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Odisha Particularly Vulnerable Tribal Group Empowerment and Livelihood Improvement Program (OPELIP)

Project team

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CGIAR

Background

OPELIP - aims to empower and improve livelihoods of vulnerable tribal communities in Odisha India.

- Program duration: 2017 – 2024
- The program covers 12 districts in Odisha and aims to improve the living standards of at least 62,356 households (IFAD, 2014).
- The scheduled tribes and castes are among the poorest population groups in rural India (IFAD, 2014)

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Program components

1. Community empowerment
   - Promotion of self-help groups, rural finance and savings, and strengthening village development associations to plan need-based activities
2. Natural resource management and livelihood improvement
   - Issuing landless households with land title certificates for the land they have been cultivating, construction of storage facilities, support for crop improvement activities to improve food security etc.
3. Community infrastructure and drudgery reduction
   - Installation of rice hullers; drying yards; milling units; threshing floors etc.
4. Program management
   - Program administration and budget management; program operations; and intervention implementation.

Motivation

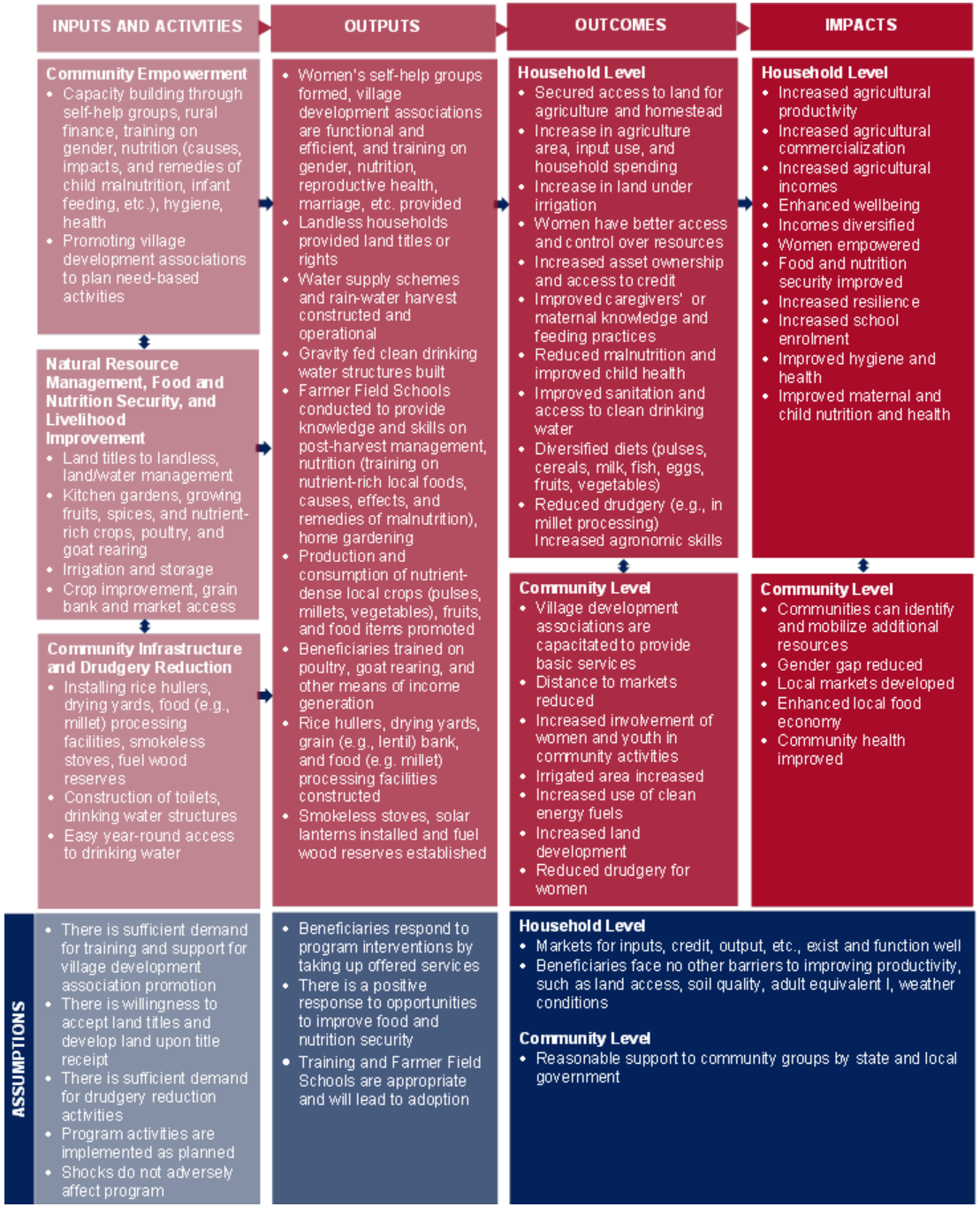
- Limited evidence exists on the impact of agricultural development interventions on livelihood of tribal communities

