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Research Article

Productive safety net program and its impact on the livelihood of rural households in Doba district, Ethiopia

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Abstract

The Productive Safety-Net Program (PSNP) stands as a pivotal policy endeavor jointly undertaken by the government and donors to transition numerous chronically food-insecure rural inhabitants from a reliance on recurrent emergency food aid to a more stable, foreseeable, and predominantly cash-oriented form of social safeguarding. This study aimed to scrutinize the principal attributes of the PSNP and its influence on the sustenance of rural households within the confines of Doba District, Ethiopia. A meticulous multi-stage sampling methodology was deployed to select 220 participants for the study, encompassing both PSNP beneficiaries and non-participants. Data collection was conducted through a blend of questionnaires, focus group discussions, key informant interviews, and a thorough review of pertinent documents. The data underwent analysis utilizing the propensity score matching (PSM) technique and the binary logistic regression model. Findings indicate a noteworthy enhancement in total annual income by 39% and calorie intake by 8.4% within PSNP beneficiary households in contrast to non-participating counterparts. In summation, the PSNP exhibits a discernibly positive and statistically significant impact on food consumption, total annual income, and overall livelihoods of households. Moreover, outcomes derived from the logistic estimator underscore a substantial correlation between PSNP participation and factors such as land under cultivation, livestock ownership, housing materials sourced from the extension office, and accessibility to credit services.

Keywords: Food security, graduation, livelihood, productive safety net program, safety net, social security protection

1. INTRODUCTION

The safety net is one of the components of social protection aimed at combating poverty and vulnerability. Social safety nets are programs designed to provide support to individuals at risk

of poverty, food insecurity, or other forms of deprivation through the provision of food, cash, or vouchers (WFP, 2017). According to Subbarao et al. (1996) and Devereux (2002), safety net programs can be provided conditionally or unconditionally, in kind or through cash or vouchers, by the public sector (state, donors, NGOs) or by private actors (individual or group charity, informal household arrangements, etc.).

Social safety nets have their roots in Latin America (the 1980s) and Eastern Europe (the 1990s), which prompted the International Monetary Fund (IMF) and the World Bank (WB) to emphasize the importance of social safety nets in addressing vulnerable groups. According to Rahman et al. (2011), the first cash transfer program for the poor was initiated in 1994 during the Mexican crisis (the Tequila Crisis), and the first conditional cash transfer program in 1995 in Brazil, which has now been expanded to many countries. There is a growing interest, with an increasing number of countries introducing safety net programs. Social safety nets are currently available to individuals and families in 131 developing and emerging countries (Banerji & Gentilini, 2013).

Chronic food insecurity has long been a defining feature of poverty affecting millions of Ethiopians. The majority of poor households reside in rural areas and heavily depend on rain-fed agriculture for their sustenance. Recurrent drought, with its far-reaching consequences, remains the primary cause of food insecurity among these households. Since the famine of 1983–84, the response to the threat of food insecurity has mainly consisted of emergency appeals for food aid and other forms of urgent assistance (Gilligan et al., 2008). While these efforts prevented widespread famine, they did not avert resource depletion in drought-affected and vulnerable households. Consequently, the demand for emergency food assistance surged from approximately 2.1 million in 1996 to 13.2 million in 2003, before declining to 7.1 million in 2004 (World Bank, 2004).

Acknowledging the situation, the Ethiopian government initiated the Food Safety Program in 2003 and officially launched the PSNP in 2005 to tackle food insecurity with both governmental and funding support. This program stands as one of Africa's largest national social protection initiatives, with an annual budget of around $650 million. Operating in seven regions and benefiting at least eight million people during Phase IV (mid-2015–2020), it encompasses 4,444 communities, including the most drought-prone districts (Knippenberg et al., 2017).

The program's primary objective is to address predictable food insecurity by introducing innovative strategies to bolster households' resilience and ability to adapt to various shocks. In line with this, and to build on the accomplishments and insights gained from prior PSNP phases,

the final phase of the 2015–2020 program (PSNP-4) was devised with the aim of "enhanced participation in an improved national safety net for the welfare and food security of food-insecure households" (MoARD, 2015).

In terms of the program's targeting process, the PSNP employs a combination of geographic and community-based approaches to identify households grappling with chronic food shortages. Initially, the PSNP focused on selecting households facing significant food insecurity, including those reliant on past food aid. The initial selection is based on fundamental criteria, with subsequent validation and refinement carried out by program developers according to the household's living conditions (assets and income). However, communities have substantial autonomy to modify this method and update their lists of food-insecure households annually using local criteria. This flexibility allows households experiencing sudden impoverishment due to severe asset loss to be considered and may exclude households that have regained financial stability and no longer require state assistance from the recipient lists (Berhane et al., 2017).

In practice, the program offers cash, cereals, or a combination of both for public works. Beneficiaries unable to participate in public works due to chronic illness or other constraints receive unconditional cash or food transfers of equivalent value. These contributions are provided to households for a period ranging from 6 to 12 months. The program comprises two main components: (i) the labor-intensive Public Work (PW) component, which includes Temporary Direct Support (TDS) recipients; and (ii) the Permanent Direct Support (PDS) component. In 2016/17, personal works of the beneficiaries accounted for 86% of the total 8 million beneficiaries. The public work component encompasses a significant number of projects at the municipal level, with around 60% dedicated to natural resource restoration, such as soil and water conservation, and enhancing climate resilience in Ethiopia (Haverkort et al., 2015).

The Doba District is one of the seventeen targeted districts in West Hararghe Zone, historically characterized by chronic food insecurity and reliance on food assistance. The PSNP was initiated in the district in 2005, initially targeting approximately 16,456 households. However, the number of beneficiary households has since increased to 35,245 across the district's 40 rural kebeles. Among these beneficiaries, 82% are involved in public works, while the remaining 18% receive direct support in addition to PSNP; 21,053 beneficiaries are assisted through emergency programs. This data highlights that around 32% of the district's population receives support from PSNP and emergency food aid (WHANRO, 2019). Consequently, this study aims

to examine the key features and impacts of the PSNP on rural household food security in the Doba district, where the program has been operational for the past fifteen years.

An expanding body of literature now explores the effects of safety net programs on rural household food security, particularly in terms of influencing food consumption, income, and asset accumulation. While various studies have investigated the impact of the PSNP in Ethiopia at national level, such as by Andersson et al. (2009), as well as at district level by Habtamu (2011), Tadele (2011), Yitagesu (2014), Nesreddin (2014), and Anwar (2015), these assessments have focused on areas like livestock and tree holdings, household resilience, asset building, sustainable land management, and enhancing food security at the household level to reduce vulnerability.

