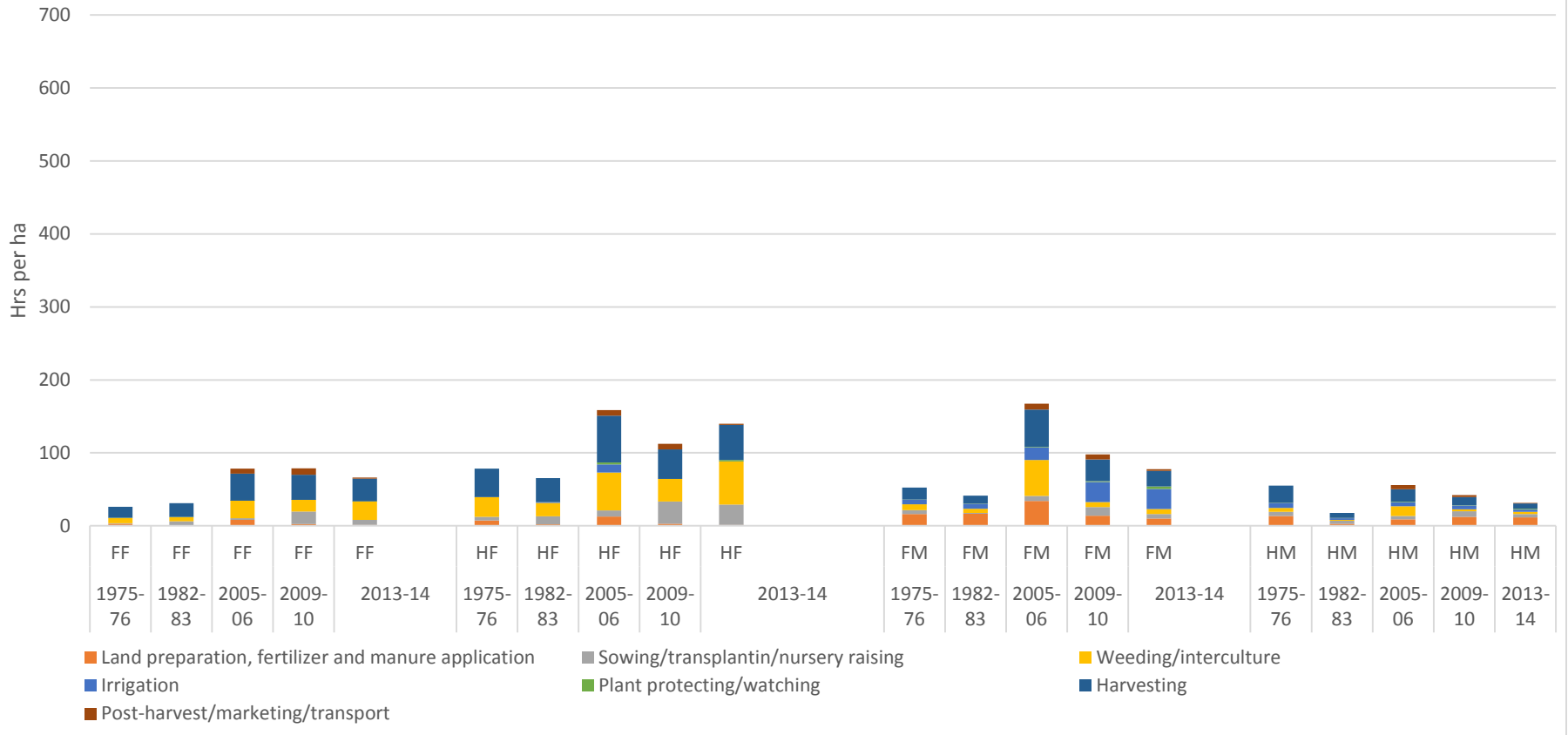


Figure 19f. Labor use by operation and type of labor, Shirapur village, Solapur district, 1975-2014