The midline assessment aims to:

1. provide useful mid-program implementation insights and feedback for continued program implementation
2. evidence on impacts of agricultural investments on development outcomes and living standards of poor and vulnerable populations

Theory of change

(IFAD, 2017)



Impact assessment (IA) questions

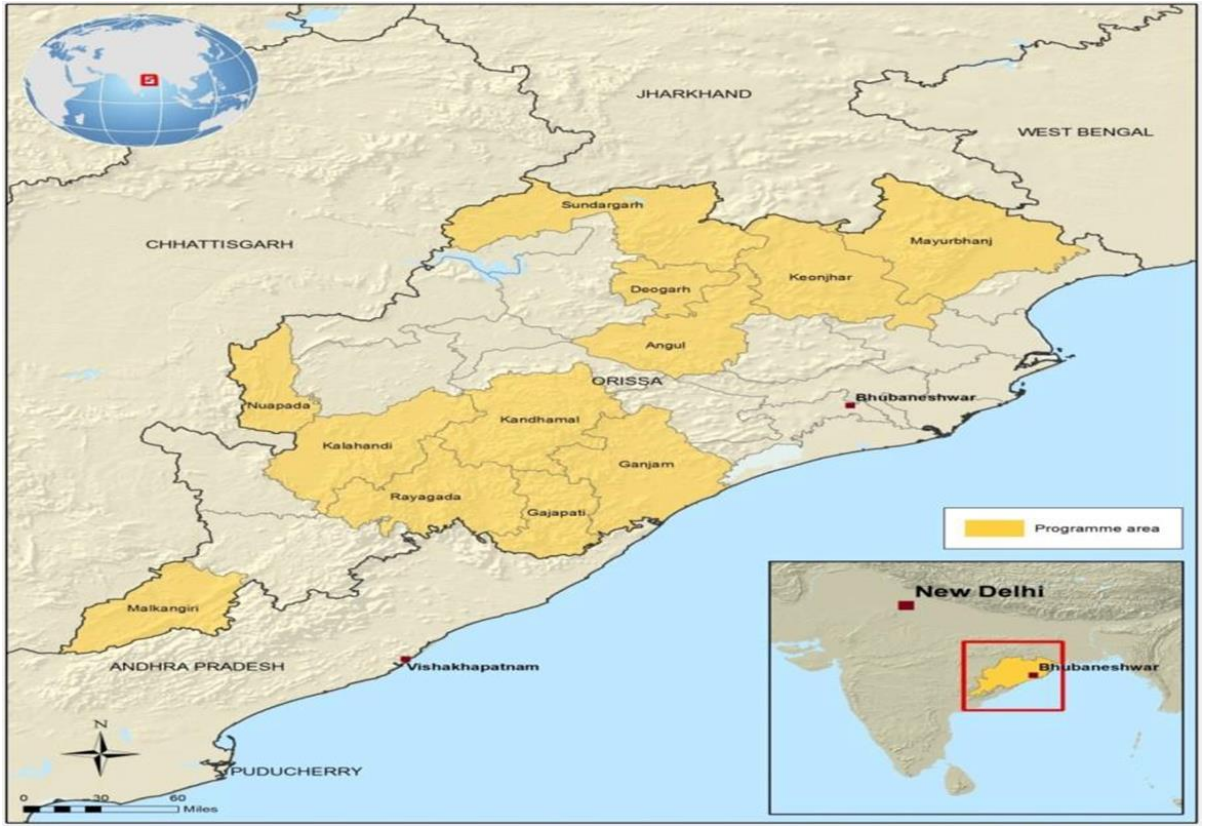
1. Does the program improve technology adoption and use of complementary inputs among program beneficiaries?
2. Does the program contribute to improved agricultural production?
3. Does the program contribute to improved sales or better market access?
4. Does the program contribute to income growth, consumption expenditure, asset accumulation, and reduced poverty among the beneficiaries?
5. Does the program increase income diversification or livelihood opportunities among beneficiaries?