Andersson et al. (2009), Habtamu (2011), and Tadele (2011) suggest that while the PSNP's impact on asset maintenance and accumulation has been limited, it has effectively addressed the food deficit. Conversely, studies by Yitagesu (2014), Nesreddin (2014), and Anwar (2015) demonstrate that the PSNP has played a crucial role in curtailing livestock losses, boosting household income, and alleviating poverty through increased wealth creation. Nonetheless, despite extensive research on the effects of the PSNP on household food security at both national and local levels, there remains limited empirical evidence on whether the program has achieved its intended outcomes in enhancing household food security, particularly within the study area. This study aims to evaluate the primary characteristics and impacts of the productive safety net program on rural households' livelihoods in the selected study area over the past 15 years since its inception.

2. MATERIALS AND METHODS

2.1. Description of the study area

Doba District is one of the seventeen districts in the West Hararghe Administrative Zone of Oromia National Regional State. The astronomical location of the district is between 9°10'0" N and 9°30'0" N latitudes and 40°55'0" E and 41°16'0" E longitudes (Figure 1). It shares boundaries with Chiro District in the south, Mieso District in the west, the Somali Region in the north, the East Hararghe Zone in the east, and Tulo District in the southeast. The district covers a total area of 702.82 hectares and is located 382 km to the east of Addis Ababa, which is the capital city of Ethiopia, and 45 km from Chiro, the zonal capital of the West Hararghe Zone. The district has 40 rural kebele administrations and 2 town kebele administrations that are in different geographical features of agroecological zones (WHPEDO, 2018). Doba District has a total population of 133,939, with 68,512 (51%) males and 65,427 (49%) females (CSA,

2007). The district's annual mean maximum temperature is computed as 25°C, the annual average minimum temperature is 19°C, and the average of the two is found to be 22°C. The annual rainfall in the district ranges from 559 mm to 1235 mm (NMA, 2019). Doba District falls under the Western Hararghe Agro-Pastoral Livelihood Zone. Rain-fed crop production is an important means of livelihood in addition to livestock production (WHANRO, 2019).

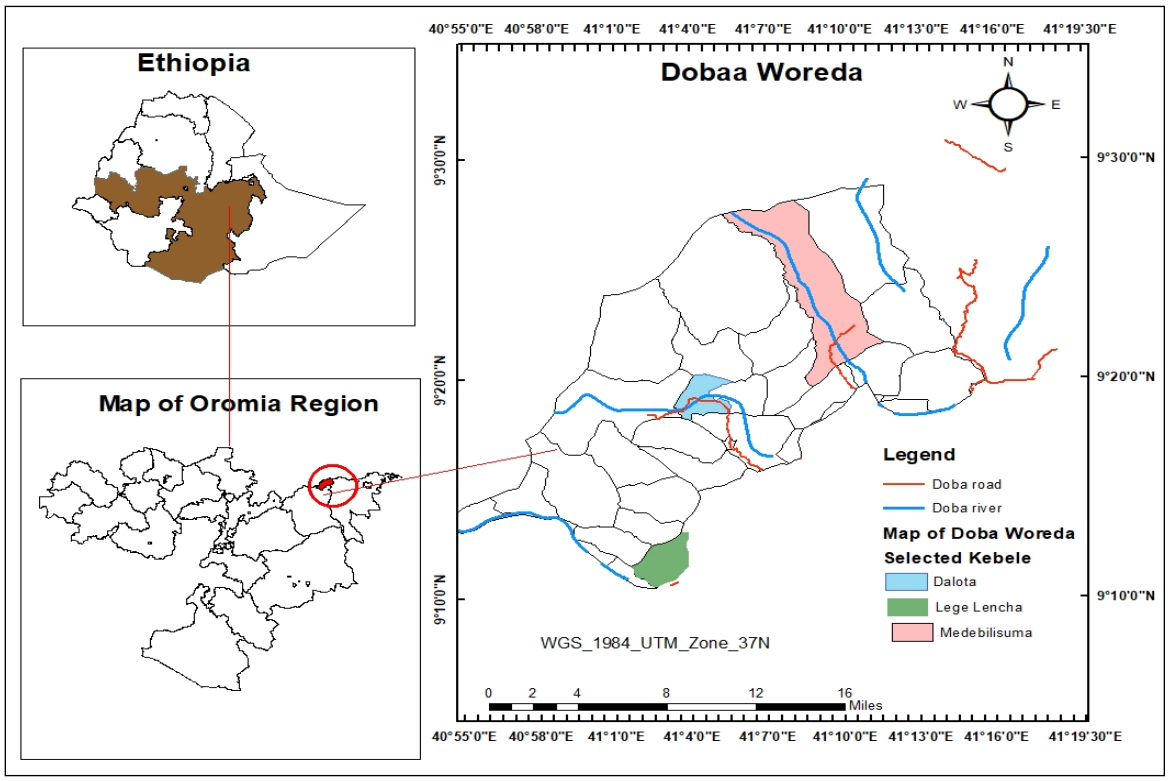


Figure 1. Map of the Study Area.

2.2. Research design and approach

This study was conducted using a quasi-experimental design, also known as the "non-experimental method," which is used when randomization is not feasible (i.e., constructing treatment and comparison groups through an experiment is not possible). According to Jalan and Ravallion (2003), for large-scale or national projects, it is typical to have access to only a single cross-sectional survey conducted after the project's implementation. The study utilized a primarily mixed-methods approach for collecting and analyzing both quantitative and qualitative data.

2.3. Data sources and collection methods

Data were collected from both primary and secondary sources, encompassing qualitative and quantitative data. The primary data were gathered from 220 selected sample respondents, the district food security task force, the kebele food security task force, and key informants.

Secondary data relevant to the research were collected from various stakeholders, particularly from the district and zone agriculture and natural resource offices, as well as non-governmental organizations operating in the district. In addition to the primary data, secondary data were sourced from government official reports, CSA, NMA, books, journals, and other relevant sources for this study. Household surveys, focus group discussions, key informant interviews, and document reviews were employed to collect both quantitative and qualitative data.

2.4. Sample size and sampling procedure

Doba District was purposefully selected due to its chronic food insecurity, higher caseload, and years of support provided through emergency and safety net programs, as reported annually (WHANRO, 2018). Subsequently, employing a stratified random sampling technique, three kebeles were chosen, and a total of 220 households (110 PSNP participants and 110 PSNP non-participants) were selected using proportionate random sampling based on Cochran's formula (1963). Cochran developed Equation 1 to obtain a representative sample for proportions and proposed a correction formula to calculate the final sample size in this case, as detailed below (Equ. 1&2):

$$no = \frac{Z^2 pq}{e^2} \quad \text{..... (equ. 1)}$$

$$n = \frac{n_o}{1 + \frac{n_o - 1}{N}} \quad \text{..... (equ. 2),}$$

2.5. Methods of data analysis

The study analyzed the main features and impacts of the Productive Safety Net Program on the livelihoods of rural households using both descriptive statistics and an econometric model. A fundamental challenge in quantitatively evaluating the impact of a program like the PSNP is that only the outcomes of beneficiaries receiving benefits are observable, while what would transpire for these households without benefits is unobservable, known as the problem of the counterfactual. Another issue is selection bias, which emerges when beneficiaries systematically differ from non-beneficiaries. The study's ability to draw conclusions about the causal impact of the PSNP hinges on effectively addressing these two challenges (Berhane et al., 2017). Consequently, the study employed the propensity score matching (PSM) method, currently a widely used matching technique in program impact evaluation. PSM utilizes a fully nonparametric approach to estimate the outcome model. Finally, to quantify the empirical results, statistical software (STATA version 13 for data analysis and SPSS version 20 for coding and data entry) was utilized.

