

Role of women's time in nutrition-sensitive food systems: panel data evidence from rural India

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Agriculture for improved nutrition: SDG's

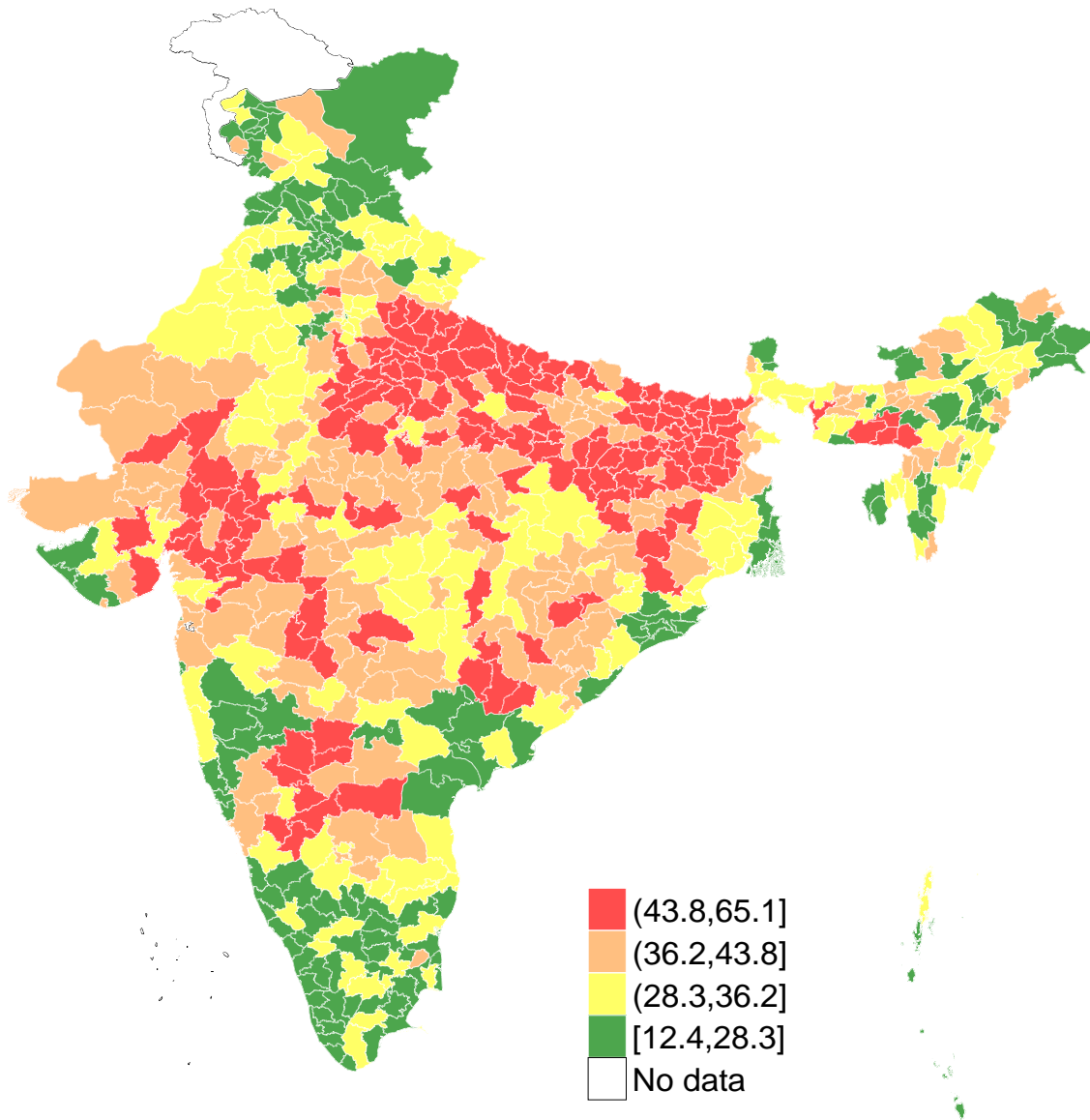


End hunger, achieve food security and improved nutrition and promote sustainable agriculture

- 815 million undernourished in the world (*FAO, 2017*)
- 96 % of the undernourished live in **South Asia** and Sub-Saharan Africa
- 36% women are underweight, and 56% of women and 56% of adolescent girls between 15 and 19 years old are iron deficient (*NFHS-4*)

Agriculture for improved nutrition: pathways

Child Stunting



End hunger, achieve food security and improved nutrition and promote sustainable agriculture

- Agriculture's role is vital in improving nutritional outcomes
- Agriculture to nutrition pathways (*Ruel & Alderman, 2003*)
 1. Food access from own-production
 2. Source of income from sale of produce
 3. Food prices
 4. Women's empowerment
 5. Women's time in agriculture
 6. Women's health through engagement in agriculture

Source: Working paper: Rahman, Venireddy and

Rising women's role in agriculture and nutrition

- Women's labor force participation in agriculture is about 35% in South Asia and about 50% in Sub-Saharan Africa (*FAO 2011*). 32% of their time is spent on agricultural activities such as transplanting, weeding etc.
- Women are solely responsible for household activities such as cleaning, cooking, childcare (*Jain n.d.; Kumar 1995; Newman 2002; Sharma, Nagar, and Chopra 2007*).