IA questions…

6. Does the program improve child nutrition, dietary diversity, and improve food security among beneficiaries?
7. Does the program increase access to secure agricultural land among beneficiaries?
8. Does the program increase child school enrolment among beneficiary households?
9. Does the program improve women's empowerment or intra-household decision-making?

Target population / program coverage

- OPELIP is implemented in 12 districts in the state of Odisha, which has the largest number of the PVTGs in India
- Within the 12 districts of Odisha, OPELIP is implemented in 17 micro-project areas, which are covered by a micro-project agency (MPA)
- MPAs are government entities that were formed in the late 1970s. They implement special programs targeting PVTGs
- The 17 MPAs cover all the 13 PVTGs in Odisha and serve as the implementing units for OPELIP
- Across the 17 MPAs, OPELIP covers 84 GPs (basic village-governing or administrative units in India), 1,243 villages, and 62,356 households



Sampling strategy

- Same sampling strategy used for the 2017 baseline used (we follow-up on same households)
- Proportional stratified sampling used to select treatment/program households from 17 MPAs
- This led to sampling of 87 treatment/program villages and 1,048 treatment households at baseline
- 1,048 control households were drawn from 87 control villages located outside program areas but within the same block and District.
- Control villages were matched with treatment villages to ensure they are similar in observable characteristics
- Total baseline sample (actual is 2,099 not 2,096)

Identification strategy

- To identify the causal effects of the program, we use the difference-in-differences (DID) estimator to account for unobserved time-invariant confounding factors (Greene, 2012).
- We compare outcomes of program households with those of households not covered by the program
- We use the following specification to estimate the DID:
- $Y_{it} = \beta_0 + \beta_1 Time_t + \beta_2 P_t + \beta_3 (Time_t * P_t) + \vartheta X + \alpha D + \varepsilon_{gt}$

- where Y_{it} is the outcome of interest
- β_1 captures the time trend
- β_2 represents the group effects
- β_3 is our parameter of interest, which estimates the effects of OPELIP

Table 1. Distribution of tribal groups across treatment and control samples

Tribal group	2017			2021		
	Treatment	Control	Full sample	Treatment	Control	Full sample
Particularly vulnerable tribes (PVTG)	449	255	704	408	228	636
	(42.8)	(24.3)	(33.5)	(42.4)	(23.8)	(33.1)
Other Scheduled tribes (STs)	399	589	988	365	533	898
	(38.0)	(56.2)	(47.1)	(37.9)	(55.6)	(46.8)
Scheduled castes (SC)	46	71	117	44	67	111
	(4.38)	(6.77)	(5.57)	(4.57)	(6.99)	(5.78)
Other tribes	156	134	290	145	131	276
	(14.9)	(12.8)	(13.8)	(15.1)	(13.7)	(14.4)
Total	1,050	1,049	2,099	962	959	1,921
	(100)	(100)	(100)	(100)	(100)	(100)

Notes: Numbers are shown with column percentages in parentheses.

Table 2. Statistics of selected household variables by treatment status

	2017		2021	
Panel A: Household head characteristics	Treatment	Control	Treatment	Control
Age of head (years)	46.2	46.4	48.3	48.8
	(13.1)	(13.0)	(13.0)	(12.8)
Education of head (years)	2.58	2.53	3.00	2.99
	(3.89)	(3.78)	(4.01)	(3.96)
Female head (%)	10.2	9.63	13.6	13.6
	(30.3)	(29.5)	(34.3)	(34.2)
Married head (%)	86.7	85.8	82.2	82.3
	(34.0)	(34.9)	(38.3)	(38.2)
Observations	1,050	1,049	962	959

Notes: Point estimates are sample means. Standard deviations are in parentheses. A two-sample t-test is used for the test of mean differences between treatment and control groups in the same year. Level of significance $^{*}p$ <0.10, $^{**}p$ < 0.05, and $^{***}p$ <0.01.

