

Analysis of the Significance of Fishing on Food Security Status of Rural Households Around Lake Ziway and Langanu in Ethiopia

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Abstract

This research work was conducted to investigate the significance of fishing on food security status of rural households around Lake Ziway and Langanu in Ethiopia. The studied districts were selected using purposive sampling, as they are adjacent to the two lakes. Simple random sampling was employed to select **344** rural households for primary data collection. For this particular work, respondents were further classified into food secured fishing households and food insecure non-fishing households by employing food security index method. As a result, **156** households were identified constituting of **51.3%** food secure fishing households and **48.7%** food insecure non-fishing households.

The range of data collected were comprises of household socio-economic characteristics, food production, food consumption, food purchases, fish income, non-fish income, and the like. Data analysis were made using descriptive statistics, food security index and the propensity score matching.

Descriptive statistics examines distribution and socioeconomic characteristics of respondents using frequency distribution tables. Considering, the equivalent male adult scale and energy composition of foods commonly consumed by average household, the food security index was computed. Accordingly, the available food energy was **31234kcal** and **9283kcal** for the food secure fishing household and food insecure non-fishing household, respectively. On the contrary, the required food energy was greater for the food insecure household as compared to the food secure once, indicating **14145kcal** and **12523kcal**, respectively. The mean difference were significant at 5% level.

To examine the impact of fishing on food security status of rural household we employed the propensity score matching method. This has been used to balance the observed distribution of covariate across the food secured fishing and food insecure non-fishing household. Balancing test was made after matching that ascertained absence of significant differences in covariate between fishing and non-fishing households in the matched sample. Thus, the matched comparison groups were considered to be a plausible counterfactual. Accordingly, the result of impact analysis verified the significance of fishing on food energy intake of average household using the matched samples. In this regards, food secured fishing household was able to obtain extra energy from food consumption as compared to the non-fishing food insecure counterpart indicating **ATT** of **27375 kcal** and **27213 kcal** using **KBM** and **NNM** algorithms, respectively. The results were statistically significant at 5% level. Consequently, the stability of the findings were tested using Rosenbaum bounds approach that confirmed absence of hidden bias due to unobserved confounders, thus supporting the positive treatment effect of fishing activity.

In this regard; promotion of income diversification opportunities, awareness promotion on family planning and in-depth investigation of household food security situation were suggested.

Keywords: Lake Ziway, Lake Langanu, Food security, Energy intake, PSM, ATT, Ethiopia

1. INTRODUCTION

Food is a basic necessity for the existence of man. Food in the appropriate quantities and quality is required for a healthy and productive life (Ajibola, 2000). Food-insecure people are defined as those consuming less than the nutritional target of roughly 2,100 calories per day per person (Rosen *et al.*, 2012). Thus, food insecure occurs when per capita food consumption for a country or income deciles fall short of the nutritional target of roughly 2,100 calories per person per day.

Johnson (1986) explained food security as the degree of accessibility to food, adequacy in quality and quantity, to fulfill the dietary requirements of all household members during the whole year.

Though food security as a problem at the national level was first felt in Ethiopia in the 1960s, it only started influencing policy in the 1980s, when food self-sufficiency became one of the objectives of the Ten-year Perspective Plan (TYPP) in the early 1980s. This took place after the 1983/84 drought and famine, which claimed millions of lives (Alemu, *et al.*, 2002). While efforts to ensure adequate food supplies at the national level are laudable, these efforts on their own cannot ensure food

availability for households and individuals.

According to FAO (1999), employment in off-farm and non-farm activities is crucial for expansion of the sources of farm households' livelihoods. It minimizes the danger of food shortage during the time of unanticipated crops failure through food purchases.

In many countries, a great chance of famishment for themselves and their families during periods of chronic or transitory food insecurity has always been avoided and reduced to a great extent because of diversification of sources of income that has been a strategy for survival for such a long time (Devereux 1993, Maxwell and Frankenburger, 1992).