*Picture credits: Vidya Vemireddy
A women farmer taking out the weeds in the farms*

A growing concern: time constraints can impact nutrition

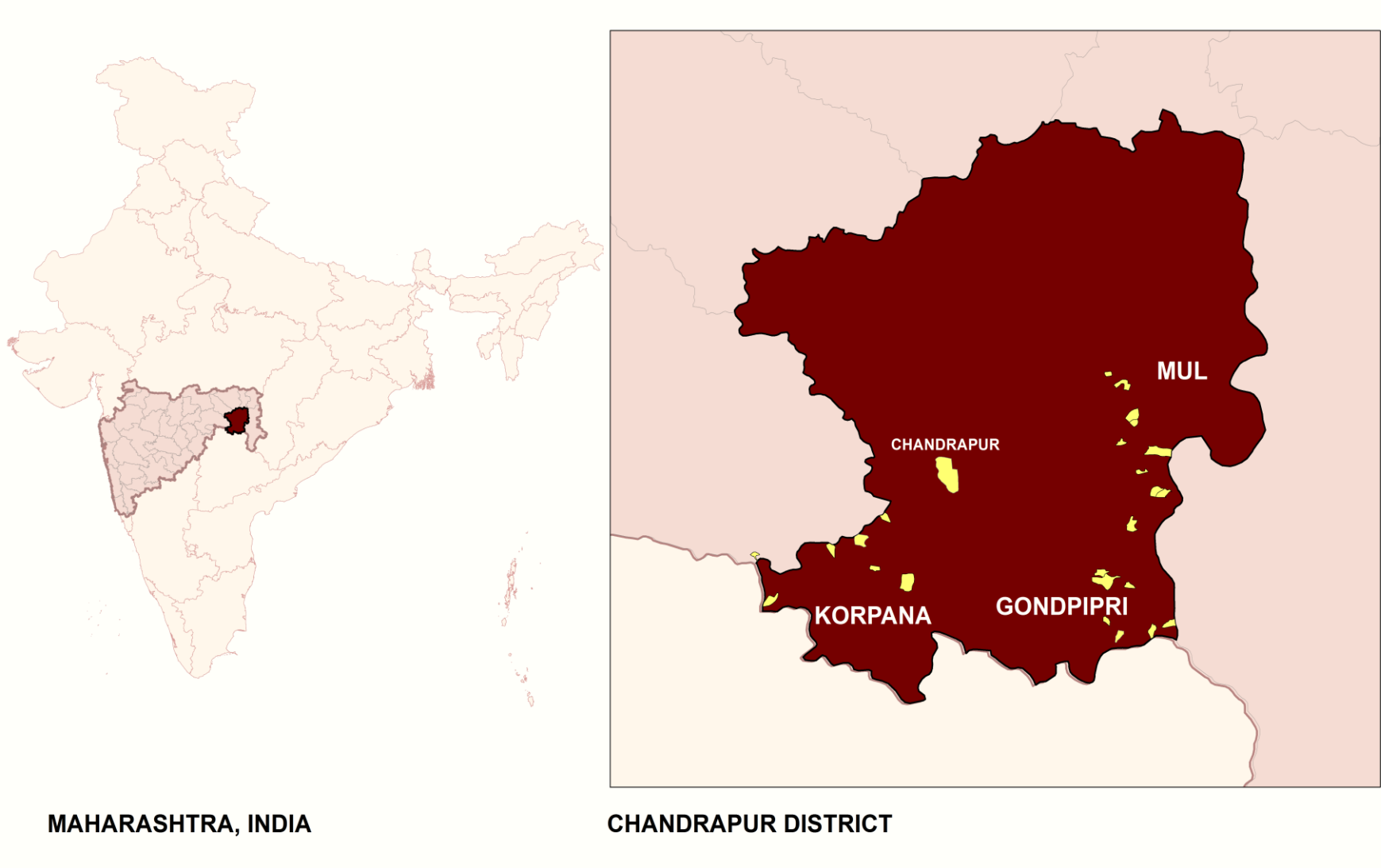
- Given the multiplicity of roles: time becomes a constraint in ensuring the competing demands of work for pay and household activities, this may vary across seasons
- Increasing women's agricultural work can negatively impact their time for providing nutrition to the household, has received greater attention (*Kadiyala et al. 2014; Komatsu, Malapit, and Theis 2018; (Carletto, Corral, and Guelfi 2017; Cunningham et al. 2015; Ruel et al. 2018)*)
- **However, studies have not looked at this relationship rigorously and in detail (Johnston et al. 2019)**

Addressing research gaps

What is the relationship between women's opportunity cost of time in agriculture and nutritional outcomes?

