Gendered time, Seasonality and Nutrition: Insights from two Indian districts

Abstract

Some of the key pathways linking agriculture and nutrition run through women's work, yet the evidence on these links are weak. Using time use data from two Indian districts, this paper seeks to fill this gap. In principle, women's agricultural work could have positive and negative implications for nutrition, through increased control over incomes or intensifying work burdens. The emerging evidence points to the nuanced ways in which social identity, seasonality and context mediate to shape women's work in agriculture and consequently food intakes and feeding practices. Overall, women's work in agriculture seems to have a negative effect on household nutrition through two pathways: lack of adequate time for care work in peak agricultural seasons, and seasonal energy deficits that adversely affect their own health. Recognition of women's physical contributions to both agricultural production and domestic reproduction, and supporting them adequately, is central to improving nutritional outcomes.

Keywords: Gender, Time, Seasonality, Nutrition, Energy, India

Section 1: Introduction

Given women's central role in reproduction – child-bearing, child-care and child-rearing, nutritional studies in India, and globally, give considerable attention to women's work, alongside their education, health and status (Cavatorta et al. 2015, Smith et al. 2003). Employment data similarly acknowledge women's high work participation in agriculture, a phenomenon referred to as the feminisation of agriculture, albeit as labourers and family workers, rather than independent cultivators (Srivastava and Srivastava, 2010, Majumdar and Neetha, 2011, Siddiqui et al. 2017). Growth in food production is seen as an important pathway for reducing malnutrition

(Headey, 2013). Yet, relatively few studies explore the implications of women's work in agriculture on nutritional outcomes. This is somewhat unexpected given the high levels of under and malnutrition in rural India, dependent mostly on a feminised agricultural sector for survival.

Agricultural work is seasonal, with peak and lean periods in terms of gendered labour requirements, and the availability of food and incomes, with implications for wellbeing (Longhurst, 1986, Devereux et al. 2012). In exploring the range of strategies open to women for coping with seasonality and crises, Jiggins (1986) highlighted the importance of switching tasks and responsibilities ascribed by gender, changing the intensity and mix of multiple occupations, and strengthening forms of social organisation and support.

Feminist research on divisions of labour has relied on time allocation studies, which have indeed made significant contributions to understanding the gendered nature of agrarian livelihoods and wellbeing (Dixon-Mueller, 1985). Yet, given the complexity of this methodology, they have often ignored seasonal variations in time use, including the temporary switching and sharing of tasks within households during periods of labour stress, and importantly, the energy intensity of different activities and patterns of work (Johnston et al. 2018). Without such understanding, however, it is difficult to draw causal links between work and wellbeing, especially in terms of nutritional outcomes (Palmer-Jones and Jackson, 1997; Floud et al., 2011). While seasonal stresses in work burdens, or food consumption, may not immediately reflect in nutritional and health statuses as measured through the Body Mass Index (BMI)[1], they do have short-term implications on body weight, diets and the performance of caring roles (Richards, 1939; Panter-Brick, 1991; Glick and Sahn, 1998).

In an early review paper on women's work and child nutrition, Leslie (1988) pointed to the possible tension between a positive income effect and a negative time effect. She however noted a lack of comparability and consistency amongst studies, due to the failure to define women's work in any systematic way. Kadiyala et al. (2014), in a more recent review of the literature on agriculture-nutrition links, propose at least three different pathways that mediate, positively and negatively, women's work, especially in agriculture, and child nutrition. First, women's work and control over income can potentially contribute to greater say in decision-making, with implications for household food expenditures, consumption choices reflecting dietary diversity, and consequently improvements in child nutrition. Second, women's work could potentially have negative outcomes, especially for the young child, whose nutrition depends more on the mother's time for breastfeeding and supplementary feeding and less on other activities (Glick and Sahn, 1998). The double burden of work and care, often leads to a time trade-off between the two[2]. Outcomes here reflect the availability and quality of care provided by substitutes in the mother's absence. If there are no substitutes, or these are older siblings, children themselves, rather than adults, outcomes are likely to be negative or less favourable (Engle et al. 1999). A final dimension relates to the implications of women's work for their own health and nutrition. Several studies note that longer working hours for women or increased work intensity can have detrimental effects on their own health (Bamji and Thimayama, 2000), and in turn, their ability to care for their children, leading to poor child, and indeed household-level, nutrition outcomes (c.f recent reviews by Pandey et al. 2016 and Ruel et al. 2018).

While not directly addressing the income effect, this paper focuses on the last two disconnects noted by Kadiyala et al. (2014), namely the role of time trade-offs and women's own health in mediating household-level nutritional outcomes. Using time

use data, collected from different social groups in two different rural, agricultural communities, it specifically asks: how do seasonal shifts in gendered labour requirements affect care tasks, and in what ways does this vary across social groups and agro-ecological locales? Further, what is the extent of seasonal energy stress encountered by different social groups and genders and its likely impact on their health?