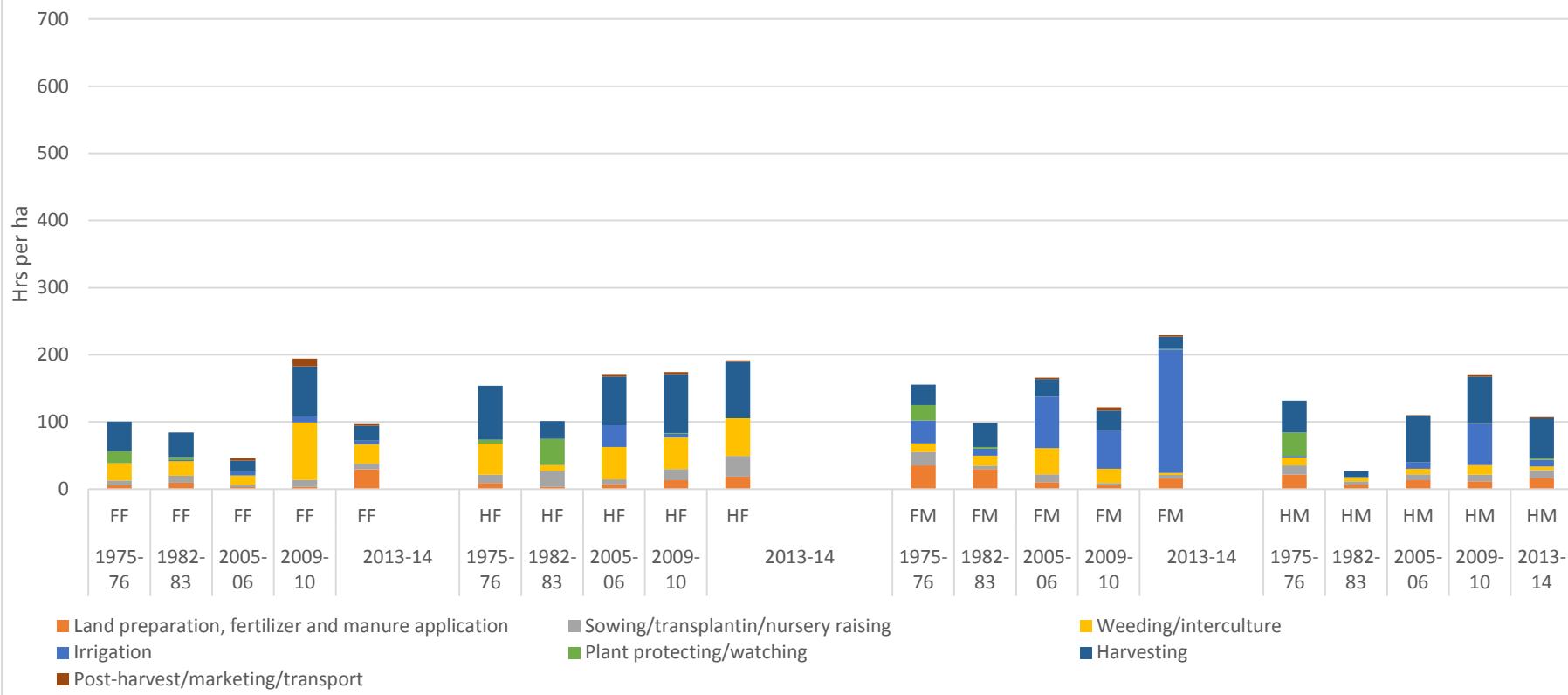


Figure 20. Average dietary composition in selected districts, 1975-2013 (using consumption expenditure data)

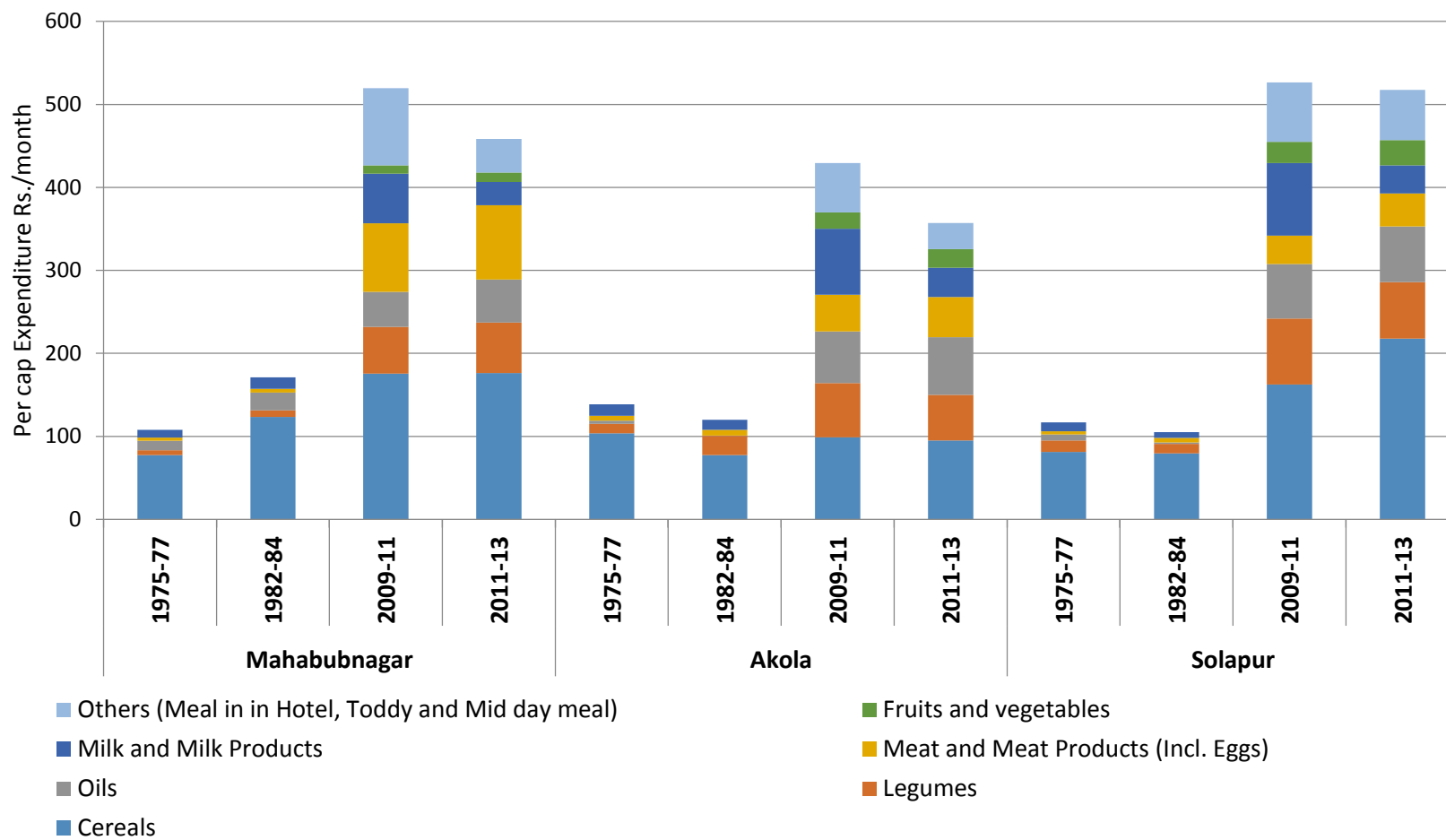


Figure 21. Dietary diversity scores of women 18-49 years age, selected villages of Mahbubnagar, Akola and Solapur districts, 2013-14