Table 2…

	2017		2021	
Panel B: Household characteristics	Treatment	Control	Treatment	Control
Household size (count)	4.83	4.78	4.69	4.58
	(1.87)	(1.75)	(1.85)	(1.76)
Number of children below 14	1.49	1.43	1.36**	1.20
	(1.37)	(1.34)	(1.31)	(1.26)
Number of youth 15-29	1.40	1.39	1.33	1.38
	(1.20)	(1.18)	(1.19)	(1.23)
Number of adults 30-64	1.73	1.75	1.76	1.76
	(0.85)	(0.86)	(0.84)	(0.81)
Number of adults 65 and over	0.20	0.22	0.25	0.24
	(0.46)	(0.48)	(0.52)	(0.52)
Dependency ratio	0.66	0.65	0.63***	0.56
	(0.64)	(0.64)	(0.65)	(0.61)
Literacy rate (%)	50.9	52.4	57.2	59.0
	(30.8)	(29.5)	(30.2)	(29.0)
Observations	1,050	1,049	962	959

Notes: Point estimates are sample means. Standard deviations are in parentheses. A two-sample t-test is used for the test of mean differences between treatment and control groups in the same year. Level of significance $^{*}p$ <0.10, $^{**}p$ < 0.05, and $^{***}p$ <0.01.

Table 3. Effect of OPELIP on adoption of inputs, production, and sales

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Inputs		Use of improved seed (%)	Use of chemical fertilizer (%)	Use of manure (%)	Use of pesticide (%)	Irrigation (%)
Time × Treatment (program)		3.145	15.235***	-2.337	3.690	-8.168**
		(4.013)	(4.235)	(4.802)	(3.555)	(3.736)
Control variables		Yes	Yes	Yes	Yes	Yes
R-squared		0.339	0.159	0.319	0.100	0.554
Observations		7,028	7,028	7,028	7,028	7,754
Panel B: Production	Total value of production (rupees)	Log of total value of production	Value of crop production (rupees)	Log of value of crop production	Value of livestock production (rupees)	Log of value of livestock production
Time × Treatment (program)	3941.3	0.413**	26,908.1*	0.665**	-1,520.8*	0.361
	(2,689.7)	(0.188)	(14,451.2)	(0.262)	(891.8)	(0.242)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.757	0.274	0.020	0.231	0.956	0.288
Observations	4,020	4,020	4,020	4,020	4,020	4,020

Notes: Point estimates are estimated using difference-in-difference regression. Robust standard errors clustered at the village-level appear in parentheses. Level of significance $^{*}p < 0.10$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

Table 3…

	(1)	(2)	(3)	(4)	(5)	(6)
Panel C: Revenue/Sales	Value of sales (rupees)	Log of value of sales	Value of crop sales (rupees)	Log of value of crop sales	Value of livestock sales (rupees)	Log of value of livestock sales
Time × Treatment (program)	510.2	0.096	2398.6	0.327	-729.4	-0.180
	(1,471.3)	(0.377)	(1,585.7)	(0.417)	(1,332.5)	(0.289)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.167	0.206	0.218	0.244	0.127	0.168
Observations	4,020	4,020	4,020	4,020	4,020	4,020

Notes: Point estimates are estimated using difference-in-difference regression. Robust standard errors clustered at the village-level appear in parentheses. Control variables include: age of household head, age of head squared, sex of head, marital status of head, education of head, household size, land size, squared land size, land *patta*, irrigation dummy, TLU, group membership, prior coverage by MPA, time, and interaction of time district dummies. 1 USD = 65.1 INR (Indian rupees). Level of significance $^{*}p < 0.10$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

Table 4. Effect of OPELIP on wellbeing indicators

	(1)	(2)	(3)
Panel A: Income	Per adult equivalent monthly income (rupees)	Log of per adult equivalent monthly income	Income poor (%)
Time × Treatment (program)	96.113	0.412*	-6.472**
	(76.160)	(0.214)	(2.883)
Control variables	Yes	Yes	Yes
R-squared	0.278	0.347	0.285
Observations	4,020	4,020	4,020
Panel B: Consumption	Per adult equivalent monthly expenditure (rupees)	Log of per adult equivalent monthly expenditure	Consumption poor (%)
Time × Treatment (program)	81.57	0.113**	-8.812***
	(50.076)	(0.049)	(3.469)
Control variables	Yes	Yes	Yes
R-squared	0.209	0.313	0.214
Observations	4,020	4,020	4,020

Notes: Point estimates are estimated using difference-in-difference regression. Robust standard errors clustered at the village level appear in parentheses. Level of significance $^{*}p < 0.10$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

Table 4...