Within nutritional studies, an understanding of gender largely refers to a focus on women as a relatively homogenous category, given their role in human reproduction, and the care and nurture of the young child. However, there are differences in child-rearing practices across cultures and social groups (Panter-Brick, 1991). In India, class, caste and ethnicity play important roles in shaping access to resources (especially land) and social relations, but equally mediate women's agency, social norms around appropriate behaviour, notions of care and food cultures (c.f Desai and Jain, 1994). In fact, the Scheduled Tribes (STs)[3], while recognized as historically marginalized and economically poor by the Indian Constitution, are seen to be relatively more gender egalitarian, poverty perhaps making men and women cooperate much more within households in the performance of both productive and reproductive work, than the middle castes and classes (Author, 2008). Miller similarly found that "propertied groups exhibit more son-biased intra-household food allocation patterns than do the unpropertied" (1997: 1685). Rather than considering men and women as homogenous and often opposing groups, this paper examines the intersections of gender with other forms of social identity and inequality. In doing so, the paper seeks to fill the knowledge gap on men's allocation of time.

After setting out the methodology and context in Sections 2 and 3, Section 4, based on time use data, examines the changes in the gendered divisions and nature of work and

care across seasons and groups. Section 5 then highlights the seasonal nature of energy stress and its differential nutritional impacts across social groups. Section 6 provides some conclusions and policy recommendations.

Section 2: Methodology

This paper is based on primary data from 12 villages in two Indian districts, Wardha (Maharashtra) and Koraput (Odisha), collected as part of the Farming System for Nutrition (FSN) study under the research programme 'Leveraging Agriculture for Nutrition in South Asia' (LANSA). Detailed baseline livelihood, anthropometric and dietary surveys were conducted with 150 households in each district in early 2013. Given the importance of social identity for both work and food consumption patterns, from these 150 households, 30 households were selected in each site, representing different castes/ethnicities, for the conduct of time use surveys. At least five households were selected from each sub-group, to ensure that the selected cases were not atypical of the group. Sample details are in Annex 1. To investigate seasonal effects, data was collected for one day each across three agricultural seasons – planting, harvesting and the lean period. In both sites, the peak planting season is between July and September. While paddy harvest occurs in November-December (in Koraput), cotton harvest takes place between November and March (in Wardha). The lean period, with little cultivation, extends during the hot summer months, from April to June. Data was collected in July 2014, November 2015 and April 2016 in Koraput, and April 2014, November 2015 and July 2016 in Wardha.

The time use survey was based on 24-hour recall methods, using half-hour intervals, with simultaneous activities noted. We classified the activities into the nine categories (and 176 activities) developed by the Government of India in its Time Use Study (MoSPI, 1999). This includes three components. First, all economic work captured by

the System of National Accounts (SNA), which includes household production for self-consumption, collection of free goods from common property and other resources (Hirway and Jose, 2011), paid domestic services, and market-based work. Second, the extended SNA (ESNA), which seeks to measure and value unpaid domestic, care and voluntary work, falling under the general production boundary (Esquivel et al. 2008)[4]; and finally, leisure, personal services or non-productive (NSNA) activities (MoSPI, 1999; Hirway, 2005).

For calculating energy expenditures, we worked forward, starting with the list of activities reported in the time use survey. The energy equivalents for specific activities (Physical Activity Ratio) were calculated for each individual (per hour) as per the WHO/FAO/UNU norms (1985). These were added together to estimate the Physical Activity Levels (PAL). The total energy expenditure is the product of PAL and Basic Metabolic Rates (BMR), that is, the energy required to maintain basic body functions while resting (Floud et al. 2011). The BMR itself, varies not just by age and gender, but also ethnicity and occupation. As Carson (2014) demonstrates, African-Americans in the 19th century US required more calories per day than whites, as did farmers and unskilled workers. The BMR for the sample was calculated using the formula provided by the Indian Council of Medical Research (2013).[5]

While there are problems with time use data in terms of the treatment of simultaneous activities, activity aggregation, insufficient sample sizes and missing information, especially around contextual variables, it nevertheless helps us understand complex relationships and gendered divisions of labour on the ground. The inclusion of unpaid work is particularly important for its contributions to welfare, in this case nutrition, as household tasks are often quite energy-intensive (Sujatha et al., 2000), hence lack of

adequate energy can also lead to the curtailment of such work (Fogel, 1997). Such analysis can hence point to areas needing urgent public action (Esquivel et al. 2008).

Time use surveys, however, encounter a further problem of recall and reporting, as people often fail to report what is not considered socially and culturally appropriate (Gross, 1984). We therefore supplemented the time use surveys with in-depth, qualitative interviews conducted with these households in order to understand socio-demographic, cultural as well as ecological and farming-related factors that shape their activities and diets.

Alongside time use, we also collected data on household diets, on the same three days, in order to enable some comparison of food intakes and the burdens of work in these households. Women were asked to recall (and physically show) what was cooked and consumed the previous day (24 hour recall), and how it was apportioned to different members of the household. These quantities and portions were measured using weighing scales and standard vessels by the field-workers. The procedure for collection of food consumption data and calculation of energy intakes followed the guidelines and values provided by the National Institute of Nutrition, Hyderabad (2012). The energy (kcal) of each food item was extracted and summed up to calculate the per day energy intake.

While giving an idea about energy intakes on a particular day, this data, however, cannot be directly associated with an individual's nutritional status, which denotes a balance between nutritional intakes and the claims against it (Floud et al. 2011). Status is shaped by multiple factors, including the level of physical activity, exposure to disease, and institutional variables reflecting access to public health and sanitation (Ibid.; Fogel, 1997; Cavatorta et al. 2015), over a longer period of time. Given the small

sample size of 30 households in each location, and that data was collected only on one day in each season, we are cautious in using it for statistical analysis, or claiming causality between dietary intakes and seasonal weight losses. The data is nevertheless useful for identifying potential problem areas and groups who face severe seasonal stresses in food consumption. Like the time use data, this comparison between seasonal energy intakes and expenditures is useful in thinking about social, cultural and locational factors that may be influencing outcomes, and appropriate solutions. Names of all villages and respondents have been changed to ensure both confidentiality and anonymity.