- First paper to present evidence of how women's time constraints effect their nutrition and food consumption in the context of agriculture-nutrition linkages.
- We show how these time constraints change through peak and lean agricultural seasons and their subsequent impacts on nutrient intakes.
- We contribute methodologically by standardizing the time taken to prepare 502 locally consumed recipes and their nutrients to measure the impacts of time burdens on time

Field site and context



- More than half of population in Chandrapur is engaged in agriculture as source of main employment (*Chandrapur district factsheet*).
- 37.1 percent of women are below normal BMI levels and about 50 percent of women are anemic (*NFHS 2015*).
- To the west of Chandrapur, cash crops such as Cotton are cultivated and paddy in the east.

Sample size and data collection

Korpana (Cotton)

- 8 villages
- 40 HH in each village

Mul (Paddy)

- 8 villages
- 40 HH in each village

Gondpipri (Mixed crop)

- 8 villages
- 40 HH in each village

960
households

954
households

Household survey (Representative man and woman)

- Agriculture input use, income, health, sanitation, empowerment, height and weight measures

Recipe standardization (502 local food items)

- Precise nutrient information such as iron, zinc content etc., cooking time for local recipes

Time use and Diet information

- Each household was visited 10 times across the year
- Wages and price level data

Empirical model : Individual fixed effects model

Theoretical model: $N = N(w, p_r, p_p, p_x, V; Z)$

$$N_{ihvt}^j = \beta_0^j + \beta_1^j Wage_{vt}^f + \beta_2^j \mathbf{P}_{vt} + \beta_3^j \mathbf{Z}_{ihvt} + \beta_3^j \mathbf{H}_{hvt} + \epsilon_{ihvt}^j$$

N_{ihvt}^j : Calorie (Kcal), Protein (grams), Fats(grams), Iron(mg), Zinc(mg), Vit A (MuG) (All of these are intakes per day)

$Wage_{vt}^f$ refers wages.

\mathbf{P}_{vt} represents the vector of prices of raw food items purchased from the market

\mathbf{Z}_{ihvt} refers to individual level factors that are time varying

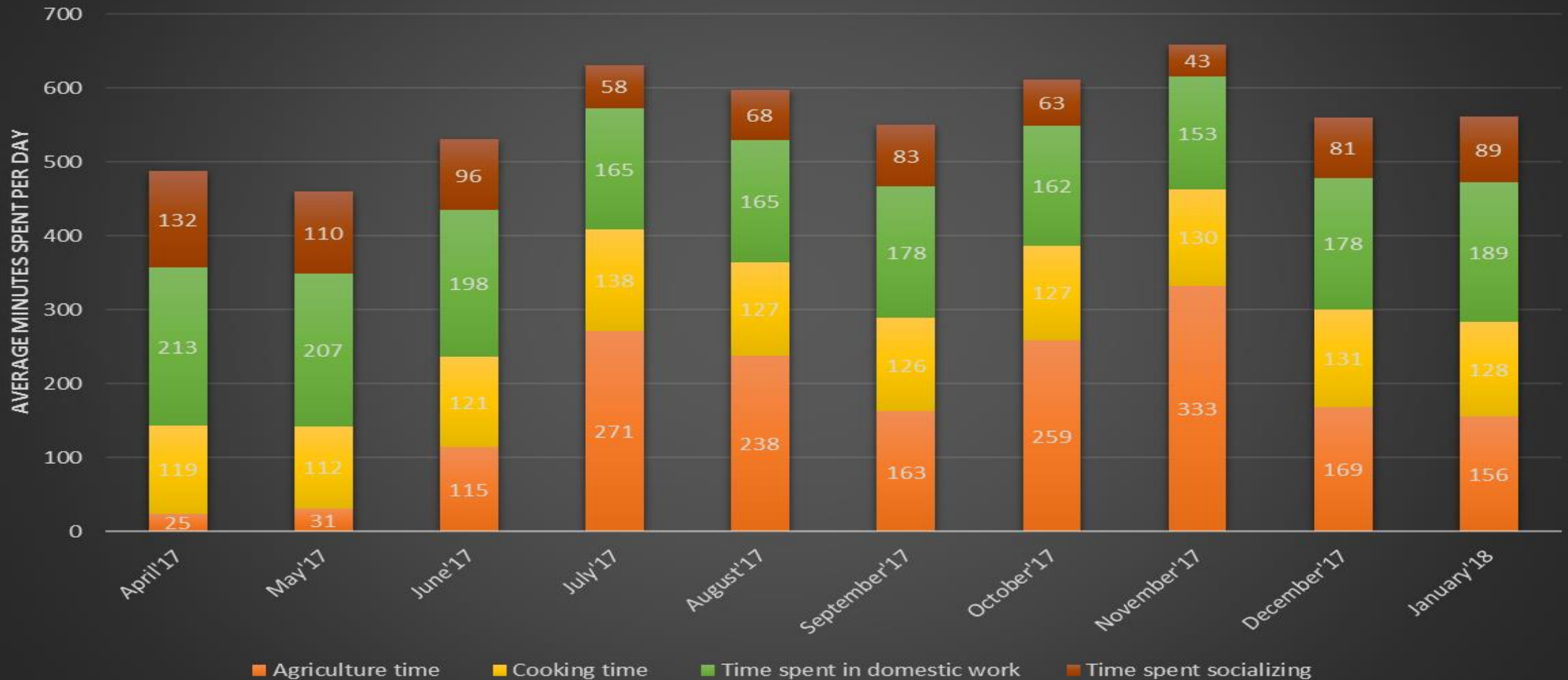
\mathbf{H}_{hvt} includes all the household level factors that are time-varying such as the non-food expenditure, whether or not an individual is sick in the household