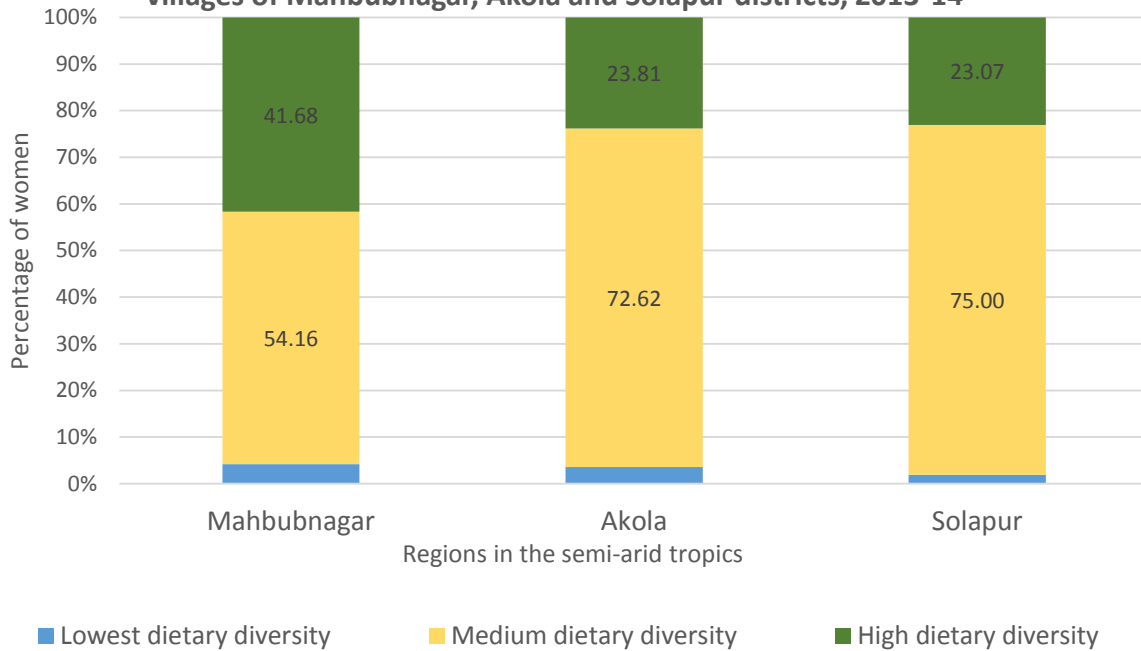


Figure 22. Dietary diversity pattern of children (under five years of age) from selected villages of Mahbubnagar, Solapur and Akola districts 2013-2014

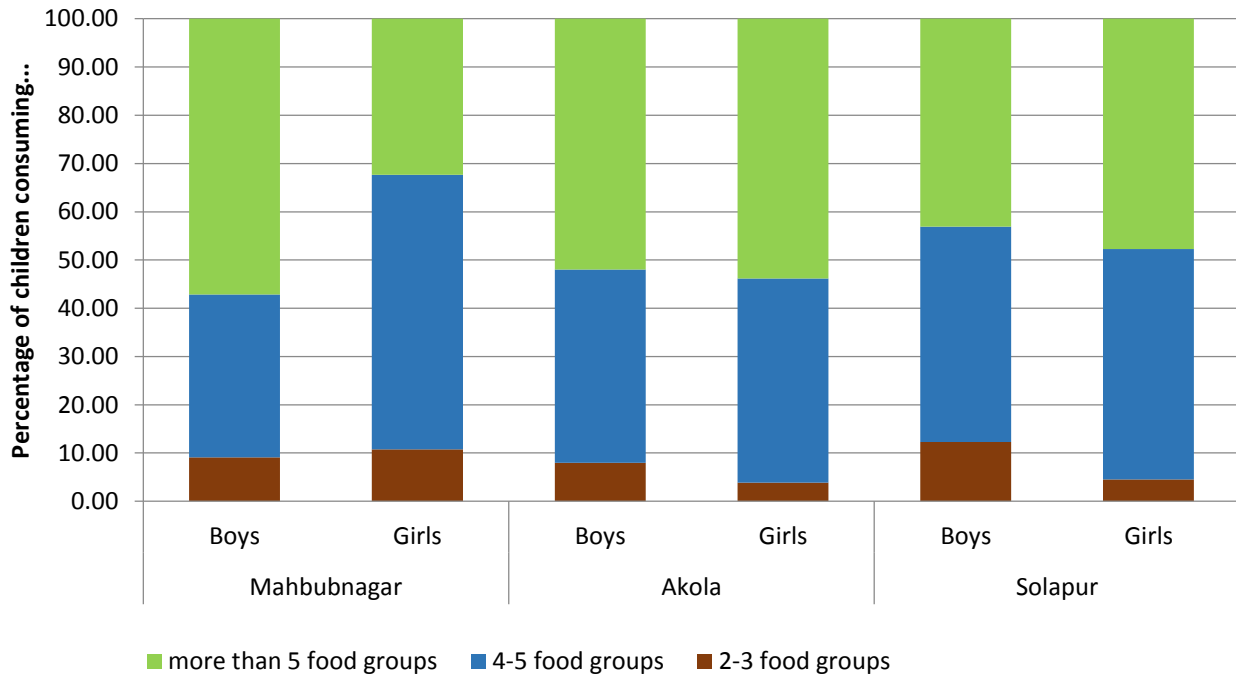


Figure 23. Nutritional status of men and women using BMI as an indicator, Mahbubnagar villages, Telangana, 1976-2013