	(1)	(2)
Panel C: Asset	Asset index	Asset poor (%)
Time × Treatment (program)	0.079	-7.605*
	(0.068)	(3.100)
Control variables	Yes	Yes
R-squared	0.262	0.218
Observations	4,020	4,020

Notes: Point estimates are estimated using difference-in-difference regression. Robust standard errors clustered at the village level appear in parentheses. Level of significance $^{*}p < 0.10$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

Table 5. Effect of OPELIP on income/livelihood diversification

	(1)	(2)
	Number of income sources (0-6)	Income diversification (Margalef index)
Time × Treatment (program)	0.076	0.005
	(0.070)	(0.007)
Control variables	Yes	Yes
Wald Chi or R squared	2,710	0.337
Observations	4,020	2,975

Notes: Point estimates are estimated using difference-in-difference regression. Robust standard errors clustered at the village level appear in parentheses. Level of significance $^{*}p < 0.10$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

Table 6. Food security and child nutrition

	(1)	(2)	(3)	(4)
Food security; Panel A	FIES (0-8)	HDDS (0-12)	Food expenditure per adult equivalent (Rupees)	Log of food Expenditure per adult equivalent
Time × Treatment (program)	0.161	0.015	70.11**	0.114**
	(0.140)	(0.021)	(30.03)	(0.048)
Control variables	Yes	Yes	Yes	Yes
(Wald chi2) R-squared	996.6	499.5	0.218	0.351
Observations	4,020	4,020	4,020	4,020
Child nutrition: Panel B		Stunting (%)	Underweight (%)	Wasting (%)
Time × Treatment (program)		-3.224	-1.691	-5.392
		(6.121)	(5.683)	(4.926)
Observations		Yes	Yes	Yes
R-squared		0.126	0.096	0.057
Observations		1,113	1,113	1,113

Notes: FIES; food insecurity experience scale, HDDS; household dietary diversity score. Point estimates are estimated using difference-in-difference regression. Level of significance $^{*}p < 0.10$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

Table 7. Effect of OPELIP on land tenure, school enrolment and women empowerment

	(1)	(2)	(3)	(4)	(5)
	Land title (%)	Land ownership (%)	% of school-aged children attending school	Women empowerment (share of women only decision) (0-1)	Women empowerment (share of joint decisions) (0-1
Time × Treatment (program)	-4.043	-0.174	1.155	-0.006	0.001
	(2.912)	(3.745)	(3.187)	(0.007)	(0.018)
Control variables	Yes	Yes	Yes	Yes	Yes
R-squared	0.384	0.178	0.112	0.887	0.294
Observations	4,020	4,020	2,739	4,020	4,020

Notes: Point estimates are estimated using difference-in-differences regressions. Robust standard errors clustered at the village level appear in parentheses. Level of significance $^{*}p < 0.10$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

Conclusion

- The midline evaluation shows positive effects of OPELIP on fertilizer use, value of production, monthly per adult equivalent incomes and consumption expenditures, and poverty reduction.
- But the results do not show significant effects on most of the indicators (e.g. on land tenure, sales revenue, food and nutrition security)
- Part of the reasons for the insignificant effects of OPELIP could be delays in program implementation or slow uptake of certain OPELIP interventions
  - e.g. access to irrigation, adoption of kitchen gardens to promote diverse and quality diets, land titling, and women empowerment trainings.

Recommendations

- Component 1: focus on how to engage women to increase their participation in women self-help groups and enrollment in women empowerment programs to improve gender balance and women empowerment.
- Component 2: the PMU should focus on promoting adoption of more productive varieties of various nutrient-dense crops traditionally cultivated by the PTVGs and promote kitchen gardens.
- Component 3: promote market access to boost farm and off-farm incomes.
  - Only 3.5% of the treatment villages had a market for selling agricultural products. Hence, we recommend construction or rehabilitation of the planned markets and upgrading of village link roads to improve market access.