2.5.1. Propensity Score Matching (PSM) Method

In the current program impact evaluation, PSM is one of the most commonly used methods when there is a lack of a baseline survey and random assignment of treatments to subjects is not feasible. PSM refers to the pairing of treatment and control groups with similar values on the propensity score, and possibly other covariates (Rubin, 2001). The dependent variable of interest for this study was program participation, which has a binary nature by taking a value of 1 or 0. Assessing the impact of any intervention requires making an inference about the outcomes that would have been observed for participants if they had not participated in the program. The appropriate evaluation of the impact of the program requires identifying the average treatment effect on the treated (ATTs), defined as the difference in the outcome variables between the treated households and their counterfactual. According to Rosenbaum (2002), counterfactual refers to what would have happened to the outcome of program participants if they had not participated in the treatment. In the case of binary treatment in the program, the treatment indicator equals one if the individual receives treatment and zero otherwise. As shown in Equ.3, for each individual i, where i= 1, 2……n, etc., the treatment effect of individual i can be articulated as:

(1) $T_i = Y_i(1) - Y_i(0)$ ……. (equ. 3)

Estimating individual treatment effects is not possible. Therefore, the average (population) treatment effect on the treated (ATT) is developed which is specified as:

(2) T_{ATT} = E (T\D = 1) = E [Y (1) \ D = 1] – E [Y (0) \ D = 1]…… (equ. 4)

Therefore, the counterfactual mean for those being treated is represented as:

- E [Y (0) │D = 1]

(3) ATT = E [Y (1) \ D = 1] - E [Y (0) \D = 1] = T_{ATT} + E [Y (0) \D = 1] - E [Y (0) \D = 0]……. (equ. 5)

Is so-called ‘self-selection bias’ then the true parameters of A_{ATT} is only identified if

(4) E [Y (0) \D = 1] - E [Y (0) \D = 0] = 0……. (equ. 6)

(5) A_{ATT} = E [Y (1) - Y (0)]…… (equ. 7)

Common support region given by:

(6) (overlap) 0 < p (D = 1\ X) < 1……. (equ. 8)

Lastly the general PSM model specified as a fallow:

(7) A_{ATT} = Ep(x) │D = 1{E [Y (1) \ D = 1, p(x)] - E [Y (0) \ D = 0, p(x)]}…… (equ. 9)

Therefore, ATTs is simply the mean difference in outcomes over the common support, appropriate weighted by the propensity score distribution of participants.

2.5.2. Binary Logit Model Specification

Adopting from Gujarati (2004) the logistic distribution function for the determining factors in livelihood status of the households is specified as follows:

(8) p_i = E (y = 1|x1) = $\frac{1}{1+e^{\beta 0 + \beta 1 x1}}$…… (equ. 10)

This can be simplified as:

(9) $p_i = \frac{1}{1+e^{-zi}}$……..…….. (equ. 11)

The probability that a given household is affected by PSNP participation (participant) is expressed by equation 11 while the probability of not being affected (non-participant) is:

(10) 1 - $p_i = \frac{1}{1+e^{zi}}$ …… (equ. 12)

Therefore, the odds ratio can be written as:

(11) $\frac{p(i)}{1-p(i)} = \frac{1+e^{z(i)}}{1+e^{-z(i)}} = e^{zi}$…… (equ. 13)

Now (Pi/1-Pi) is simply the odds ratio in favor of participating in PSNP; the ratio of the probability that a household would be influenced by the program to the probability of that they are not influenced. Finally, taking the natural logarithms of the odds ratio of equation would result the logit model as indicated below.

(12) Li= ln $\left(\frac{p(i)}{1-p(i)}\right)$ = ln [e^{zi}] = z_i…… (equ. 14)

Where: Z i= is a function of n explanatory variables (Xi) which is also expressed as:

(13) $z_i = \beta o + \beta 1\, x1 + \beta 2 x2 + \ldots\ldots \beta n Xn$…… (equ. 15)

Where: β0, is an intercept, β1, β2... βn are slopes of the equation in the model. Li is log of the odds ratio, which is not only linear in X but also linear in the parameters. Xi is vector of explanatory variables. Finally, disturbance term I which is unobserved factors are considered and the logit model becomes:

(14) Zi = $\beta 0 + \beta 1 x1 + \beta 2 x2 + - - - - - - - + \beta n\, X\, n + \mu i$….. (equ. 16)

2.6. Description of variables

The variables are described in the below table (Table 1).

Table 1. Variables definition and description used in PSM analysis

Variable	Type and definition	Measurement
Dependent variables		
TYPEOFRESPONDENT	Dummy, participation in PSNP	1 if yes, 0 otherwise
Outcome Variables		
HHCALORICONSUMTION	Continuous, calorie intake in AE	Calorie
TOTALINCOME	Continuous, Total income of the HH	Birr
Independent variables (Pre- intervention)		
AGEHHH	Continuous, age of the household head	Years completed
SEXHHH	Dummy, Sex	1 if the HH is Male and 0, otherwise
EDUHHH	Dummy, Education level of the HH	1 if the HH is literate and 0 otherwise
FAMILYSIZE	Continuous, Family size	Number of household members
DEPRATO	Continuous, dependency ratio	Ratio
TOTALLAND	Continuous, Land holding size of the household	Hectare /*Timad (Qindii)*
TOTALTLU	Continuous, Livestock holding	Tropical Livestock Unit (TLU)
CHEMIFER	Dummy, Fertilizer use of the HH	Take the value of 1 if the HH is using and 0 otherwise
IMPRVEDSEED	Dummy, improved seed Use of the HH	1 if the HH is using and 0 otherwise
HOUSING	Dummy, Pre-intervention house type	1 if corrugated,0 otherwise
ACCESSTOEXT	Dummy, access to extension	1 if a household has access to extension and 0 if not
DISTOEXTSERVICE	Continuous, distance from the Extension Service	Kilo meter
ACCESSCREDIT	Dummy access to credit	1 if a household uses credit service and 0 if not

3. RESULTS AND DISCUSSION

3.1. Socio-demographic characteristics

Sex of the household head: As presented in Table 2, 23.6% of the beneficiary and 76.4% of the non-beneficiary households were female-headed, while 33.6% of beneficiaries and 66.4% of non-beneficiaries were male-headed. Overall, 71.4% of respondents were from male-headed and 28.6% from female-headed households. Gender was not significantly associated with PSNP participation ($\chi^2 = 4.01$, $p = 0.13$), indicating no meaningful difference between participants and non-participants based on household headship. This is consistent with Abiyot (2012), who also found gender to be an insignificant factor in PSNP participation. However, Mustafa et al. (2023)

reported that gender significantly affects the food consumption score among non-participants—male-headed households had higher scores—while showing no significant effect among PSNP participants at the 10% level.