Time use and cropping patterns

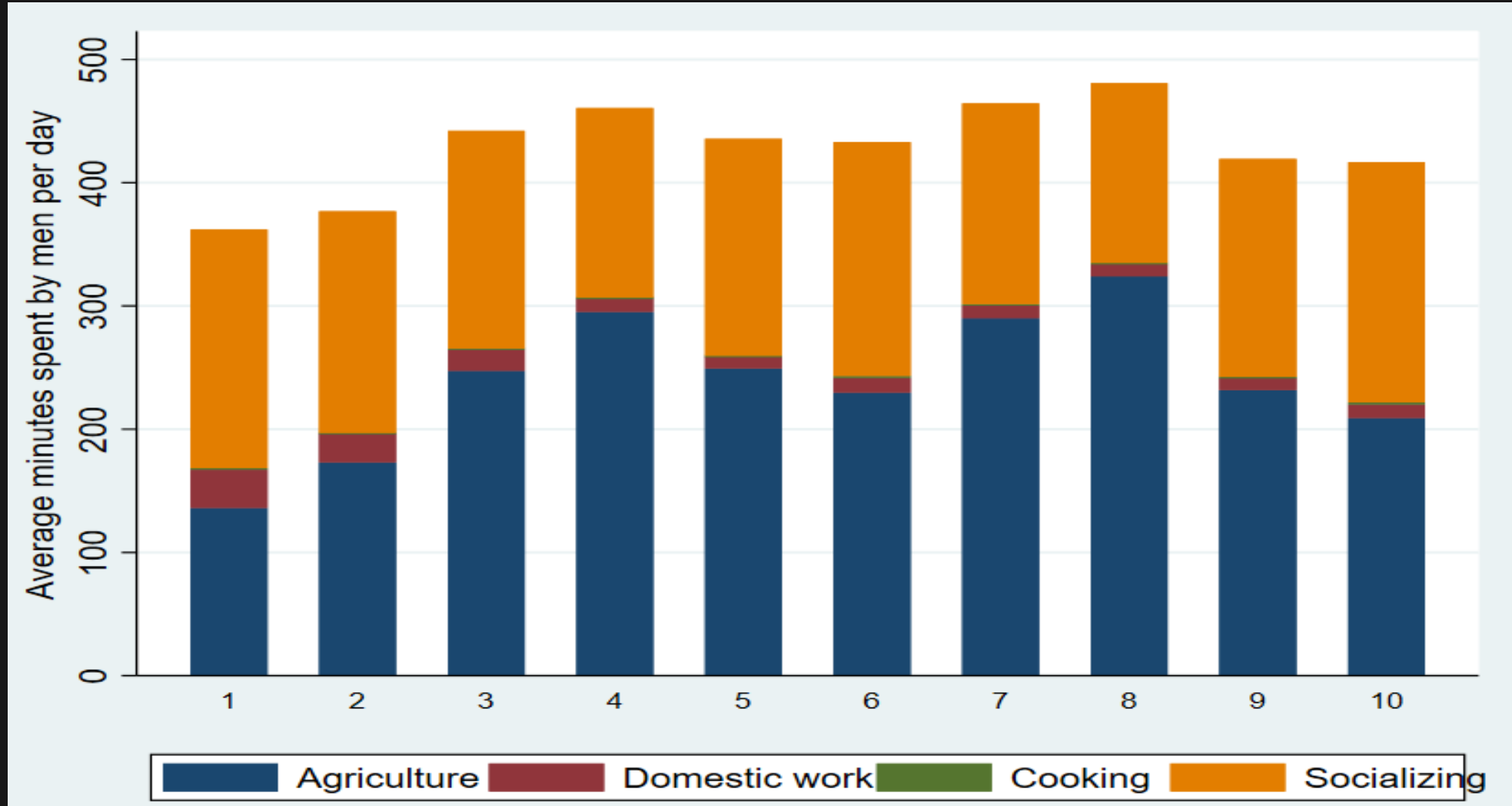
Month	Cotton	Paddy
June	Sowing	Land preparation transplanting
July	Weeding and fertilizer application	Transplanting
August	Weeding and fertilizer application	Transplanting
September	Land preparation and fertilizer application	Weeding
October	Cotton picking and fertilizer application	Weeding
November	Cotton picking	Harvesting
December	Cotton picking	Harvesting/Storage/Processing
January	Cotton picking	Harvesting/Storage/Processing
February	Relatively free months	Other activities
March	MGNREGA and other activities	Other activities