IFAD indicators

1. Demographics (age of household head, education level)
2. Assets (asset index)
3. Land use (Total land owned, cultivated)
4. Agricultural features (proportion of irrigated land)
5. Access to markets (distance to market)
6. Disability (vision, hearing)
7. Subjective wellbeing
8. Gender (e.g. Control over use of income)
9. Youth (e.g. Pro-WEAI)
10. Resilience (e.g. Livelihood diversification (Margaleff)
11. Food security (HDDS)
12. Crop production (total number of crops, yield, value of crop production)
13. Livestock production (value of livestock production)
14. Production (total value of production)
15. Market access (value of agricultural sales)
16. Agricultural technology adoption (farming practices)

Impact of home garden intervention

- Target - 32,000 beneficiaries, to help them increase their production and consumption of highly nutritious foods (IFAD, 2014)
- Households required to own at least 40 m2 of land to establish the home gardens
- Households that adopted home gardens were offered agronomic training tailored for home garden establishment
- A home garden package including a water storage tank and hoses for irrigation, seeds, seedlings, and saplings of various seasonal F&Vs was provided (IFAD, 2014).

Objective and approach

- To analyze the effects of home gardens on household food security, child anthropometry, dietary quality, income, and poverty
  - We add to the evidence of the impact of agricultural interventions in India, South Asia, and among vulnerable population groups
  - We provide evidence of impacts of home gardens on a large range of nutritional and income indicators within the same study
- Methods
  - We compare home garden adopters with non-adopters
  - Out of 1,921 households, 175 (9%) households adopted home gardens
  - Difference-in-differences estimators used to control for confounding factors
  - Propensity score matching approaches used for analysis of cross-section (dietary quality) data

Table 1. Effect of home gardens on food security and child anthropometry

	Household food security		Child anthropometry		
	(1)	(2)	(3)	(4)	(5)
Variable	Household dietary diversity score (0-12)	Value of home-produced food (Rupees)	Prevalence of stunting (%)	Prevalence of underweight (%)	Prevalence of wasting (%)
Home garden × time	0.100***	74.349***	23.100	13.130	-9.949
	(0.034)	(23.819)	(14.023)	(14.192)	(11.051)
Control variables	Yes	Yes	Yes	Yes	Yes
Observations	3842	3842	753	753	753
R-squared		0.125	0.100	0.083	0.109

Notes: Column (1) estimated using difference-in-difference (DID) Poisson regression, and column (2) estimated using DID linear regressions are shown with robust standard errors clustered at the village level in parentheses. *, **, and *** significant at 10%, 5%, and 1% level, respectively.

Table 2. Effect of home gardens on dietary quality

	(1)	(2)	(3)	(4)
Indicator	OLS ATT(SE)	Neighbor matching ATT(SE)	IPW ATT(SE)	Observations
Minimum dietary diversity (MDD) (%)	16.714	7.619	3.350	161
	(15.282)	(24.992)	(14.420)	
Minimum dietary diversity for men (MDD-M) (%)	5.110*	7.484**	4.991*	1,715
	(2.806)	(3.299)	(2.692)	
Minimum dietary diversity for women (MDD-W) (%)	4.225*	5.952*	4.521*	1,855
	(2.469)	(3.543)	(2.536)	

Notes: Point estimates are estimated using OLS and propensity score matching. Robust standard errors appear in parentheses. Control variables include: age of household head, age of head squared, sex of head, marital status of head, education of head, household size, land size, squared land size, land *patta*, TLU, district dummies. *, **, and *** significant at 10%, 5%, and 1% level, respectively.

Table 3. Effect of home gardens on income and poverty

Variable	(1) Per adult equivalent monthly income (Rupees)	(2) Income poor (%)
Home garden × time	290.281*	-11.656**
	(156.197)	(5.185)
Control variables	Yes	Yes
Observation	3842	3842
R-squared	0.275	0.294

Notes: Coefficients are estimated using difference-in-difference, and are shown with robust standard errors clustered at the village level in parentheses. Control variables include: age of household head, age of head squared, sex of head, marital status of head, education of head, household size, land size, squared land size, land *patta*, TLU, group membership, district dummies. *, **, and *** significant at 10%, 5%, and 1% level, respectively.

Conclusion on home garden intervention

- Home gardens can help promote household food security, adult dietary quality, and income gains in rural farming communities including vulnerable population groups.
- However, complementary interventions will be needed to improve children's dietary quality and anthropometry.

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Thank you!

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