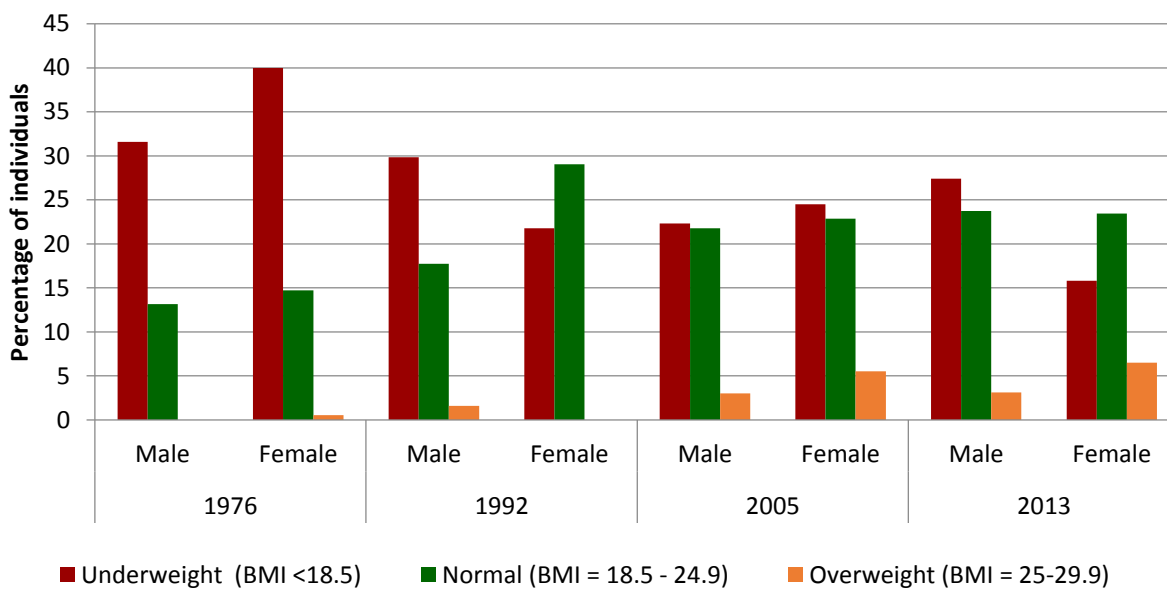


Figure 24. Nutritional status of men and women using BMI as an indicator, Solapur and Akola villages, Maharashtra, 1976-2013

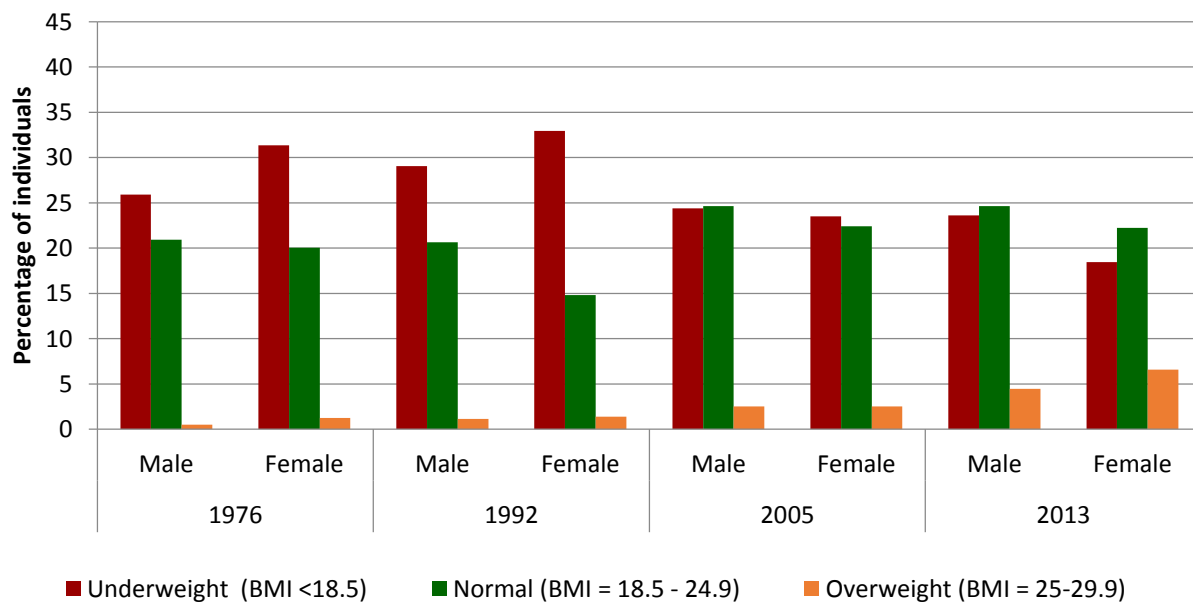


Figure 25. Nutritional status of women by different socio-economic variables, selected villages in Mahbubnagar, Akola and Solapur districts, 2013-14