Time use patterns of women across seasons

Average time spent in agriculture and other activities by women



Time use patterns of men across seasons



Sample characteristics

Variable (N=954)	Mean	Min	Max
Ownership of land (acres)	3.04	0	15
No. of children (0-6 years)	0.34	0	3
No. of children (under 18 years)	1.14	0	4
Household size	4.42	0	9
Access to irrigation	0.24	0	1
Access to electricity	0.91	0	1
Women's age	36.96	21	50
Women's Education (%)			
No education	33.6%		
Primary	13.9%		
Secondary	31.9%		
Higher secondary and above	20.5%		

Average intake of nutrients across seasons

	Calorie s (Kcal)	Protei n (gms)	Fats (gms)	Iron (mg)	Zinc (mg)	Vitamin A(MuG)
Recommended dietary allowance (RDA)**	2850	55	20	21	10	2400
Season						
April-May	2935.9		18.9	19.8	5.3	3.0
June-July	1050					
Aug-Sept	3103.6		19.1	20.3	5.6	3.2
Oct-Nov	3009.7		18.4	17.3	5.6	3.2
Dec-Jan	1115					
	3308.0		19.9	21.6	5.8	3.2
	1303					
	3251.7		19.1	24.2	5.8	3.1

**ICMR guidelines (2017)

❖ Results

As opportunity cost rises we see a decline in nutrient intakes

As opportunity cost of time increases, there is a decline in calories by 112.3 Kcal, 0.7 mg Iron, 0.4 mg of Zinc and 1.5 grams of Protein.

	(1) Calories	(2) Protein	(3) Fats	(4) Iron	(5) Zinc	(5) Vitamin A (MuG)
	b/se	b/se	b/se	b/se	b/se	
Female wages (Rs./day)	-1.237***	-0.015***	-0.018***	-0.007***	-0.004***	-1.372***
	(0.299)	(0.003)	(0.005)	(0.002)	(0.001)	(0.385)

+ 0.10 * 0.05 ** 0.01 *** 0.001, standard errors are clustered at the individual level, (Full N= 8332)

Results 2: Do cropping systems matter? (Sub-sample analysis)

The constraints are more binding in the case of food crops

	Calories	Protein	Fats	Iron	Zinc	Vitamin A
Panel A: Cotton growing households (N=3014)						
Female wages(Rs./day)	0.076 (0.593)	-0.001 (0.005)	-0.012 (0.010)	0.001 (0.002)	0.001 (0.001)	-1.334* (0.611)
Panel B: Paddy growing households (N=2664)						
Female wages(Rs./day)	-17.510** (6.722)	-0.088 (0.068)	-0.067 (0.125)	-0.101** (0.033)	-0.041* (0.017)	-50.620** (16.346)
Panel C: Cotton and Paddy growing households (N=2324)						
Female wages(Rs./day)	-4.490*** (1.037)	-0.030** (0.011)	-0.004 (0.017)	-0.017** (0.006)	-0.007*** (0.002)	-6.120* (2.393)
+ 0.10 * 0.05 ** 0.01 *** 0.001, standard errors are clustered at the individual level, (N= 8332)						

Results 3: Land-ownership status (Sub-sample analysis)

The association is greater and much more statistically stronger in the case of households with smaller landholdings as compared to women in households with larger land size

	Calories b/se	Protein b/se	Fat b/se	Iron b/se	Zinc b/se	Vit A b/se
Landless						
Female wage	-2.150* (0.848)	-0.016+ (0.008)	-0.032* (0.013)	-0.006 (0.004)	-0.002 (0.002)	-1.482 (1.174)
<=3 acres						
Female wage	-0.731 (0.517)	-0.012* (0.006)	-0.022** (0.008)	-0.008** (0.003)	-0.004+ (0.002)	-1.586+ (0.816)
>3 acres						
Female wage	-1.033 (0.513)	-0.012 (0.006)	-0.012 (0.008)	-0.005+ (0.003)	-0.003 (0.002)	-0.854 (0.559)