Section 3: The Context

Koraput, located in the semi-humid tropics, a largely rainfed, subsistence economy, known for its indigenous rice varieties, is one of the most backward districts of Odisha and India. While literacy rates and other human development indicators are low in this district, the female to male sex ratios are favourable to women and girls (Table 1). The primary crop grown in the lowlands and midlands during the *kharif* (monsoon) period (June-October) is rice, with some millets, pulses, niger and maize mix cropped in the uplands. Where some irrigation, or residual moisture, is available, vegetables and pulses (green gram and black gram) are grown in the *rabi* (winter) period (January – April). While women control the upland crops, the cultivation of rice, vegetables and pulses in the low and mid-lands reflect a complementarity in the tasks of men and women. Consumption of the staple rice is high across seasons; the seasonal spikes in energy deficiency (Table 2) can therefore be attributed to women's increased work burdens and lack of time rather than reduced availability. As Kamala Paroja said, "We leave for our fields for transplantation early in the morning. There is no time to go to the forest to collect vegetables or greens, and no time to cook. We only eat once a day - rice and *ambli (*sour gruel of rice flour and tamarind)". This narrative seems to echo

Kumar and Hotchkiss' (1988) finding that deforestation in the hill areas of Nepal had a negative effect on nutrition not just due to the loss of dietary diversity, but also increased time for fuel collection and food preparation.

Insert Table 1 here

Wardha, in the semi-arid Vidarbha region of Maharashtra, while also rainfed, is primarily dependent on a cash crop, Bt cotton. Planted in July-August, it takes 5-8 months to mature. Women harvest cotton manually, in several rounds between November and March, as reflected in their relatively high work participation rates (Table 1). Additionally, some sorghum, pigeon pea, red gram and soyabean are cultivated in the *kharif* season and gram and wheat in the *rabi*. The region has reported severe agrarian distress over the past decade resulting in a growing number of farmer suicides (Sainath, 2014). Sex ratios are much lower, closer to the national average, revealing son preference and underlying gender inequalities (Agnihotri, 2000). Here too, while diets don't reflect significant variations across seasons, levels of chronic energy deficiency (CED) do (Table 3).

The study villages comprise a mix of castes and ethnicities as reflected in Annex 1. Across sites, Scheduled Tribes constitute the majority, 42 per cent of the population. However, this category is not homogenous. Amongst the STs in Koraput, there are at least three sub-groups – the Bhumias, the Gadabas and the Parojas – all with their distinctive cultures, but more importantly, livelihoods. The Bhumias, for instance, are land-owning cultivators, the Gadabas engage in a mix of activities, land, forest and livestock-related, while the Parojas, though owning small plots of land on the hill-slopes, are virtually landless and survive by engaging in wage labour. Similarly, the Other Backward Castes (OBC) in Koraput constitute 46 per cent of the population and

include the Malis, who are intensive vegetable cultivators, and the Ranas, traditionally ironsmiths, engaged now in a host of farm and non-farm activities.

In Wardha, the 21 per cent OBCs include the Malis, also vegetable-cultivators and the Gowaris, who are livestock-keepers. The Scheduled Castes (SC) interestingly have very different social positions in the two sites. In Koraput, the Dombs (9 per cent of population) are landless agricultural workers, often the poorest and most under-nourished, while in Wardha, with a history of dalit mobilisation, influenced by Dr B. R. Ambedkar's movement for the emancipation of Mahars (12 per cent of population), they are educated and often engaged in public and private sector jobs. Social hierarchies and forms of exclusion/inclusion within the villages reflect the differences in their economic status. Other groups, which include the upper castes, those with resources and secure livelihoods, are negligible in number in Koraput, and constitute 25 per cent of the population in the Wardha villages. We did not include them in our sample.

In terms of the nutritional status of social groups in the two sites, while food production is not necessarily linked to consumption (Komlos, 1985), the Scheduled Caste households in Koraput are the worst off, with 52 per cent in the baseline survey of 150 households underweight[6], both in the under 5 age-group and amongst adults. They are followed by the Scheduled Tribes, the Parojas and Bhumias in fact doing worse than the SCs in the 0-5 age-group. In Wardha, the situation is more mixed. While Scheduled Caste children under-5 perform better than other groups, this advantage is lost in adulthood. Alongside the SCs, the Scheduled Tribe Gonds consistently have poor nutrition outcomes across age groups, with close to 48 per cent underweight. Annex 2 (figures 1 and 2) provides details by age, social-group and gender for both districts.

Section 4: Time Use and the Gender Divisions of Labour

We turn now to the time use survey to see what insights it can give us into seasonal work patterns, and how far care deficits coincide with social and class hierarchies (c.f Palriwala and Neetha, 2011).

4.1 What does the time use data tell us about gendered work patterns?

Figures 1 and 2 present the average hours spent by men and women on SNA, ESNA and NSNA across seasons in Koraput and Wardha respectively. Not surprisingly, the time spent on the 'total economy', that is, both productive and reproductive activities (SNA + ESNA) by women is more than men across seasons and across locations, roughly 56 per cent of total work. For women and men combined, however, the total hours spent on household activities in Koraput is on average two hours more than in Wardha, pointing to differences in both agro-ecological and development contexts.