Ensuring access to food, not merely increasing food supplies, should be regarded as the major pillar of food security. This assertion is borne out by empirical evidence that suggests that, even in times when countries experience famine, food supplies have been generally available, even in regions where large numbers of people died of starvation. The problem is that those who needed the food do not have the means to acquire it (Sen, 1986). Households diversify their incomes by selling firewood, working on farms as daily labourers, and selling crafts (Haile, 2005).

To determine the impacts of fishing on household food security status, this study analysis data from household survey conducted in four districts adjacent to Lake Ziway and Lake Langanu in the 2011/12 agricultural production season. The objective of the study were; to examine household socio-economic characteristics, to determine household's food security status and to analyze the impact of fishing on household food security.

2. RESEARCH METHODOLOGY

2.1. Study Area

This study was conducted in the communities residing in four districts around Lake Ziway and Langanu in the Oromia national regional state, in Ethiopia. Lake Ziway and Lake Langanu are found in the South-eastern direction of Addis Ababa at a distance of 175km and 190 km, respectively. The two lakes are found in the Great East African Rift Valley and located between $7^{\circ} 51'N$ to $8^{\circ} 57'N$ and $38^{\circ} 43'E$ to $38^{\circ} 57'E$. Lake Ziway is situated at altitude of 1636 meter above sea level having a water surface of $440km^2$ with a maximum depth of 8.95meters and average depth of 2.5meters. Lake Langanu is situated at altitude of 1582 meters above sea level, owning water surface of $241km^2$ with a maximum depth of 47.9meters and average depth of 17meter. The annual fish potential of Lake Ziway and Langanu is estimated at 2941tons and 1000tons, respectively.

Figure 1 shows the geographic location of the studied district in Ethiopia and the respective zones. We found that fishing and non-fishing households were geographically mixed, which enhance the relevance of control groups to evaluate the impact of fishing on household income.

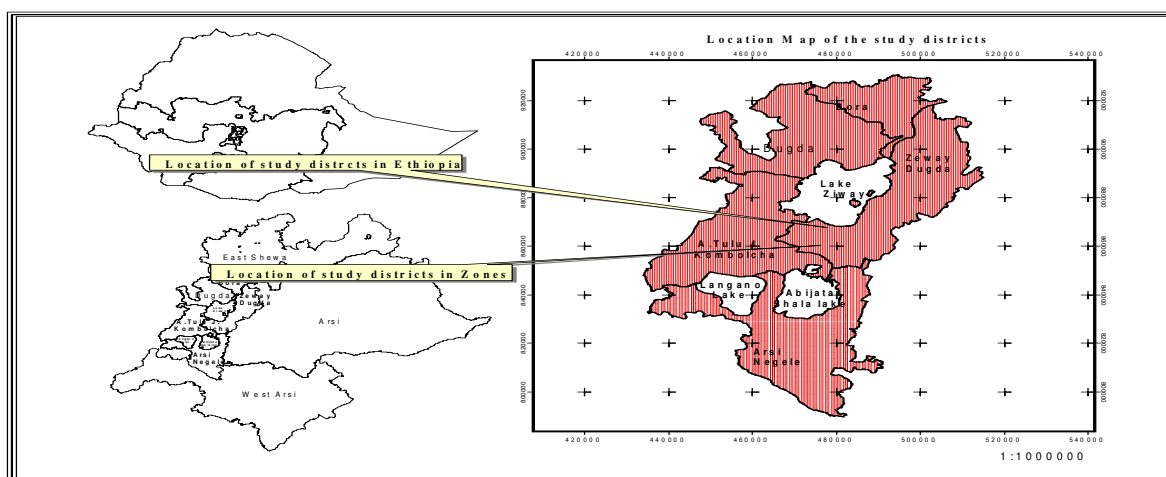


Figure 1. Geographical location of the study area

The study area enjoys bi-modal rainfall. Belg¹ rain usually commences in March & ends in April. Meher² season usually takes place from June-August is considered to be the long rainy season during which major crops like cereals, pulses, oil crops and the like are cultivated. The average annual rainfall of the area ranges from 800mm to 1100mm while the mean annual temperature varies between 11oc and 29 oc. The human population of the study area is 770,799. Population density is 138persons per km² with an average family size of 6.01.