Table 2. Sex of respondent Household heads

Description of variables	Categories	Type of respondent						χ2	p-value
		PSNP Participant		PSNP Non-Participant		Total			
		Frequency	%	Frequency	%	Frequency	%		
SEXHHH	Male	84	76.4	73	66.4	157	71.4	**4.09**	**0.129**
	Female	26	23.6	37	33.6	63	28.6		

Age of the household head: According to the results presented in Table 3, the mean age of the sampled households was 41.05, with participant and non-participant households having mean ages of 41.05 and 41.04 years, respectively. A significant age difference between participants and non-participants was observed (p = 0.99) with a t-value of 0.01, indicating a deviation from the expected relationship with participation. This finding aligns with the research conducted by Mesfin (2018), which similarly concluded that there is no significant disparity in the age of household heads between participants and non-participants in the PSNP.

Family size: The data presented in Table 3 indicates that the average family size among the sampled households was 7 individuals, with a maximum of 12 and a minimum of 2. On further examination, it was observed that the mean family size of beneficiaries stood at 6.0, while that of non-beneficiaries was slightly higher at 6.4. Despite initial impressions suggesting larger family sizes among non-beneficiary households, statistical analysis revealed that there was no significant difference in mean family sizes between participants and non-participants (p=0.1466, t=1.45). This result contrasts with the anticipated relationship based on participation status. Notably, these findings align with previous research conducted by Mesfin (2018), which similarly found no significant disparity in family sizes between PSNP participants and non-participants. A study by Mustafa et al., (2023) revealed that the household size increases the likelihood of food security de creases for the corresponding households, and thus increases the probability to participating in the program.

***Dependency ratio*:** The dependency ratio, a key demographic indicator, is influenced by factors such as family size and age distribution within a population. In a recent study, it was found that the average dependency ratio among participants stood at 2.54, whereas for non-participants, it was slightly higher at 2.81, indicating a mean difference of 0.27 between the two groups. This

suggests that households not benefiting from certain programs or services tend to have a greater number of dependent family members, defined as individuals below 15 years of age or above 65 years of age, compared to households receiving benefits. Statistical analysis further confirmed the presence of a statistically significant disparity, at a 10% significance level, in the dependency ratios between participants and non-participants, as illustrated in Table 3.

Table 3. Age, family size and dependency ratio of household head

Variables	Total HHs		PSNP Participant		PSNP Non-Participant		t-value	p-value
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**		
AGEHHH	41.05	9.03	41.05	8.59	41.05	9.48	0.01	0.9941
FAMILYSIZE	6.22	2.13	6.01	2.21	6.43	2.04	1.45	0.1466
DEPENDENCYRATIO	2.67	1.18	2.54	1.16	2.81	1.18	1.72	0.0863*

***Educational Level of household head*:** The survey results presented in Table 4 indicate that among the 220 respondents, 34.5% of beneficiaries and 40.9% of non-beneficiaries lack basic literacy skills, while 16.4% of beneficiaries and 14.5% of non-beneficiaries possess reading and writing abilities. Furthermore, 42.7% of beneficiaries and 35.5% of non-beneficiaries have completed primary and junior secondary education levels, while 7% of beneficiaries and 9% of non-beneficiaries have reached secondary education levels. Interestingly, 0.9% of non-beneficiaries have education beyond grade 12. The analysis revealed no statistically significant difference in the educational levels between participants and non-participants. These findings align with previous research conducted by Mesfin (2018), suggesting a lack of substantial variance in educational levels between participants and non-participants in the Productive Safety Net Program (PSNP).

Table 4. Educational level of household head

Description of variables	**PSNP Participant**		**PSNP Non-Participant**		**Total**		**χ2**	**P-Value**
	N	**%**	**N**	**%**	**No**	**%**	2.702	0.609
Cannot read and write	38	34.5	45	40.9	83	37.7		
Can read and write	18	16.4	16	14.5	34	15.5		
Grade 1 to 8	47	42.7	39	35.5	86	39.1		
Grade 9 to 12	7	6.4	9	8.2	16	7.3		
Above Grade 12	0	0	1	0.9	1	0.5		
Total	110	100	110	100	220	100		

***Land holding*:** The analysis conducted on the data presented in Table 5 reveals that the average land holding or farm size for the households in the sample was 0.39 hectares. A notable discrepancy was observed between participant and non-participant households, with a

statistically significant difference noted (p = 0.0003), aligning with the anticipated relationship with participation. The range of land sizes within the sample varied from a minimum of 0 hectares to a maximum of 1.5 hectares. Specifically, participant households exhibited an average land holding of 0.33 hectares, while non-participant households averaged 0.45 hectares. The statistical analysis indicated a significant discrepancy in mean land holdings between the two groups at a 1% significance level, with participant households possessing smaller land holdings than their non-participant counterparts. These findings are in line with previous research conducted by Nesreddin (2014) and Anwar and Mada (2015). Cultivated land also has a significant negative impact for participating and non-participated in PSNP, respectively, at a 10% level of significance. As one unit increases in cultivated land, the log of food consumption score for participants and nonparticipants of PSNP decreases by 0.11 and 0.153 units, respectively (Mustafa et al., 2023).

***Livestock holding*:** Livestock ownership among the sampled households ranged from 0 to 9.35 TLU. On average, PSNP participants held 1.76 TLU, while non-participants held 3.24 TLU (Table 5). The mean difference in livestock holdings was positive and statistically significant at the 1% level, indicating that PSNP participation is associated with changes in livestock size. This result aligns with findings by Nesreddin (2014), Anwar and Mada (2015). Mustafa et al. (2023) also reported that livestock positively and significantly increases the food consumption score for both PSNP participants and non-participants, with a one-unit rise in livestock increasing the log food consumption score by 0.048 and 0.061, respectively.

***Distance from the Development Agent Office*:** The average distance from households to the DA office was 2.63 km. PSNP participants lived farther away (3.09 km) than non-participants (2.17 km), with distances ranging from 0.1 to 5.5 km. Farmers typically travel about 2.6 km to access extension services (Table 5). The difference in distance between participant and non-participant households was positive and statistically significant at the 1% level, matching the expected relationship. These results align with findings by Anwar (2015) and Mesfin (2018).