Some interesting nuances emerge as we explore this data further. While the national Time Use Survey (MoSPI, 1999; Hirway and Jose, 2011) shows that women spend roughly half the time that men spend on SNA activities, this is not the case in the agricultural communities studied, except perhaps for the lean season in the Wardha villages. Women across groups and locations spend almost 75-80 per cent time that men spend on SNA activities. This is an important finding highlighting women's significant productive contributions to household agriculture, even though classified as 'unpaid family helpers' (Author, 2012). It is not just domestic and care work, but much of women's agricultural work too appears to be invisible.

Insert Figure 1 here

In Koraput, the gap between male and female activity is lowest in the planting season (2.11 hours), when both have heavy work burdens in agriculture, over 10 hours for men and close to 9 hours for women, as against the harvest season (2.76 hours). While men plough and prepare the land, women plant and transplant the paddy seedlings. Such cooperation is critical, given the centrality of rice to the identity of the tribes in the region. In this period, women's work-day stretches to 13 hours, time for sleeping and resting declines and time available for care-work shrinks by close to 30 per cent. Harvests also involve heavy work, however, given that men do the bundling and transportation of the harvested paddy from the fields to the homestead, women find a little more time for domestic and care work. It is only during the lean season, the hot and dry summer months that they get adequate time for rest and sleep.

Wardha presents a slightly different picture, with the harvest being the most intense work period for women. The gap between male and female activity is only 1.32 hours as against 2.46 hours in the planting season. The harvest period involves not just long hours of work plucking cotton, but as several women noted, the smell of cotton and cotton dust gives them a headache by the time they are finished, leaving no appetite or indeed a desire to cook or eat. They just go to bed. Given women's responsibility for cooking and managing domestic tasks, this has implications for what other family members, including children, eat. Even in this period, however, women here manage to get a little more rest than in Koraput.

Insert Figure 2 here

What emerges is that women across the board undertake a larger share of the total activities (SNA+ESNA) performed. Men do more productive (SNA) work than women, though in peak agricultural seasons, planting in the case of Koraput and harvest in

Wardha, the gap between male and female labour narrows down. Women's time for care shrinks quite substantially during these times, and male time contributions do not increase to compensate for this gap. While men are clearly not 'lazy' (Whitehead, 1999), how might we enhance household cooperation in the domain of domestic and care work to improve household nutrition and wellbeing more broadly?

4.2 How far does caste/ethnicity mediate gendered time burdens?

While land-holding data was analysed, given that both areas are rainfed, and land is often of poor quality, the more significant differences in work patterns and gender relations were based on social identity of caste or ethnicity. Following Carson (2014) on the importance of ethnicity for BMRs and calorie requirements, we examine differences across social groups in an attempt to uncover specific cultural norms and social inequalities, but also forms of cooperation that can contribute to improving nutrition outcomes. Most time use studies, and studies of women's work and nutrition, with a few exceptions (for example, Panter-Brick, 1993) miss such fine-grained analysis.

Disaggregating by caste and sub-caste, we find some interesting patterns emerging. Figure 3 reveals that while the planting season remains the most burdensome for women and men across caste groups in Koraput, amongst the OBC Malis and the ST Parojas, women's agricultural work burdens remain almost at part with men during the harvesting period too. For the Parojas, this continues into the lean season. 38-year old Sima Paroja, with three children, aged 13, 8 and 3, all underweight, noted: "When there is a transplantation job, I wake up early, complete all the household work and leave for the field. I return at 5pm. In the winter, I go for crop harvesting and collect firewood from the forest (for sale). In the summer, I go for wage labour. My husband is unwell and can't do much". With no option but to engage in effort-intensive work

through the year, it is unsurprising that almost 54 per cent of Paroja children (0-5 years) are underweight, the worst in the locality (Annex 2, Table 1).

Insert Figure 3 here

Gadaba women appear less involved with SNA activities, but this could be because they follow a mix of livelihoods, and some of their subsistence activities, which are home-based, could have been classified as ESNA. 30-year old Basanti Gadaba noted, "We don't own land, but have leased in 20 cents for cultivating paddy and some *mandya* (millets). We eat millet gruel during the summer, with some potatoes and tamarind gravy. During the rainy season, we collect yams, tubers and other greens from the forest, and small fish from the fields. If needed, we sell some yams in the market and buy rice or vegetables. During the winter months, we collect and sell firewood. A variety of vegetables and greens are available for our consumption. When agricultural work is available in planting or weeding, I go for wage-work, so does my husband". This diversified strategy for ensuring food security may also reflect an attempt to conserve their energy by reducing engagement with effort-intensive activities such as wage labouring, in a general context of scarcity (c.f Fogel, 1997).

In Wardha, in comparison to Koraput, the SNA for both men and women is lower by about half an hour across seasons (Figure 4). Amongst the Gowaris and Malis, both OBC groups, the planting and harvesting seasons are equally work-intensive, and there is hardly any gender difference in terms of time spent on SNA. The only exceptions are the SC Mahars. As noted earlier, with exposure to education, even though landless, several men are in regular employment or forms of self-employment, so their wives don't need to work outside the home. As 25 year old Sarika, mother of a 3-year old son, noted, "My husband earns by playing the casio with a band that performs in marriages

and other occasions. I used to go for labour until my son was born, but then I stopped. I take my son to the *Anganwadi*[7] for a hot cooked meal. He likes it".