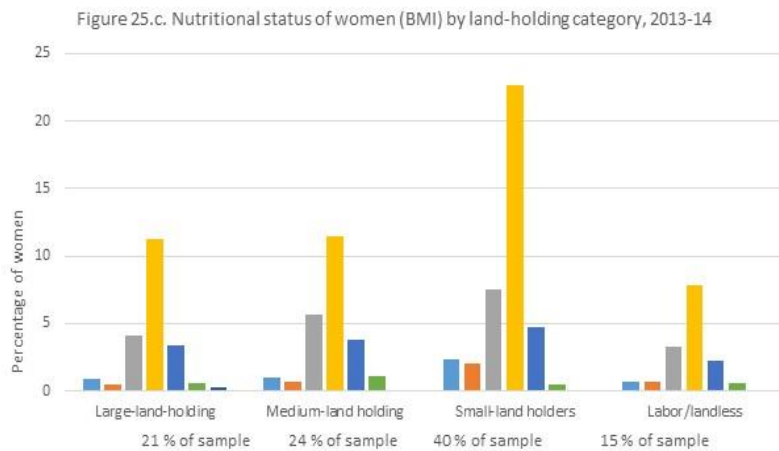
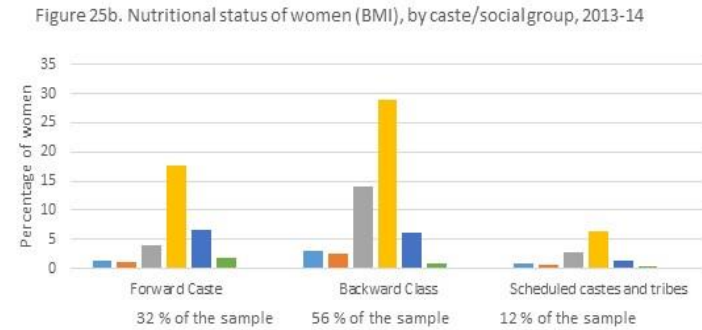
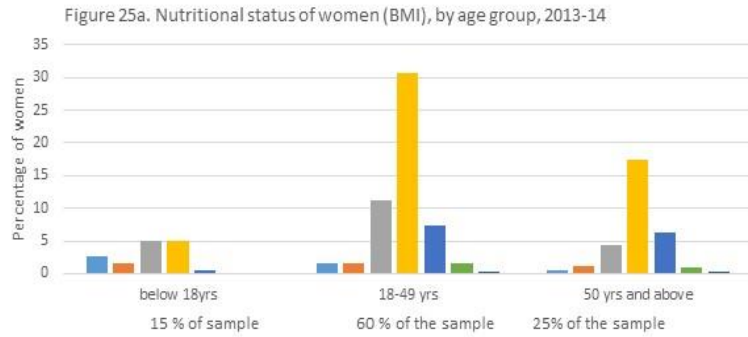


Figure 26. Nutritional status of children under five years of age using Height for age (stunting) indicator, 2013-2014

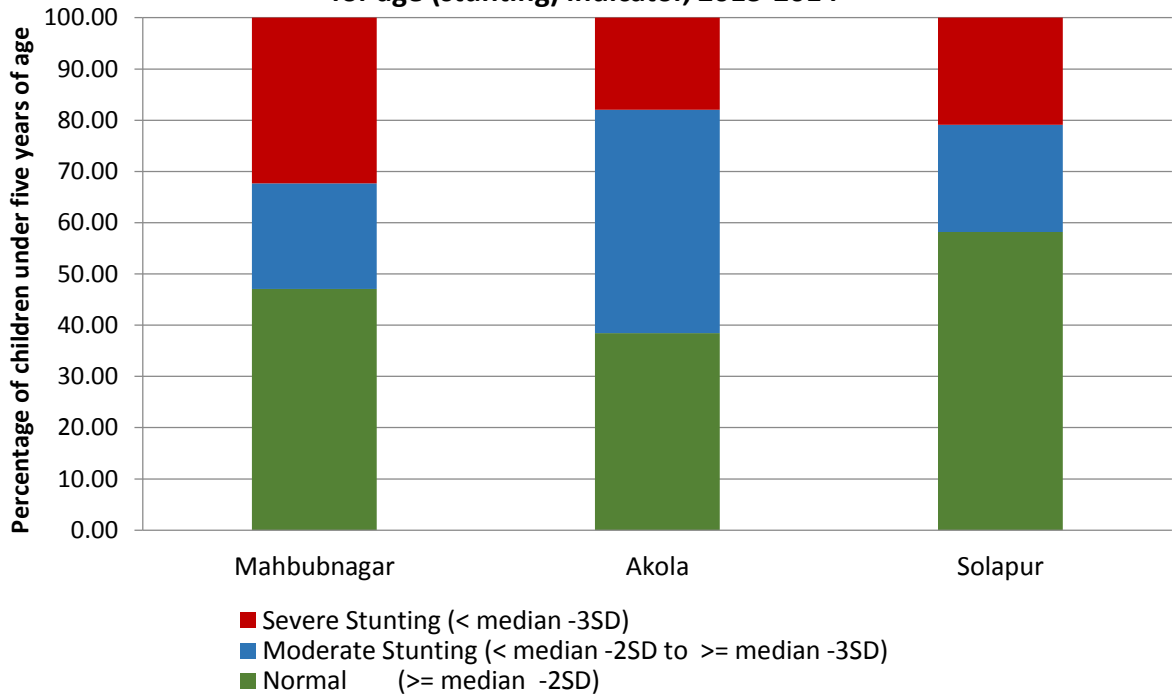


Figure 27. Prevalence of undernutrition in children under five years of age, 2013-2014