¹ Belg season represents the shorter rainy season usually from March-April in the study area.

² Meher season represents the longer rainy season usually from June-August in the study area.

2.2. The data

The four districts adjacent to the two lakes were purposively selected to define the study population. In the second stage, random sampling was used to select households from the respective district with whom detail interview was carried out.

The data for the research was obtained from a survey of 344 farm households in the four districts of the three zones that emphasis on 2011/2012 agricultural production season. The sampled households were further decomposed into 179 fishing households and 165 non-fishing households.

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A structured questionnaire was used to interview the households. Data collected from the households includes household general characteristics, fishing participation, asset holding, farmland holding, crops and livestock production, sources of income, food consumption, availability of social infrastructure services, and other relevant information.

2.3. Data analysis

The analytical tools used were descriptive statistics, food security index and econometric analysis. Descriptive statistics employed statistical tools such as mean, frequency, percentage and the like to characterize households' socio-economic situation.

2.4. Food security index

To measure household food security a food security index was constructed. This defines a minimum level of nutrition necessary to maintain healthy living, the food security line, below which households are classified as food insecure (Muhammad-Lawal and Omotesho,2008).

The nutrients content of both produced and purchased food items are used to estimate both calorie and protein availability to the household. Hence, a daily recommended level of 2,100 calories per day per person (Rosen *et al.*, 2012) and 65gm of protein per capita per day (Muhammad-Lawal and Omotesho,2008) defines the food security line.

Although definitions of food security and insecurity revolve mostly around "food", the main player behind is calorie and not protein, micro-nutrients, etc. This is due to the fact that analysis operates on the principle that other needs are usually met when calorie intake is satisfactory (Maxwell and Smith, 1992). Accordingly, much importance has been placed on food calorie consumption by different literatures. Hence, it is useful to look food security measured as food calorie intake among the households.

The intensity of food insecurity may be measured in terms of levels of food intake. One option is to relate the severity of food insecurity to how consumption falls below a threshold of 2,100 kcal per day (Asatiani, 2009), with an indicator could be Energy intake measured in kilocalories.

The food security index can be expressed as below

$$Z = \frac{A}{I} \quad (1)$$

Where;

Z= Food security index

A= Household's daily per capita calorie or protein availability

I= Household's daily per capita calorie or protein requirement

For the purpose of this study, a household is defined as a group of people living together and eating from the same pot.

2.5. The Propensity Score Matching Methods

Rural households involve in fishing, based on resource base, awareness, legal enforcement mechanism (both observable and unobservable). Given these, simple comparisons of mean differences in food energy intake of fishermen with non-fishing group are likely to give biased estimates of the impacts of fishing when observational data are used. Hence, estimation of the impacts of fishing on food energy intake requires a solution to the counterfactual question of how food energy consumption would have performed had the fishermen not been involving in the fishing business. Hence, we used propensity score matching methods to overcome this and other econometric problems and ensure robust results.

The propensity score is the probability of participation rather than nonparticipation of an individual in a treatment group. In the treatment- effect literature, this predictor given observable variables is an important intermediate step, even though ultimate interest lies in outcomes of that treatment (Cameron and Trivedi, 2009). After estimating the propensity scores, the average treatment effect for the treated (ATT) can then be estimated. Several matching methods have been developed to match treated with non-treated of similar propensity scores. Asymptotically, all matching methods should yield the same results. However, in practice, there are tradeoffs in terms of bias and efficiency with each method (Caliendo and Kopeinig, 2008).

The balancing test is normally required after matching to ascertain whether the differences in covariates between the two groups in the matched sample have been eliminated, in which case the matched comparison group can be considered as a plausible counterfactual (Lee, 2008).