Insert Figure 4 here

Moving on to ESNA, or reproductive and care work, based on the Indian Time Use Survey, Rajivan (1999) reported that women spent more time in the care of children, and ill and elderly people; 3.16 hours per week as compared to 0.32 hours for men. In aggregate terms, women performed 90 per cent of all unpaid care work. The data presented in figures 5 and 6 is in line with the above conclusion; if anything, male contributions, especially in Wardha, seem to be lower, with women performing 95 per cent of all unpaid work. In a general context of agrarian decline and distress, more men, especially from rainfed regions, are migrating in search of employment.

While care work remains primarily women's responsibility across sites and social groups, we note some interesting differences. First, in the case of Koraput (Figure 5), most groups except the Gadabas face a shortfall in time for care-work during the planting season. For the Gadabas, the higher levels of ESNA may reflect prioritising care for their children over earning more money. 25 year old Latha said, "I used to work, but now that I have a young son, he is only one, I am not going for wage labour. My husband works locally. If he migrates, he can earn more, but it is also very difficult work. We eat a little less during the rainy season, but for my son, he gets three eggs a week and some supplementary mix from the *anganwadi* centre. I have to take him there". This reveals that household livelihood and nutritional strategies involve not just enhancing production or incomes, but equally accessing available entitlements and services. Latha knows that in her absence her young child will be deprived of his nutritional entitlement. Rather than considering the household as a single unit, with a

uniform food strategy, we need to recognise that women use differentiated approaches, in this case, protecting the young child from food stress, even though other members of the household may get less to eat, a point also noted by Panter-Brick (1993) in the case of rural Nepal.

For the Parojas, and to some extent the Malis, the time deficit runs right through the year. Bhanu Mali, six months pregnant with her third child, noted, "I work in our vegetable fields, though it is my mother-in-law who takes the produce to the market. She keeps and manages the money. My two older children are five and two years old. When I am away, sometimes my husband's sister, who is 15 years old, looks after them, at other times they play on their own". Physical care, that is, bathing, cleaning and feeding children, is exclusively women's responsibility; hence, the lack of time to ensure proper feeding and hygiene of the children adversely affects their health and hampers normal growth (Annex 2, Table 1 and 2).

Second, there is a difference in male contributions across seasons. Amongst the OBCs, men contribute to ESNA in the lean season, performing a host of domestic activities related to household maintenance, which lie within the production boundary, such as repairing the house, purchasing materials, which include travelling to nearby towns or locations. Being part of the caste hierarchy, this is partly reflective of the restrictions on women's mobility. Amongst the ST groups, the Parojas get least support from their men – this is because being mainly wage labourers, many Paroja men migrate for work during the lean summer months and are absent from their homes. They bring home cash for household expenses, yet in their absence, the entire burden of managing the home falls on the women. As Samari Paroja noted, "My husband worked as a construction labourer in Vishakhapatnam, when there was no work at home. He was earning Rs 5-6000 per month. Yet the work was too strenuous, and probably there was

not enough food, so he fell ill and returned home". While the income was necessary for the family's sustenance, his migration ultimately added to Samari's care burdens. Nutritional surveys amongst tribal groups from 1985-2008 point to a secular decline in dietary diversity, especially amongst men (NNMB 2009: 65), resulting largely from a collapse in agriculture and dependence on migrant work.

Insert Figure 5 here

The SC Dombs too are landless labourers; here both husband and wife go for wage labour, hence when they return home after work, they cannot manage without sharing some of the domestic work. In many cases, adolescent daughters help with household work. As Subhangi said, "When I go to work, my daughter looks after the youngest, fetches water, and even comes with me to collect firewood". Amongst the land-owning ST groups, such as the Bhumias and Gadabas, in the harvest season, while women are busy harvesting the paddy, men look after the infants, and supervise the older children (Table 1, Annex 3).

The Wardha villages have better access to infrastructure and services, such as electricity, drinking water and cooking stoves, and this may be a reason that ESNA activities here are less time-consuming than in Koraput. Here too, women with the highest burden of SNA, the Malis and Gowaris, have the least time for ESNA. As Savita, a Gowari woman, explained, "I go for agricultural work, forest work, cooking, whatever is available. My husband also does any kind of labouring task. Sometimes I take my children with me, otherwise leave them in the village. The older one has just started school and the younger one is in the *anganwadi*. He just goes there, collects the *khichdi* (rice and lentils) and comes home – there is no one there to look after them or feed them". Even though they own livestock, and can potentially have diverse diets,

yet in terms of child nutrition outcomes, especially weight for age, the Gowaris do only slightly better than the STs (Annex 2, Table 2).

Insert Figure 6 here

Male contributions are low, an average of 24 minutes a day, almost 15 minutes less than in Koraput. This perhaps signals that with greater 'development', gender divisions of labour become more rigid, with the performance of domestic tasks in particular seen as reducing male status, hence confined to women's domain (c.f Author et al. 2008). An important observation in both sites, however, was that men generally cook and fetch the water, in the absence of adolescent girls, or another adult woman in the home, during the menstrual cycle of their wives each month. Menstrual taboos mean that women are considered 'impure', and not allowed to touch the cooking pots or water. Further, in Wardha, when women were tired and unable to cook during the cotton harvesting period, men did help them. Given that cooking remains the most time consuming of all domestic chores, provision of clean energy, cooking stoves and better equipment could help reduce the time and drudgery involved in this task, a recommendation also made by Desai and Jain (1994). Finally, men here are involved in teaching, training and instruction of the children, driven perhaps by the premium placed on their education (Table 2, Annex 3).