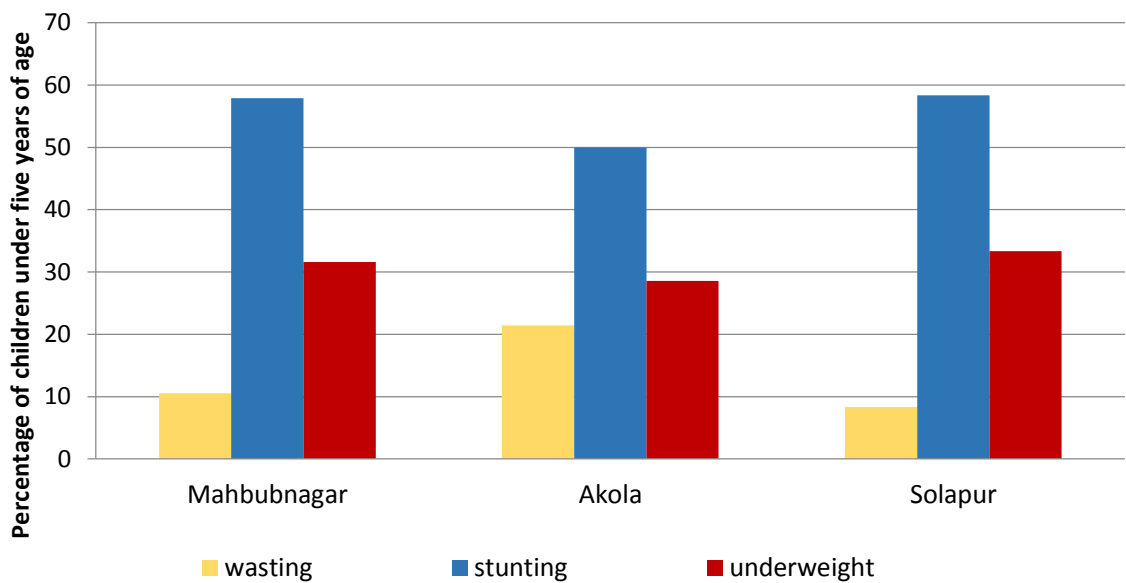


Figure 28. Nutritional status of children by stunting indicator, all villages, 2013-14

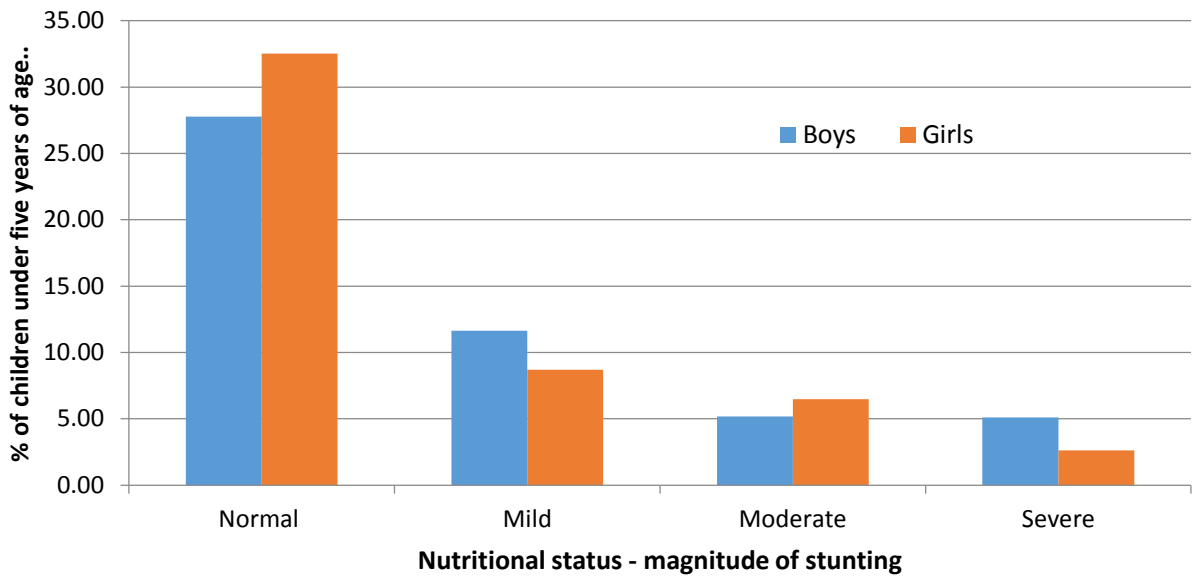
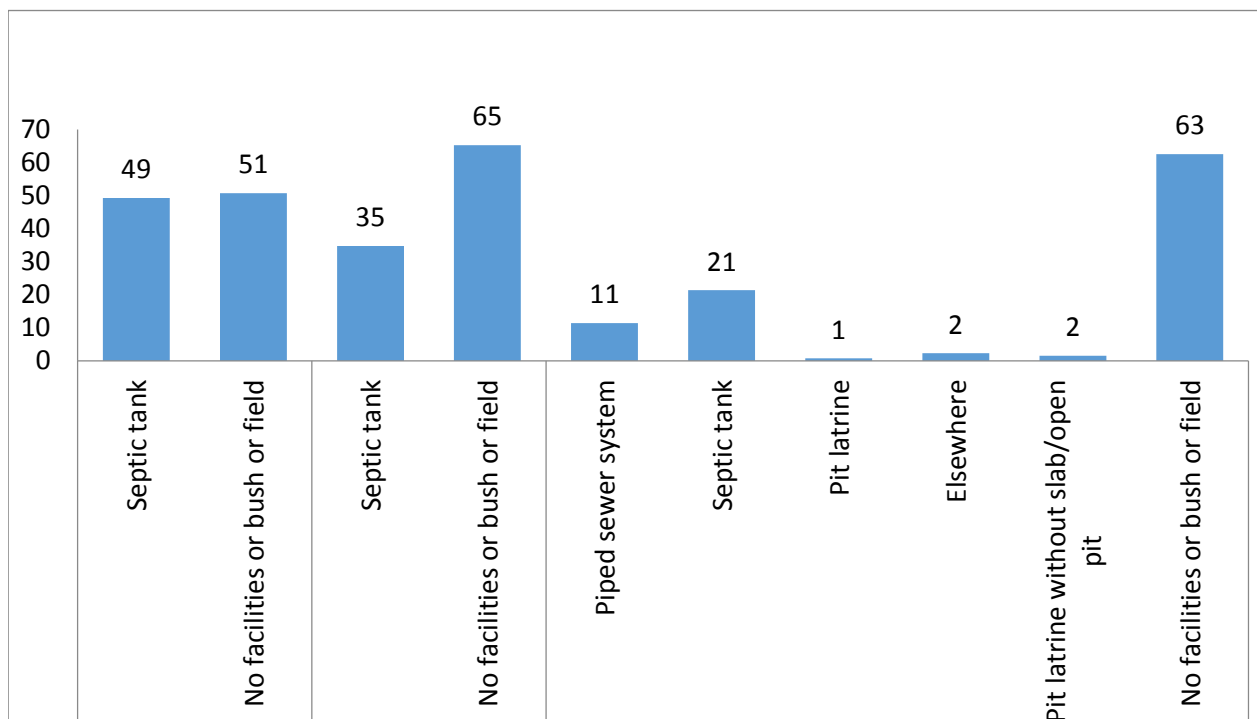