+ 0.10 * 0.05 ** 0.01 *** 0.001, standard errors are clustered at the individual level , (N= 8332)

Time in agriculture and nutrients

Relationship between time spent in agriculture and nutrients disaggregated by major meals within a day (Morning and Evening)

	(1) Calories b/se	(2) Protein b/se	(3) Fats b/se	(4) Iron b/se	(5) Zinc b/se	(6) <u>VitA</u> b/se	(7) <u>VitC</u> b/se
Morning meal							
Time spent in agricultural activities (min)	-0.049 (0.032)	-0.001* (0.000)	-0.002*** (0.001)	-0.000 (0.000)	-0.000 (0.000)	-0.064 (0.049)	-0.000 (0.001)
Evening meal							
Time spent in agricultural activities (min)	-0.123*** (0.036)	-0.002*** (0.000)	-0.004*** (0.001)	-0.001*** (0.000)	-0.000 (0.000)	-0.022 (0.058)	-0.002** (0.001)

Discussion and Conclusion

- Time is an ignored (both theoretically and empirically), yet important resource when we think of nutrition. Even in a rural context!
- Women face severe time trade-offs during peak seasons of agriculture and there is a decline in time spent for nutrition.
- This leads to a subsequent decline in nutrient intakes, across different nutrients. Theoretically, substitution effect seems to dominate the income effect.

Discussion and Conclusion

- Women's contribution significantly to agricultural activities and hence, it is important to bear in mind their gendered needs in terms of extension and technology needs to reduce their drudgery, without the loss of their employment
- Their contribution to unpaid work is also highlighted, especially for nutrition. This calls for introducing technologies and infrastructure that are time saving in nature and reduce drudgery. This can be at the household level and at the farm level. Redistribution of some of this workload among family members, particularly men could be one way.
- Increased incomes coupled with greater control over income and decision making capacity can also help women to achieve nutritional security at the household level.

Thank you!

FULL SAMPLE

	(1) Calories (KCal) b/se	(2) Protein (g) b/se	(3) Fats (g) b/se	(4) Iron (mg) b/se	(5) Zinc (mg) b/se	(6) Vitamin A (MuG) b/se
Panel A: No controls						
Female wages (Rs./day)	0.014 (0.237)	-0.008*** (0.002)	0.004 (0.004)	-0.002* (0.001)	-0.002** (0.000)	0.573* (0.278)
Male wages (Rs./day)	2.269*** (0.220)	0.012*** (0.002)	0.017*** (0.004)	0.003** (0.001)	0.002*** (0.000)	1.767*** (0.293)
Panel B: Controls						
Female wages (Rs./day)	-0.745** (0.285)	-0.013*** (0.003)	-0.003 (0.005)	-0.006*** (0.002)	-0.004** (0.001)	-0.364 (0.351)
Male wages (Rs./day)	1.562*** (0.244)	0.010*** (0.002)	0.009* (0.004)	0.003** (0.001)	0.002** (0.001)	1.501*** (0.320)
Panel C: Controls and Season dummies						
Female wages (Rs./day)	-1.237*** (0.299)	-0.015*** (0.003)	-0.018*** (0.005)	-0.007*** (0.002)	-0.004*** (0.001)	-1.372*** (0.385)
Male wages (Rs./day)	0.787** (0.281)	0.008** (0.003)	0.000 (0.005)	0.000 (0.001)	0.001 (0.001)	0.556 (0.371)

Note: All regressions use individual fixed effect models. Women who have not participated in agriculture at all across ten months are excluded from the sample. Standard errors are clustered at individual level. Significance levels: + 0.10 * 0.05 ** 0.01 *** 0.001

Cropping pattern

	(1) Calories (KCal) b/se	(2) Protein (g) b/se	(3) Fats (g) b/se	(4) Iron (mg) b/se	(5) Zinc (mg) b/se	(6) Vitamin A (MuG) b/se
Panel A: Cotton growing households (N=3014)						
Female wages (Rs./day)	0.076 (0.593)	-0.001 (0.005)	-0.012 (0.010)	0.001 (0.002)	0.001 (0.001)	-1.334* (0.611)
Male wages (Rs./day)	-3.718 (4.470)	-0.075+ (0.043)	0.077 (0.070)	-0.031 (0.020)	-0.009 (0.009)	6.649 (4.273)
Panel A: Paddy growing households (N=2664)						
Female wages (Rs./day)	-17.510** (6.722)	-0.088 (0.068)	-0.067 (0.125)	-0.101** (0.033)	-0.041* (0.017)	-50.620** (16.346)
Male wages (Rs./day)	13.753*** (2.747)	0.061* (0.031)	0.076 (0.051)	0.046** (0.014)	0.020** (0.007)	21.102** (6.893)
Panel A: Cotton and Paddy growing households (N=2324)						
Female wages (Rs./day)	-4.490*** (1.037)	-0.030** (0.011)	-0.004 (0.017)	-0.017** (0.006)	-0.007*** (0.002)	-6.120* (2.393)
Male wages (Rs./day)	-0.103 (0.814)	0.007 (0.012)	0.002 (0.014)	0.007 (0.006)	0.010 (0.007)	1.202 (1.081)