Time use surveys fail to capture such cooperation for several reasons including socio-cultural norms that link the performance of particular tasks to status, researcher biases, and the practical difficulties of conducting gendered research. They present a picture of rigid divisions of labour, and while this holds true in a broad sense, the in-depth interviews and field observations point to some flexibility in such divisions, especially in the observance of menstrual and other ritual taboos, and in responding to increasing

pressures on survival. While the 'dirty work' (Bridget Anderson, 2000) remains almost entirely confined to women, men do take pride as fathers in their children. They are willing to take on care responsibilities, especially holding their children, playing with them, and teaching them. This is an area that needs to be recognised so that men can be supported to take on further caring roles, essential for meeting the Sustainable Development Goal 5.4, which calls for the recognition, reduction, and redistribution of unpaid care work.

Finally, if we look at NSNA, or personal time for leisure and sleep, we find a gap on average of 2 to 2.5 hours between men and women in Wardha and Koraput respectively. In Koraput, women have a 13-hour working day not just during the planting season, but also at harvest time, especially amongst the Parojas, Malis, Bhumias and Dombs. This is because the ESNA expands to take over the time saved from SNA activities. In fact, calculating the time available for sleeping, the Malis and Parojas appear to be the most sleep-deprived, getting roughly 6-7 hours per day. Several studies have pointed to the link between lack of adequate sleep (less than 7 hours per night on a regular basis) and poor health and nutrition outcomes, including weight gain and obesity, diabetes, hypertension, heart disease and stroke, depression, impaired immune function, amongst others (Watson et al. 2015).

In Wardha, both men and women get slightly more time for rest and relaxation than in Koraput. This is particularly visible in sleep patterns where women across the board get about 8 hours of sleep or more throughout the year.

Insert Figures 7 and 8 here.

The above analysis points to variations in time use across locations, seasons and between social groups within each location. The situation in Koraput appears to be worse for women (and men) in terms of the intensity and duration of work throughout the year compared to Wardha. This reflects differences in agro-ecological conditions and cropping patterns, access to technology and infrastructure, and general levels of poverty and development. Within Koraput, the Parojas and Malis confront the worst care deficits, while in Wardha this is the case for the Malis and Gowaris. Except for the Parojas, the others are not necessarily at the bottom of the social or class hierarchy. This finding goes against linking poor nutrition to socio-economic or poverty status alone; as in households with land and assets, women may have higher subsistence workloads and greater time and energy constraints (c.f Miller, 1997; Panter-Brick, 1993). This insight provides a clue to understanding the South Asian enigma, wherein despite reduction in levels of poverty, and sustained economic growth, nutritional outcomes are not necessarily improving (Ramalingaswami et al. 1996). While households may have money, women have no time to cook and feed, particularly during the peak agricultural seasons in their locality.

This also provides a clue to the disconnect between maternal and child nutrition. While women confront time deficits, and indeed energy deficits, as discussed in the next section, with implications for their own health, the household may be able to provide food to its children. In fact, one limitation of this study is that the work contributions of other household members, especially adolescent daughters, as well as mothers/ mothers-in-law, is not taken into account in the time use survey. In selecting the households, we also did not specifically select paired mother/child duos, so not all the women in the sample have young children. Nevertheless, from the qualitative data, we know that without the contributions and support of female family members, household reproduction would not be possible. It is those without any support for

domestic and care tasks, therefore, who are the worst off nutritionally, even if they are relatively economically secure. Any intervention to address the nutritional problem needs to keep this in mind.

Section 5: Energy Stress and Women's BMI

We turn now to examining the implications of these work patterns on women's own health. The calculations of energy intake and expenditure are only rough estimates; they nevertheless highlight the pressure points in the lives of men and women of different groups, and can give some indication in terms of policy priorities.

While relating to an urban Indian context, Sujatha et al.'s (2000) calculations of energy expended on different activities reveal that their values largely match the range of activities in the global compendium (WHO/FAO/UNU, 1985). In their list of activities, the most energy intensive ones are domestic chores like fetching water and washing clothes, and in terms of care activities, walking holding the child. They classify cooking, scouring vessels and bathing the child as light to moderate. In the rural contexts explored in the present study, women cannot cut back on their SNA activities during the peak planting and harvesting seasons, hence they conserve energy by cutting back on their ESNA activities. The energy intensive task of walking holding the child is shared by their men, as is water collection (c.f Author, 2008). These tasks could also be performed by adolescent children (Mitra and Author, 2017), or alternate care-providers, an element not captured in our time use survey.

In examining energy intakes and expenditures, surprisingly, we find that both men and women in Koraput households generally do better than in Wardha. This probably relates to their livelihood and food strategies (c.f Komlos, 1985). Most families in Koraput, with the exception of the Dombs, own some land and practice subsistence

cultivation, alongside wage labour. The Public Distribution System, one of the largest food-based safety net programmes in the world, revamped under the National Food Security Act, 2013, guarantees 25 kilograms of food grains at subsidized prices, to over 75 per cent of all rural households, through a network of over 500,000 fair price shops across the country (Pradhan and Author, 2018). Despite reports of leakages and poor quality, a majority of people do receive their full entitlement (Khera, 2011). In Koraput, this supplements home production, ensuring cereal (energy) adequacy.