Figure 29. Use of sanitation facilities in the selected villages of the semi-arid tropics, 2013-14



Tables 1- 8

Table 1. Sample size in the study villages, 1975-2014 (the numbers given below correspond to the latest year – 2013-14)

Villages	Number of Households surveyed				
	Total	Round 1	Round 2	Round 3	Round 4
Telangana Villages	123				
Aurepalle	66	65	65	65	65
Dokur	57	56	54	52	55
Akola villages	123				
Kanzara	72	78	77	78	78
Kinkheda	51	50	50	50	49
Solapur villages	161				
Shirapur	97	94	94	94	93
Kalman	64	69	67	66	67
Grand total	407	402	407	405	407

Villages	Number of Individuals surveyed (for the nutrition and time-use indicators)						
	Total	Adult men (18 yrs and above)	Adult women (18 yrs and above)	Boys ¹	Boys ²	Girls ¹	Girls ²
Telangana Villages	452						
Aurepalle	228	89	89	6	24	5	15
Dokur	224	83	75	12	21	17	16
Akola villages	740						
Kanzara	292	112	99	12	33	9	27
Kinkheda	448	171	148	23	46	23	37
Solapur villages	737						
Shirapur	444	168	147	23	46	23	37
Kalman	293	109	108	15	31	10	20
Grand total	1929	732	666	91	201	87	152

1. Children between 0- 59 months
2. Children between 5 years to below 18 years of age

Sl.No	Region	Represented by the study villages
1	Drought prone region of Mahbubnagar	Aurepalle Dokur
2	Assured rainfall region of Akola	Kanzara Kinkhed

3	Drought prone regions of Solapur but with access to canal irrigation	Shirapur Kalman
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Table 3. Survey round information by agricultural season intensity		
Round No	Period	Agricultural season intensity
1	August to October 2013	High
2	November to January 2014	Medium
3	February to April 2014	Low
4	June to August 2014	High
There was no data collection in the month of May 2014 due to the general elections in India		

Table 4. Concept of leisure as perceived by women in the semiarid tropics of India.

Drought prone region of Mahbubnagar	Assured rainfall region of Akola	Drought prone regions of Solapur but with access to canal irrigation
<ul style="list-style-type: none"> ▪ meeting other women in the community, SHGs members and leaders and talk about the issues facing the villages, ▪ discussing about how to maintain the water taps installed at regular places in the villages, ▪ to gossip while doing sewing or embroidery on clothes for their family, ▪ to participate in social activities, religious events and functions (eg. Bathukamma festival) and ▪ to some women it also meant watching television. 	<ul style="list-style-type: none"> ▪ For the women of Akola district, where the pathway of development is through intensification of agriculture, leisure to them meant sorting, grading and storing seeds for the next crop/season (like seeds of pigeonpea which is a pulse crop). ▪ It also meant informal meetings and gossip with members of their own kin. Kinship networks are very strong in this region and are a major source of information for women. ▪ Community events especially religious events were also interpreted as leisure by women. 	<ul style="list-style-type: none"> ▪ Skill enhancement ▪ helping children in their school work ▪ being happy, mentally and physically relaxed and participating in social and community events ▪ Community events especially religious events were also interpreted as leisure by women.