After matching, there should be no systematic differences in the distribution of covariate between the treated and control groups. As a result, the standardized mean difference, pseudo- R^2 should be lower and the joint significance of covariate should be rejected (Sianesi, 2004).

If there are unobserved variables that simultaneously affect the participation decision and the outcome variable, a selection or hidden bias problem might arise, to which matching estimators are not robust. While we controlled for many observable, we check the sensitivity of the estimated average participation effects to hidden bias, using the Rosenbaum (2002) bounds sensitivity approach. The purpose is to investigate whether inferences about treatment effects may be changed by unobserved variables.

Our main parameter of interest was the average treatment effect on the treated, which is given by:

$$ATT = E(Y_1 - Y_0 | D = 1) = E(Y_1 | D = 1) - E(Y_0 | D = 1) \quad (1)$$

Where Y_1 is the treated outcome, Y_0 is the untreated outcome, D indicates treatment status and is equal to 1 if the individual receives treatment and 0 otherwise.

The evaluation problem arises from the fact that the untreated outcome for a treated individual, $E(Y_0 | D = 1)$, can never be observed. Using the outcome for untreated individuals as an estimate of the counterfactual will generate bias equal to:

$$b = E(Y_0 | D = 1) - E(Y_0 | D = 0) \quad (2)$$

If the selection is based on variables that are observable to the analyst, the problem of selection bias can be solved by controlling for these variables in a regression analysis or the propensity score matching method. However, if the selection is based on variables that are unknown to the analyst, other methods need to be applied. In the impact analysis, treatment is largely based on household characteristics and asset holding that are observable both to the community and to the analyst; we therefore applied propensity score matching in this study.

The advantage of using propensity score matching, compared to regression analysis, is that it is a non-parametric approach in which the functional relationship between the dependent and independent variables is not specified, and in which no distributional assumptions are made for the outcome variable (Rosenbaum and Rubin 1983; Heckman *et al.*, 1998).

Accordingly, PSM relies heavily on two assumptions that formally can be written as:

Assumption 1 (conditional independence)

$$Y_0 \perp D \mid X \quad (3)$$

Where \perp indicates stochastic independence and X is a set of observable characteristics; and

Assumption 2 (common support)

$$\Pr(D = 1 | X) < 1 \quad (4)$$

Assumption 1 implies, conditional on a set of observed characteristics, the untreated outcome is independent of treatment status, i.e., $E(Y_0 | D = 1) = E(Y_0 | D = 0)$. This implies that the untreated outcome can be used as an unbiased estimation of the counterfactual outcome for the treated individuals, which solves the evaluation problem described in the previous section.

Rosenbaum and Rubin (1983) were the first to show that matching on the probability of treatment $p(x) = \Pr(D=1|X)$, referred to as the propensity score, is valid.

Assumption 2 implies no explanatory variable is allowed to perfectly predict treatment. In order to control for time invariant unobserved heterogeneity, we followed the approach suggested by Heckman *et al.* (1997) and used change in Y as the outcome variable.

When estimating the propensity score, it is important that the variables used to predict the probability of participation into treatment are unaffected by treatment, i.e., they should be measured before a household involve in the treatment. Given this analytical technique, the outcome variable for this study is defined as Food Energy Intake in kilo calories of a household from food consumption in 2011/12 agricultural production season.

3. RESULTS AND DISCUSSION

3.1. Household classification based on food security index

To analyze food security status, the study has considered a total of 344 households. The composition of household food consumption were examined during questionnaire administration at field level. In this regard, attention were given to women members to obtain relevant information on meal service. Considering the total available food to a household from own production and purchase, total food available during the year were worked out based on food energy and protein composition of foods commonly used in Ethiopia. Given, the

equivalent male adult scale weights to determine adjusted household size household food requirement was computed taking 2100kcal/AE/day as a threshold. Consequently, food security index was constructed based on which household with food security index greater than one recognized as food secure and those with less than one as food insecure. Accordingly, from 179 fishing households 45 percent were food secure and 55 percent were food insecure. Likewise from 165 non-fishing households, 54percent were food secure and 46 percent were food insecure. Household classification using food security index were presented in **Table 1** below.