***Access to fertilizer use*:** The study found that 74.5% of sampled households had access to fertilizer. Among them, 70.9% were beneficiaries and 78.2% were non-beneficiaries. Although non-beneficiary households showed slightly higher access, the difference between the two groups was not statistically significant. These results, presented in Table 6, highlight that factor beyond program participation may influence fertilizer access.

***Access to improved seed*:** About 35.4% of surveyed households had access to improved seeds. Of these, 27.3% were beneficiaries and 43.6% were non-beneficiaries. The difference was

statistically significant at the 5% level, with non-beneficiary households having greater access. These results are consistent with findings by Anwar (2015) and Mesfin (2018) (Table 6).

Table 5. Household Total land holding, Total Livestock (TLU) and Distance to extension office

Variables	Total HHs		PSNP Participant		PSNP Non-Participant		t-value	p-value
	Mean	SD	Mean	SD	Mean	SD		
TOTALLAND (ha)	0.39	0.25	0.33	0.254	0.45	0.28	3.69	0.0003***
TOTALTLU (TLU)	2.5	2.1	1.76	1.84	3.24	2.1	5.58	0.0000***
DISTTOEXTOFFICE(KM)	2.63	1.68	3.09	1.38	2.18	1.84	4.17	0.0000***

*** means significant at 1% probability level.

***Type of roof*:** Table 6 shows that 30.9% of PSNP participants lived in grass-thatched houses, compared to only 9.1% of non-participants. This difference was statistically significant at the 1% level. Most non-participant households (90.9%) lived in corrugated iron–roofed homes, compared to 69.1% of participants. Since roofing material reflects household economic status, the results suggest that owning a corrugated iron roof is negatively associated with PSNP participation, consistent with Anwar (2015).

Table 6. Households access to chemical fertilizer, improved seed, extension, credit and house type

Description of variables	Categories	Type of respondent				χ2	p-value
		PSNP Participant		PSNP Non- Participant			
		Frequency	%	Frequency	%		
Access to Chemical Fertilizer	Yes	78	70.9	86	78.2	1.53	0.139
	No	32	29.1	24	21.8		
Access to Improved Seed	Yes	30	7.3	48	43.6	6.44	0.008**
	No	80	72.7	62	56.4		
Access to Credit	Yes	20	18.2	16	14.5	1.58	0.454
	No	90	81.8	94	85.5		
Access to Extension Service	Yes	102	92.7	104	94.5	0.31	0.392
	No	8	7.3	6	5.5		
Housing	Grass	34	30.9	10	9.1	16.36	0.000***
	Corrugated iron sheet	76	69.1	100	90.9		

*** and ** means significant at the 1% and 5% probability levels, respectively.

***Access to credit service*:** In the study area, a mere 16.36% of sample respondents from households engaged in credit services. Notably, 18.2% of program beneficiary households utilized a credit service, whereas only 14.5% of respondents from non-program households did so. The findings suggest that there exists no statistically significant variance between participant and non-participant households regarding access to credit services. This outcome aligns with

the research conclusions put forth by Mesfin (2018), as detailed in Table 6. In addition, another finding revealed that there is a significant association between credit access and PSNP of respondents with a p-value of 0.000. Respondents who have credit access are 0.3816 times less likely than those who did not have credit access to the participating PSNP (Mustafa et al., 2023).

***Access to extension Service*:** Table 6 shows that 93.6% of all sampled households received extension services. Among them, 92.7% of PSNP beneficiaries and 94.5% of non-beneficiaries were engaged by development agents in 2019. This consistent engagement helped identify beneficiary households as food insecure. However, the difference in access to extension services between the two groups was statistically insignificant.

***Household income and consumption*:** The average annual household income was 17,049.94 Birr. PSNP participants earned a higher mean income (18,581.05 Birr) than non-participants (15,518.82 Birr), a significant difference of 3,062.24 Birr (t = 3.24, p = 0.001) (Table 7). This aligns with Tsegaye (2017). Daily calorie intake ranged from 1,347 to 4,594 kcal. Participants consumed an average of 2,390.03 kcal, slightly higher than the 2,300.62 kcal for non-participants, with an overall mean of 2,345.32 kcal. The difference was significant at the 10% level (t = 1.8, p = 0.078), consistent with findings by Nesredin (2014) and Abduselam (2017) but contrary to Mesfin (2018).

Table 7. Household total annual income and Calorie available per AE in (Kcal) per day

Variables	PSNP Participant		PSNP Non-Participant		Total		MD	t-Value	p-value
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**			
Total Annual Income (Birr)	18581.05	6836.65	15518.82	7183.38	17049.94	7162.46	3062.24	3.24	0.0014***
Calorie available per AE in (kcal)	2390.027	434.71	2300.62	303.086	2345.32	376.54	89.41	1.8	0.0782*

*** and *, means significant at the 1%and 10% probability levels, respectively.

3.2. Major features of PSNP

The Productive Safety Net Program (PSNP) has several key features that set it apart from other social support programs. It includes three main components: means of subsistence, direct support, and social services. The means of subsistence component builds skills in marketing, business management, and value chains, and helps beneficiaries develop business plans for microfinance access. The direct support component provides cash, grain, or both—currently 42 ETB per person per day. Beneficiary selection is community-based, prioritizing households in the lowest wealth ranks. About 90% of beneficiaries engage in labor-intensive public works linked to income generation and natural resource conservation. The PSNP operates alongside

other food security programs, and beneficiaries receive identification cards. Overall, the program supports households with resources and opportunities for improved livelihoods and investment activities.

a) PSNP targeting

According to the survey results, a significant portion of respondents weighed in on the fairness of targeting in relation to the Productive Safety Net Program (PSNP). The data indicates that 75% of PSNP beneficiaries and 36% of non-PSNP beneficiaries viewed the targeting process as fair. Conversely, 25% of program beneficiaries and 64% of non-program beneficiaries expressed opinions that the targeting was unfair. Notably, households not benefiting from the PSNP expressed a desire to be included in the program, citing concerns about insufficient allocated resources and instances where individuals were targeted despite not meeting the criteria. This led to the exclusion of individuals who were deemed in need of program support.

The findings from the focused group discussions conducted with key informants in Dalota, Lega-Lencha, and Meda-Bilisuma kebeles indicate that the targeting of the Productive Safety Net Program (PSNP) did not align with the program's implementation manual. According to the manual, households should be either poor or have low land size to qualify for the program, yet many of the program's clients did not meet these criteria. Similarly, discussions with the WFSTF, KFSTF, and key informants revealed that the resources allocated to the district were insufficient to support all food-insecure households, potentially leading to some households being excluded from the program. While efforts were made to address targeting errors, it became evident that targeting remained a critical issue requiring attention. These findings are consistent with previous research conducted by Fekadu (2009), Welteji (2017), and Alem-meta (2024).

b) Appeals management mechanism

Survey results show that 19 PSNP beneficiaries (17.35%) and 42 non-beneficiaries (35%) appealed to the KFSTF about targeting problems, but none received a response. Focus group discussions revealed that no effective mechanism exists for addressing such appeals beyond the Kebele level, even when issues are raised to district or zonal authorities. These findings are consistent with Fekadu (2009) and Samuel (2020).

c) Payment modality

The survey results analyzing the payment preferences of program beneficiaries reveal that all payments were made in cash. When asked about their preferred mode of transfer, 16.4% of households expressed a preference for cash only, while 60% favored grain-only payments, and

23.6% indicated a preference for a combination of half grain and half cash. Notably, a significant majority of participants, accounting for around 60% of the total, articulated a preference for receiving payment in grain rather than cash. This preference stems from the belief that grain better meets their needs and holds a higher value compared to the cash payments they currently receive.