Table 5. Classification of food groups to create Dietary Diversity Scores	
Food Groups to create the Women’s Dietary Diversity Score (WDDS)	Food Groups to create the Children’s Dietary Diversity Score (IDDS)
Starchy staples Dark green leafy vegetables Other vitamin A rich fruits and vegetables Other fruits and vegetables Organ meat Meat and fish Eggs Legumes, nuts and seeds Milk and milk products	Cereals White tubers and roots Vegetables Fruits Meat Eggs Fish and other seafood Legumes, nuts and seeds Milk and milk products Oils and fats Sweets Spices, condiments and beverages
<p>1 The starchy staples food group is a combination of Cereals and White roots and tubers.</p> <p>2 The other vitamin A rich fruit and vegetable group is a combination of vitamin A rich vegetables and tubers and vitamin A rich fruit.</p> <p>3 The other fruit and vegetable group is a combination of other fruit and other vegetables.</p> <p>4 The meat group is a combination of meat and fish</p>	

Table 6. Prevalence of underweight, normal, and overweight women by selected socio-economic characteristics, 2013-2014				
Variable	Underweight	Normal weight	Overweight	Total
Location				
Mahbubnagar	26	62	11	100
Akola	37	52	11	100
Solapur	29	55	16	100
All six villages together	31	55	14	100
Age (in years)				
Below 18 years	65	32	3	100
18-45 years	27	58	14	100
45-60 years	20	55	25	100
Above 60 years	21	65	14	100
Total	31	54	14	
Household income (latest year)				
Low	37	53	10	100
Medium	33	54	12	100
High	24	55	21	100
Total	31	54	14	100
Farm size				
Large land holding	28	55	17	100
Medium land holding	33	51	17	100
Small land holding	31	56	12	100
Labor/landless	33	52	15	100
Monthly percapita household consumption (Rs/month)				
Low expenditure	34	56	11	100
Medium expenditure	31	56	14	100
High expenditure	29	51	19	100
Total	31	54	14	100
Caste group (social groupings)				
Forward Caste (FC)	20	58	37	100
Backward Class (BC)	28	35	37	100
Scheduled caste and scheduled tribe	18	27	55	100
Source : Authors' calculation based on VDSA surveys (Special purpose surveys and Household Consumption Surveys, 1975-2013/14)				

Table 7. Anova: Time spent by women in hours and their BMI by round and education, women aged 18-49 years, semi-arid tropics study villages, 2013-2014.

	All women					Illiterate women					Upto Primary education					Higher than or equal to secondary edn				
	Rd1	Rd2	Rd3	Rd4	p-val	Rd1	Rd2	Rd3	Rd4	p-val	Rd1	Rd2	Rd3	Rd4	p-val	Rd1	Rd2	Rd3	Rd4	p-val
Farm and non-farm work, livestock	10.29	9.42	8.71	10.44	0.0123	9.22	9.07	10.08	9.63	0.526	8.35	8.68	8.72	8.62	0.2251	7.55	7.43	5.89	6.34	0.381
Domestic/household chores	0.75	0.83	0.85	0.89	0.241	2.76	2.50	3.08	2.81	0.512	2.81	2.93	3.26	3.11	0.821	3.25	2.94	2.99	3.50	0.492
leisure	2.73	2.64	2.42	3.03	0.032	2.17	1.49	2.26	2.09	0.012	2.28	2.00	2.30	2.32	0.046	2.88	2.44	2.92	2.38	0.064
personal care, resting, sleeping	7.63	7.57	6.77	8.25	0.712	8.47	7.54	8.58	8.49	0.621	8.62	8.41	8.98	9.04	0.024	8.62	7.57	8.34	8.62	0.0614
Others	2.60	3.55	5.25	1.39	0.045	1.38	3.40	0.00	0.98	0.217	1.94	2.00	0.74	0.92	0.572	1.69	3.62	3.86	3.16	0.126
BMI	21.06	21.06	21.06	21.06	0.0002	21.67	21.67	21.67	21.67	0.210	21.08	21.08	21.08	21.08	0.04	22.87	22.8	22.87	22.87	0.42

p-val is the p-value of Anova test for differences in mean across the four rounds

BMI:Anthropometric measurements were taken only once for adults; hence the mean BMI is reported here for women for different classifications.

Table 8. Two stage least square estimation using dependent variable as Women's BMI and Independent variable as time use by women in productive work

Parameter Estimates						
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t 	
Intercept	1	28.43012	2.408382	11.80	<.0001	
Time_consume	1	0.011154	0.101903	0.11	0.9131	
social_group	1	-1.52636	0.339427	-4.50	<.0001	
IS_BET_15_49	1	5.033050	0.700198	7.19	<.0001	
MARI_STAT	1	1.419648	0.429601	3.30	0.0013	
AGE	1	-0.17946	0.035666	-5.03	<.0001	
EVER_ATTEN_SCHOOL_1	1	-3.31352	0.752107	-4.41	<.0001	
HOUSE_TYPE	1	2.035896	1.605975	1.27	0.2080	
R-square	0.60284					
Adj R square	0.57326					
F value	20.38					
Pr > F	<.0001					