Yet, women and men of all social groups do poorly during the harvest season, before their crops are ready to be consumed. They have, by this time, exhausted all stocks of food (Table 2). The Dombs, landless labourers, are the worst off, with men in particular facing energy stress across all seasons, ranging from 700-1000 kcal per day; they largely belong to the category of chronically under-nourished (Annex 2, Figure 1). Mali men also face negative energy gaps during the planting season, as while work burdens are heavy, food is less available, however, these gaps are relatively small, and could be a result of measurement errors. Amongst women, it is only Mali women, and to a lesser extent the Ranas, who face energy stress during the planting season[8].

Insert Table 2 here

In Wardha, we find energy stress amongst all the groups throughout the year, with the SC Mahar's perhaps doing slightly better than the rest in the lean season (Table 3). As noted earlier, farming here is dominated by cotton production, and all food items need to be purchased from the market. Over the past few years, cotton prices have fluctuated sharply, and drought conditions have increased farmers' distress. The Public Distribution System has been a great help, but the quantities available are inadequate for meeting their energy requirements. On the open market, cereals are expensive, as

are other food items. People can hardly afford to buy pulses, vegetables or fruits, and even cereal consumption is limited if they are constrained for cash.

Insert Table 3 here

Seasonal weight losses due to inadequate food intakes are common amongst most poor, rural people in developing countries, 65 per cent according to one estimate (Ferro-Luzzi et al. 1994), and an area of concern in terms of potentially negative nutritional and functional implications. While seasonal stresses aggravate the problem for chronically under-nourished people (BMI< 18.5), they can push people, otherwise well nourished, into the category of CED (chronic energy deficiency) seasonally. What also emerges is that thinner people are likely to be worst affected in terms of functional impairment. This would suggest that they should sacrifice physical activity in order to save energy and avoid depletion of their lean tissues (Ibid.: 170), a point noted by Chanchani (2015) in her ethnography of a marginal, tribal community in Chhatisgarh.

Most studies of seasonal body weight changes are located in Africa. What they indicate is a rather modest gender difference, with women tending to have slightly smaller weight losses (1.4-4.6 per cent) than men (2.3-6.4 per cent) (Ferro-Luzzi et al. 1987: 47). The present study only partially confirms this finding (See Table 4 and 5 below). While the data on seasonal changes in weight for the sample of 30 households in each location is not statistically significant, due primarily to the small sample size, it is nevertheless indicative of the groups that are most vulnerable and the periods of stress.

In Koraput, in line with the energy stress noted in Table 2, the Scheduled Tribe men all experience a loss of body weight of 2-3 per cent during the harvest season, while for women, except the Gadabas, this is somewhat higher at between 3-4 per cent. For

Bhumia and Domb (SC) women, the weight loss is delayed, recorded at the time of planting. Time lags in the visibility of weight loss are common. Amongst the Parojas, perhaps the most marginalised amongst the tribes, and the thinnest amongst all the groups studied, women reveal a decline of 1.56 kg, that is, a little less than 4 per cent of body weight, while men have a slightly lower decline of 1.15 kg or 2.5 per cent of body weight. It is only amongst the OBC Malis, that the pattern corresponds with what the literature says; the weight loss for men is 4 per cent as against 2.5 per cent for women. As already mentioned, one possible strategy, especially for women, is to reduce physical activity during times when adequate food is not available (c.f Fogel, 1997). However, this is not possible in agricultural communities, when the physical activity is often most intense during the planting and/or harvesting periods, as revealed in the time allocation study presented in the earlier part of this paper.

In nutrition studies, the focus has largely been on energy intakes, rather than strategies for reducing energy expenditures and thereby improving wellbeing (Floud et al. 2011). In fact, groups such as the Gadabas, who seek to preserve their ecosystem-based lifestyles, are often termed as 'traditional' and even 'lazy', their lifestyles blamed for their poverty. There are however fewer underweight children under five amongst the Gadabas compared to other ST children, whether Paroja or Bhumia (Annex 2, Table 1).

Insert Table 4 here

In Wardha, we find men generally having a higher mean weight than in Koraput. Despite energy stresses, their weight losses are marginal, less than 2 per cent, except for the Scheduled Tribe Gonds, who appear to lose over 5 per cent of their body weight between the lean and planting periods. Women across groups experience a weight loss of between 2-3 per cent between the lean and planting seasons, with Mali women doing

particularly badly. While in Koraput, most of the weight loss was recorded in the harvest period, when work is intense, and the new crop not yet ready for consumption, in Wardha it is in the planting season. Employment is low during the lean season, and reserves of cash and food are exhausted. As food has to be purchased from the market, the minimum is consumed. Rather than a substantial reduction in activity levels, we find energy intakes reducing at this time, especially amongst Mali women.

Insert Table 5 here

Predicting the longer-term outcomes of shifting BMIs is beyond the scope of the data available, however, our field insights and baseline nutrition data reveal that the nutritional deprivation of adults does affect the children in their care. In Wardha, for instance, of the 16 under-5 children in our sample, 10 were underweight. The mothers of these 10 children all had a BMI < 18.5, in fact, dropping to below 18 in the planting and harvesting seasons. There is clearly an intergenerational effect, be it through income (in the case of men), time (in the case of women) or genetics. Local recognition of this link makes women try and conserve their bodies and prevent excessive energy depletion, as perhaps in the case of the Gadabas, however, this is often not possible for the majority, given the seasonality of agricultural work cycles.