"The cash transfer we receive—42 birr per person per day—is not enough to cover our households' consumption needs. The change made in the 2014 PIM has also created problems. Because of the five-family-member limit, many of us who were originally targeted with all household members now get support for only five people. This leaves larger families with serious gaps in assistance. On top of that, the payments don't come on time, and the disbursement often doesn't follow the schedule that the PIM says it should."

D) Graduation

The findings from the survey conducted among respondent households regarding their awareness of the program and perceptions of graduating from it indicate that a significant majority, specifically 98 households (89.1%), were knowledgeable about and had details concerning graduation, whereas 12 households (10.9%) stated a lack of information on the subject. In terms of the perception of beneficiary households towards graduating from the program, the survey results illustrate that 18 households (16.3%) expressed support, 89 households (81%) expressed opposition, and 3 households (2.7%) did not provide a response. These outcomes align closely with the conclusions drawn by Berhane (2013) as documented in Figure 2.

In the aftermath of focus group discussions conducted with the Kebele Food Security Task Force (KFSTF), District Food Security Task Force (DFSTF), and key informants within the Kebele and district settings, participants were probed about their sentiments regarding graduation. It was observed that while the livelihoods of beneficiary households experienced positive transformations upon their enrollment in the Productive Safety Net Program (PSNP), there was a prevailing lack of enthusiasm towards program graduation. This reluctance stemmed from recurring natural calamities, limited or absent access to credit facilities, inadequate savings practices, and an absence of sustained technical assistance from relevant sectors, all of which hindered participants from meeting the required graduation criteria. Conversely, households that managed to amass the necessary assets for graduation displayed a disinterest in exiting the program. Furthermore, there were concerns raised about the inadequate screening of individuals meeting graduation benchmarks by KFST, leading to the

emergence of a dependency syndrome among both Public Works (PW) beneficiaries and members of the KFSTF.

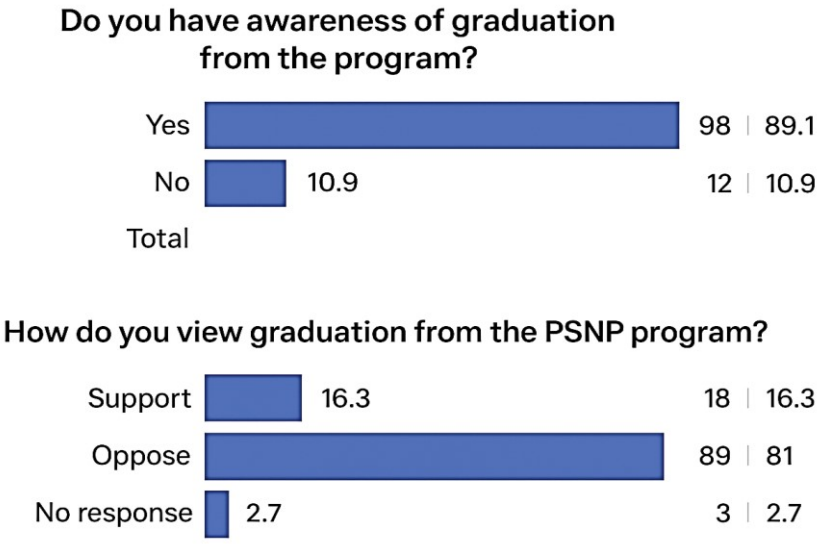


Figure 2. Awareness and perception of HH on graduation from PSNP

3.3. Socio-economic impacts of PSNP

3.3.1. Social impacts of PSNP

A key goal of the PSNP is to promote social and economic well-being, security, and social justice. Participants reported increased engagement in community events and institutions—both formal (farmers' cooperatives, savings and credit associations, irrigation associations) and informal (Afosh/Ider, Guza/Faraqa)—as well as kebele meetings. Most participants became ordinary members, with few advancing to committee roles. The program also helped reduce social discrimination and enhance the inclusion of poor households, consistent with Samuel (2020).

3.3.2. Economic impact of PSNP

3.3.2.1. Impacts of PSNP participation on household's food security

In this study, households' calorie intake per adult per day was used to identify food-secure households. As a result, out of all sampled households, 78 (71%) of PSNP and 32 (29%) of non-PSNP households were food-secure, meaning they were unable to obtain the minimum recommended energy level for a healthy and productive life. This suggests that PSNP beneficiaries gain more calories than non-PSNP beneficiaries due to their participation in the PSNP program (Figure 2). This finding is consistent with the study conducted by Hailu and Amare (2022) that being a member of PSNP significantly increases household food security

status. It was interpreted as the impact of PSNP on household food security for PSNP program participants is 2519.29348kilocalories as compared to non-participants.