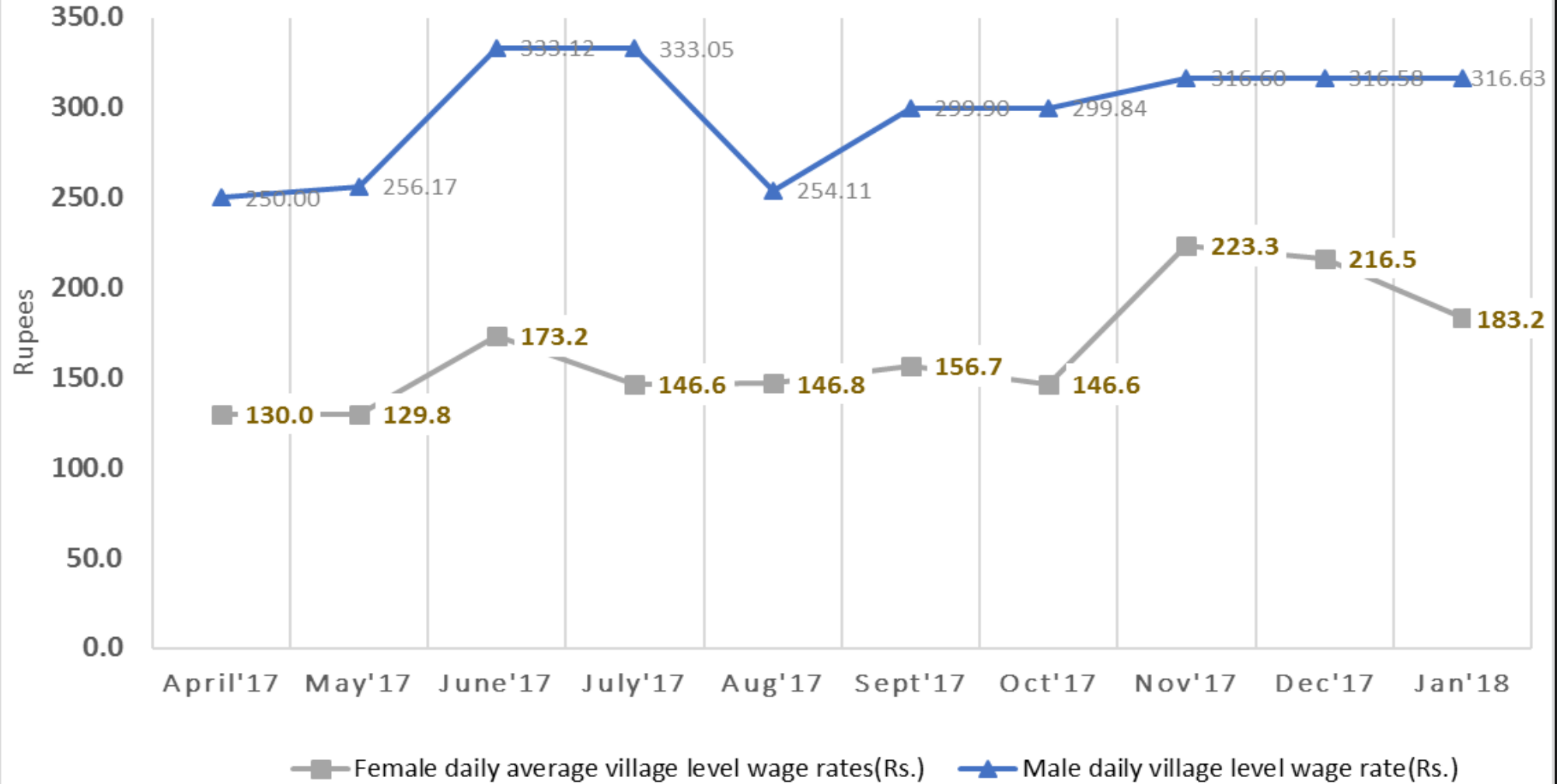
Note: All regressions use individual fixed effect models. Women who have not participated in agriculture at across ten months are excluded from the sample. Standard errors are clustered at individual level. Significance levels: + 0.10 * 0.05 ** 0.01 *** 0.001