Section 7: Conclusions

The evidence presented in this paper points to the ways in which gender, location and social identity intersect to shape the duration and intensity of work across seasons, and in turn, nutritional outcomes. Despite the ambiguity in the literature on gender-agriculture-nutrition links (Kadiyala et al., 2014), we find clear evidence of the negative implications of women's seasonally high work burdens in agriculture, on nutritional

outcomes, both of their children, through time trade-offs, and their own health, due to energy stress.

While the Government of India's Time Use Survey, conducted in 1998-99 showed women's SNA (productive contributions) to be roughly half that of men, this study finds women performing about 75-80 per cent of male SNA contributions. Additionally, they bear almost the entire burden of domestic and care work. Variations by social group (caste/ethnicity) and location are significant (c.f Panter-Brick, 1993; Miller, 1997; Carson, 2014), pointing to the role of differential access as well as differences in institutional and infrastructural support (c.f Cavatorta et al. 2015), on both work and consumption patterns.

The implications of women's increasing SNA contributions to agriculture, without a simultaneous reduction or redistribution of care and domestic work has meant that during peak agricultural seasons, the time available for the latter is squeezed, and for some women, by almost 30 per cent. This time trade-off has implications for children's health and nutrition, as seen in the poor child nutrition outcomes amongst the Parojas (ST), Bhumias (ST) and Dombs (SC) in Koraput, or the Gonds (ST), Gowaris (OBC) and Malis (OBC) in Wardha. We also find these groups doing worse than others in terms of seasonal weight losses and changes in BMI experienced by women. While a small sample meant that we cannot prove this point statistically, our combination of methods indicates their significance.

The lack of attention to women's time as a key factor mediating child nutrition outcomes is perhaps the main reason for the persistence of poor nutrition outcomes despite economic growth. India has once again performed poorly on the Global Hunger Index (Grebmer et al., 2017), ranked 100th out of 119 countries. If women's

agricultural work and the time trade-offs they confront are acknowledged as the most significant variables mediating child nutrition outcomes, several strong messages emerge for policy. First, it is important to recognize women as farmers and agricultural workers and ensure equal entitlements, given their significant contributions to farming. This would mean that research and extension, technology and finance, are sensitive to women's gendered needs and interests. At the same time, women's reproductive labour and care-work needs to be recognised and its performance supported. The latter could be done through infrastructural support that can reduce the drudgery and effort/time intensity of tasks, especially cooking, through, for instance, the provision of clean energy, drinking water etc. Efforts are also required to redistribute this work across institutions – while men can be supported to take on additional care tasks, in a context of seasonal male migration, state services for reliable child-care and feeding need to be strengthened.

Most importantly, policies need to be sensitive to contextual differences in food habits, tastes, agricultural practices and gender norms. Without such context-specific interventions, we will not just fail to meet the SDG Goals of reducing hunger and poverty, and moving towards gender equality, but also fail to stop the intergenerational reproduction of nutritional deprivation.

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[1] BMI (Weight (kg)/(Height (m))2) is used as the measure of Chronic Energy Deficiency (CED) for adults.

[2] There is a rich body of literature on women's double and triple burdens of work, including, production, reproduction and community management tasks (Moser, 1993).

[3] The exploitation of natural resources (forests and minerals) by the colonial rulers and the entry of markets and middlemen in the remote locations inhabited by the tribes led to intense exploitation, protest movements and rebellions, and further subordination of these groups (Singh, 1985). Article 342, Part VI of the Constitution of Independent India, recogizing their historical marginalization, therefore entitled the Scheduled Tribes to special provisions to promote their educational and economic interests (Author, 2008).

[4] They emphasise that the 'total economy' should include both paid and unpaid work covered under SNA as well as unpaid work that constitutes ESNA.

[5] Calculation of energy expenditure

Physical Activity Ratio (PAR): hours spent on each activity (hours) by an individual / 60 minutes

Physical Activity Level (PAL): Sum of each individual PAR / 24 hours

Total Energy Expenditure (TEE): PAL x BMR (BMR based on age and gender was calculated using the following formula given by "Nutrient Requirements and Recommended Dietary allowanced for Indian" by Indian Council of Medical Research (2013).

Equations for calculating Basal Metabolic Rate (BMR): >18 years adults :

Male : 18-30yrs :14.5 x B.W.(kg) + 645
30- 60 yrs : 10.9 x B.W.(kg) + 833
>60 yrs : 12.6 x B.W.(kg) + 463

Female : 18-30yrs : 14.0 x B.W.(kg) + 471
30- 60 yrs : 8.3 x B.W.(kg) + 788
>60 yrs : 10.0 x B.W.(kg) + 565

[6] Underweight is defined as weight for age < –2 standard deviations (SD) of the WHO Child Growth Standards median for the reference population. http://www.who.int/nutrition/nlis_interpretation_guide.pdf accessed on 5/10/17. WHO has developed the Anthro (calculates the standard deviation for underweight in <5 years children) and Anthro plus software (calculates the standard deviation for underweight in 6 to 17 years) for calculating the standard deviation (Z scores) by comparing it with the standard (WHO has also given the standard growth charts specific to age and gender). This software was used for calculating the percentage of underweight based on the calculated standard deviation.

[7] Anganwadis are centres established under the Integrated Child Development Services, and are meant to provide food, immunisation and child development services for children under six.

[8] Details of individual energy intakes and expenditures for the 60 households studied are available on request.