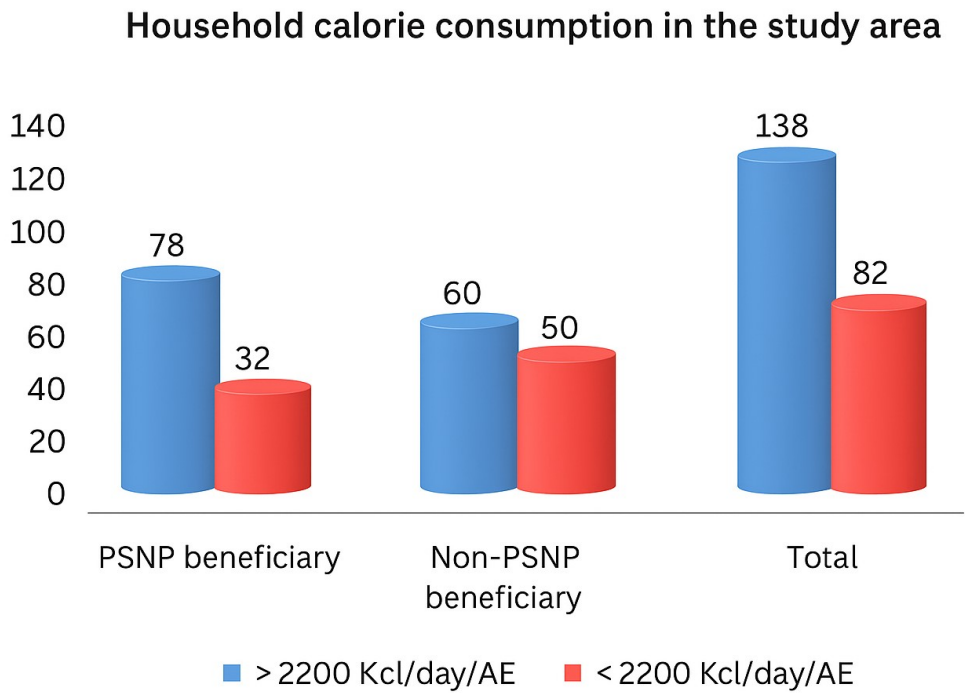


Figure 3. Study area's food security status. Source: Survey result, August 2020

3.3.2.2. Impacts of PSNP participation on annual income

The majority of PSNP beneficiaries have experienced significant improvements in their household income and standard of living as a direct result of the PSNP intervention. This suggests that safety net payments offer substantial economic opportunities for impoverished households to maintain their livelihoods. These findings align with the research conducted by Welteji (2017) and Samuel (2020).

3.3.2.3. Impacts of PSNP participation on asset accumulation

Targeting a productive safety net program enabled households to meet their essential domestic needs through the use of equipment and livestock. According to this study, the PSNP has influenced the accumulation of livestock and enhanced the livelihoods of impoverished households. These results are in line with the research findings of Anwar (2015), Welteji (2017), and Samuel (2020).

3.3.2.4. Impacts of PSNP participation on financial literacy

The beneficiaries received training in financial planning and budgeting, the significance of saving, profit calculation, and a better grasp of credit. The majority of PSNP beneficiaries stated that they have gained knowledge and fundamental skills that enhance their business acumen since enrolling in the program. Overall, training presents a significant opportunity for

impoverished households to transform their livelihoods. These findings are in line with the research conducted by Samuel (2020) (Table 8).

Table 8. Doba district financial literacy training activities performed from 2017 to 2020

Fiscal year	Activity	Number of PSNP clients participated						Percent achievement versus plan
		Plan			**Achievement**			
		M	F	T	M	F	T	
2017	Financial literacy training	1250	1250	2500	474	302	776	31
2018	Financial literacy training	1100	1100	2200	675	1155	1830	83
2019	Financial literacy training	1000	1000	2000	806	1644	2450	123
2020	Financial literacy training	300	300	600	300	300	600	100

Source: WHZANRO, 2020

3.3.2.5. Economic impacts of PSNP at community level

The PSNP aims to strengthen communities through projects planned and prioritized locally. In Doba district, 28 projects were completed between 2015/16 and 2019/20 at a cost of 19,249,838 Birr, benefiting the wider community. Focus group discussions and key informant interviews confirmed that community involvement in planning led to significant economic and social gains, consistent with Welteji (2017) and Samuel (2020).

Table 9. Community based projects built by PSNP

Types of Projects	**Unit**	**Quantity**	**Capital Budget allocated (Birr)**	**Project performance %**
Farmers Training Center	No.	2	1,330,000	97
Development Agent House	No.	2	1,909,401	100
Veterinary Health Post	No.	3	1,905,032	99
Additional Classroom	No.	3	1,728,402	100
Warehouse	No.	3	2,065,032	100
Spring Development	No.	5	3,168,827	100
Small Scale Irrigation	No.	1	647,580	100
Irrigation Canal Construction 7km	No.	3	2,200,027	100
Drinking water expansion 2km	No.	2	1,634,002	100
Night Storage Pond with 300M^3	No.	2	541,535	100
Pond (18501 M^3)	No.	2	2,120,000	100
Total		**28**	**19,249,838**	

Source, DDANRO, 2020

Table 9 displays the integrated community-based projects established by the Productive Safety Net Program. This initiative is viewed as a valuable economic opportunity that significantly contributes to the well-being of the community in the Doba district.

To examine the impacts of PSNP on rural household's Livelihood, Propensity Score Matching (PSM) model was used (Table 10).

(a) Propensity scores estimation

Table 10. Results of the Logistic Regression Model

Participation	Coefficients	Std. Err	Z values	P- value
AGEHHH	.0174159	.0124552	1.40	0.162
SEXHHH	.1963319	.2631665	0.75	0.456
EDUHHH	.4723398	.2638091	1.79	0.073*
FAMILYSIZE	-.015881	.0573377	-0.28	0.782
DIPENDCYRATIO	-.33823	.1277362	-2.65	0.008**
TOTALLAND	-1.141492	.5491791	-2.08	0.038*
TOTALTLU	-.2612097	.0598635	-4.36	0.000***
CHEMICALFERTLIZER	-.1752716	.2762005	-0.63	0.526
IMPROVEDSEED	-.0192438	.2539833	-0.08	0.940
HOUSING	-.8762617	.2863639	-3.06	0.002***
ACCESSTOEXT	.5186559	.4022539	1.29	0.197
ACCESSTOCREDIT	.9507699	.2140767	4.44	0.000***
DISTANCETO EXT.OFFICE	.310707	.0734215	4.23	0.000***
_cons	.081147	.7635733	0.11	0.915
N	220			
LR chi2 (13)	110.38			
Prob> ch2	0.0000			
Log likelihood	-97.30233			
Pseudo R2	0.3619			
Count r2				

***, ** and * means significant at the 1%, 5% and 10% probability levels, respectively.

(b) Imposing common support region

After estimating propensity scores, a common support region was applied, ranging from 0.0441 to 0.8959, based on the minimum and maximum scores of PSNP participants and non-participants. Scores outside this range were excluded, resulting in the removal of 22 non-participant households from the sample. This ensured that only comparable PSNP participant and non-participant households were used to estimate program impacts (Table 11).

Table 11. Distribution of Sample Households by Estimated Propensity Scores

Group	N	Mean	Std.	Min.	Max.
Total Households	220	0.5	0.3255677	0.0022698	0.996478
Treated Households	110	0.7124228	0.2475616	0.0440871	0.996478
Control Households	110	0.2875772	0.2461697	0.0022698	0.8959153

The distribution of estimated propensity scores, with and without the imposition of the common support condition, for program and non-program households, respectively Most of the PSNP participant households have a propensity score greater than 0.896, whereas a significant majority of the PSNP non-participant households have a propensity score around 0.04 (Figure 4).