Landownership status

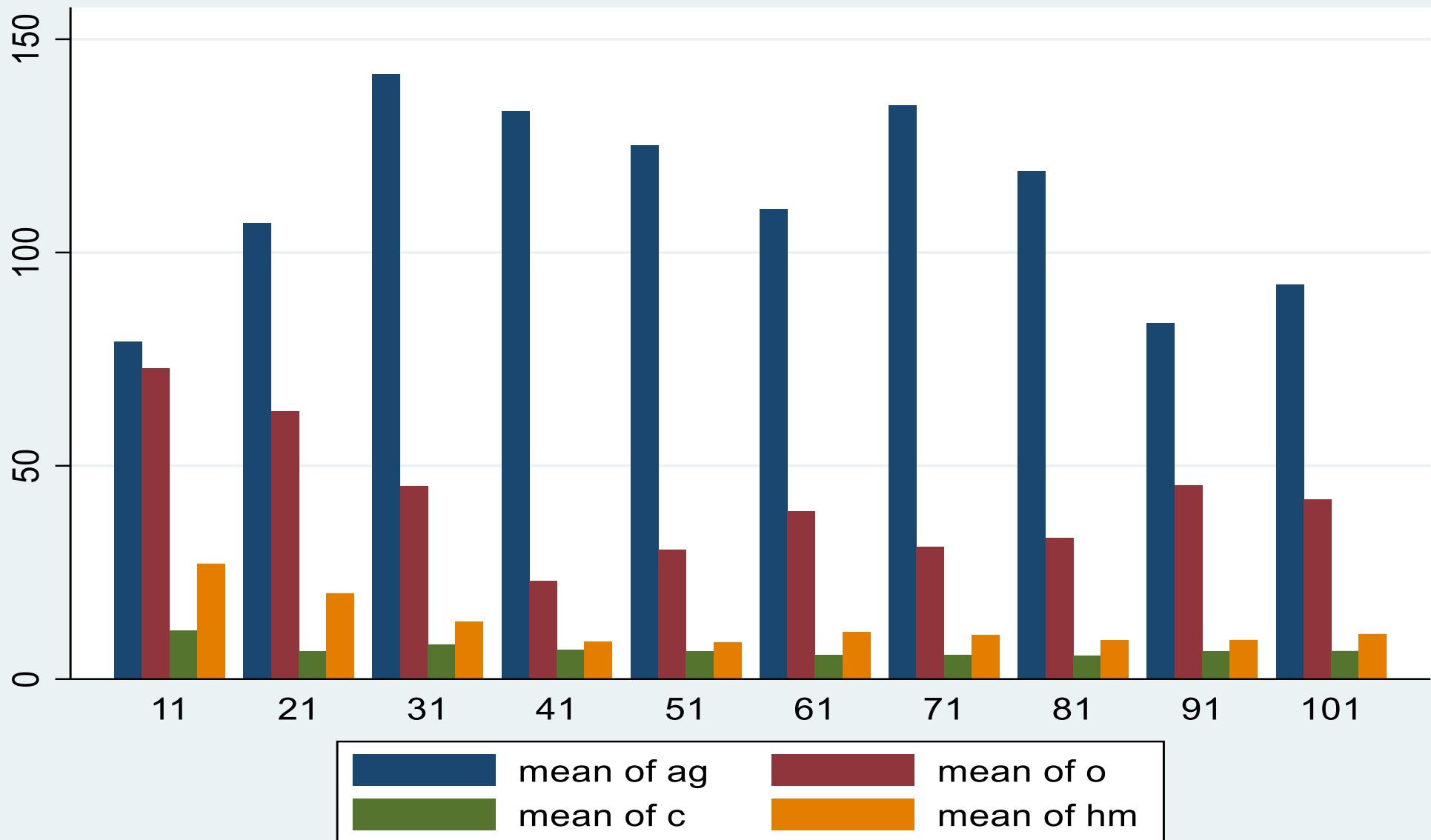
Caste composition

Landownership	N	Percentage
Landless	2,971	31.09
>0-2.3 acres	2,427	25.40
>2.5-5 acres	2,639	27.62
>5 acres	1,519	15.90

Average wages per day(Rs.) across seasons



Time use patterns of men across the rounds (average minutes per day)



Women's contribution to nutrition



- Women are solely responsible for household activities such as cleaning, cooking, childcare (*Jain n.d.; Kumar 1995; Newman 2002; Sharma, Nagar, and Chopra 2007*).
- They contribute to nutrition through their role in food procurement and preparation for the family (*Hyder et al, 2015*).
- Women in India spend about 9 times more time in unpaid work as compared to men and they spend an average of 300 minutes for a



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