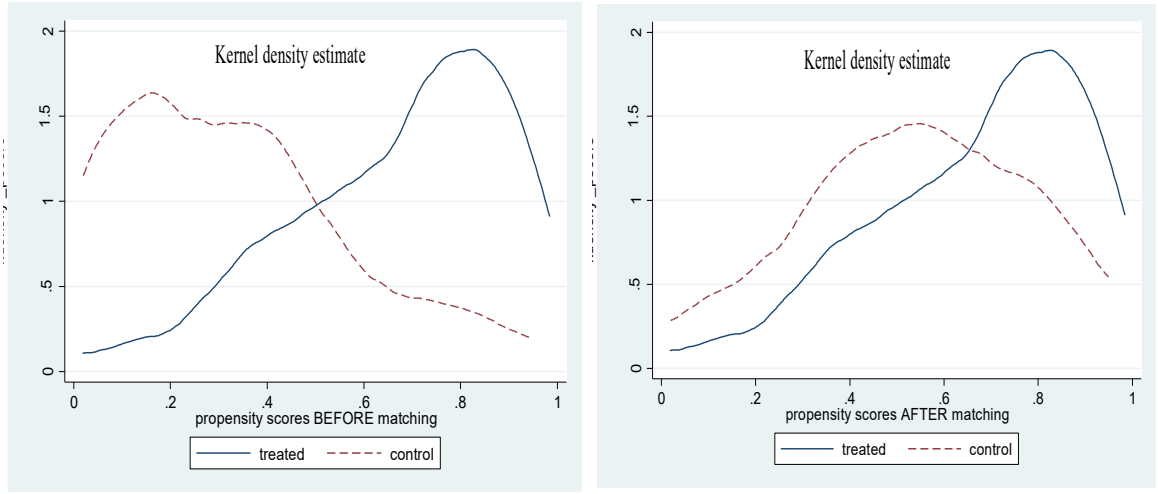


Figure 4. Kernel Density of PSM before matching (left) and after matching (right)

(c) Choice of matching algorithm

Table 12. Comparison of Performance of different matching estimator for total annual income

Matching estimator	Performance criteria		
	Balancing test*	**pseoudo-R2**	**matched sample size**
NN			
NN (1)	11	0.270	189
NN (2)	11	0.288	180
NN (3)	12	0.288	180
NN (4)	12	0.288	180
Radius caliper			
0.01	12	0.288	147
0.25	11	0.288	198
0.5	8	0.232	198
Kernel			
band width 0.1	12	0.288	190
band width 0.25	12	0.288	198
band width 0.5	10	0.270	198

Source: Own estimation result, August 2020 N.B: * Number of explanatory variables with no statistically significant mean differences between the matched groups of PSNP participant and PSNP Non-participant households.

(d) Testing the balance of propensity score and covariates

The estimated results of tests of matching quality are contingent upon the utilization of the best estimator's kernel bandwidth of 0.25. As depicted in Table 13, the balancing test of covariates before and after the matching revealed a notable distinction in the pre-intervention variables such as age, access to extension service, access to credit service, and distance from the extension office. Nevertheless, following the matching process, no further disparities were discerned. This

indicates that the matching procedure effectively mitigated the initial differences in the covariates, thereby enhancing the comparability of the treatment and control groups.

Table 13. Results of the Balancing tests of Covariates Using Kernel band width 0.25 Estimator

Variable	Mean		%	t-test		V(T)/V(C)
	Treated	**Control**	bias	**t**	**P>(t)**	
Pscore	.71293	.6602	22.1	1.71	0.089	1.41
AGEHHH	41.055	40.335	7.6	0.54	0.592	0.60*
SEXHHH	.76364	.75301	2.4	0.18	0.855	
EDUHHH	.65455	.73359	-16.4	-1.26	0.208	
FAMILYSIZE	6.0091	6.0496	-1.9	-0.13	0.898	0.83
DIPRATIO	2.4	2.68	-30.0	-2.06	0.040	0.99
TOTALLAND	.33109	.31918	5.1	0.43	0.665	1.12
TOTALTLU	1.7609	2.1689	-21.0	-1.63	0.105	0.97
IMPROVEDSEED	.27273	.24068	6.9	0.54	0.590	
HOUSING	.69091	.69595	-1.3	-0.08	0.936	
CHEMICALFERTLIZER	.70909	.8132	-23.2	-1.81	0.072	
ACCESSTOEXT	.96364	.928	13.5	0.86	0.390	0.63*
ACCESSTOCREDIT	.56364	.40428	25.5	1.77	0.078	2.61*
DISTOEXTSERVICE	3.0918	3.18	-5.4	-0.39	0.695	0.53*

***, ** and * means significant at the 1%, 5% and 10% probability levels respectively.

(e) Treatment Effect on Treated

PSNP participation significantly improves household food security (Table 14). Using PSM analysis, participants had an average increase of 185.79 Kcal/AE/day in calorie intake—an 8.4% rise over non-participants—consistent with Nesreddin (2014), Anwar and Mada (2015), Abduselam (2017), Andualem (2020), and Tadesse (2022). Additionally, PSNP households saw an average annual income increase of 5,218.63 Birr, a 39% gain compared to non-participants, aligning with Nesreddin (2014), Mada (2015), and Tadesse (2022).

Table 14. Average treatment effect on the treated (ATT) for annual income and dietary intake

Variable	Sample	Treated	Controls	Difference.	S. E	t-test
Total annual income	ATT	18581.05	13362.42	5218.63	1403.07	3.72 ***
Household calorie consumption	ATT	2390.027	2204.24	185.79	69.56	2.67 ***

*** means significant at 1% probability level.

4. CONCLUSIONS AND RECOMMENDATIONS

This study employed a combination of descriptive statistics and econometric techniques, specifically Propensity Score Matching (PSM), to analyse the empirical data gathered from both the treatment and control groups within the study area. The findings revealed statistically significant mean differences between program participants and non-participants concerning various socio-economic factors such as sex, dependency ratio, land holding size, livestock ownership, access to improved seed, and housing roof types. However, there was a statistically insignificant difference in mean values for family age, family size, education level, access to

extension services, and access to chemical fertilizers between the two groups. The results from the logit model highlighted that program participation was significantly influenced by a combination of factors, including smaller land sizes, fewer livestock, housing conditions, distance to extension services, and access to credit facilities. The study also demonstrated that the annual income and daily household calorie consumption per adult equivalent (AE) were notably higher for participants in the Productive Safety Net Program (PSNP) compared to non-participants. Consequently, participant households exhibited a higher level of food security. Based on these empirical findings, the study put forth five policy recommendations. Firstly, there is a need to integrate family planning programs with the PSNP, considering the higher dependency ratio and family size among participant households. Secondly, the targeting process for program support should align with the program manual to ensure adequacy and efficiency. Additionally, payment modalities should be demand-driven and closely monitored to ensure timely disbursement. Furthermore, a systematic approach to graduating households from the program and linking them with livelihood projects should be implemented to facilitate the entry of new households. Strengthening support mechanisms, such as access to loans and technical assistance, at the district and zonal levels is crucial for enhancing graduation rates. It is imperative to fortify the appeal management system and consider the identified variables in participant selection to maximize program impact in similar contexts. Lastly, future research endeavours should encompass larger sample sizes and longitudinal studies to deepen the understanding of program impacts.

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Competing Interests
The authors hereby declare that they have no competing interests.

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