Table 1. Household classification using food security index

Household category	District					Total	Percentage
	Dugda	Adami Kombolcha	Tulu Jido	Arsi Negelle	Ziway Dugda		
Fishing	37	61		41	40	179	100
Food secure	19	29		18	14	80	45
Food insecure	18	32		23	26	99	55
Non-fishing	37	53		37	38	165	100
Food secure	20	27		20	22	89	54
Food insecure	17	26		17	16	76	46

Source: Computed from data of 2011/12 household survey

Based on the food security index, the total sample households of 344 were further decomposed to arrive at food secure fishing households and food insecure non-fishing households for the subsequent analysis. Based on the analysis result, 156 households were identified comprises of 51.3percent food secure fishing households and 48.7percent non-fishing households.

3.2. Socio-economic characteristics

As presented in **Table 2** below, female comprises of 16.7percent and out of the female and male heads 11 and 69 are food secure, respectively. The food secure fishing household were relatively younger than the food insecure non-fishing household with average age of 32.3 years. Age difference is statistically significant at 1% level.

Moreover, food secure fishing households have attained, relatively better education level than the food insecure one with average of 2.9 and 1.8, respectively. The equality of mean was rejected at 1% level. The mean Tropical Livestock Unit (TLU) holding was 4.9. The average farmland holding appeared to be greater for food insecure compared to food secured households, which is statistically significant at 1% level. Food insecure households have better access to irrigation use indicating 1.7 hectares of land cultivation. Both food secure and insecure households were equally accessing credit from formal sources indicating mean result of 0.5. Food insecure households were found at a distant location from market compared to the food secured partners with average distance of 3.8 and 0.8 kilometer, respectively, the difference is also statistically significant at 1% level. Likewise, participation in *Equib* contribution showed significant difference with better involvement of food secured fishing households, which is statistically significant at 1% level.

Table 2. Households socio-economic characteristics

Characteristics	Food secure fishing households	Food insecure non-fishing households	Total	t-value
Gender of household head (1/0)				
Male	69	61	130	
Female	11	15	26	
Age of household head in year	32.3	43.3	37.6	6.8***
Household family size (unadjusted)	5.9	6.1	2.4	1.2
Household family size (adjusted AE)	5.9	6.7	6.3	2.1**
Education level of household head (grade)	2.9	1.8	2.4	-4.2***
Livestock holding (TLU)	4.3	5.5	4.9	1.5
Farmland holding (ha)	1.9	2.8	2.4	4.1***
Irrigation area (ha)	0.6	1.7	1.1	0.89
Access to formal finance (1/0)	0.5	0.5	0.5	0.29
Location from big market (km)	0.8	3.8	2.3	21.1***
Access to telephone service (1/0)	0.6	0.7	0.6	0.92
Participation in <i>Equib</i> contribution (1/0)	0.6	0.1	0.5	-3.8***
Household income in Birr	22,944.8	19,369.4	21,202.9	-1.15
Home improvement cost in Birr	2,329.0	2,244.7	2,287.9	-0.11
Remittance income to the hh in Birr	462.4	338.5	686.8	1.16
Grain stored in the preceding year in KG	32.5	121.6	99.8	1.15

*Significant at 10% level, ** significant at 5% level *** significant at 1% level

Source: Computed from data of 2011/12 household survey

3.3. Composition of household food consumption

According to the study result, household food consumption is dominated with cereals (100%) followed by fish (80%). Cereals appear in every meal services. Pulses, vegetables and animal products were serving as an ingredient to the major household meal constituting of cereals such as Maize, *Teff*, Wheat, Sorghum and Barley. Almost 63% of the surveyed households were consuming root crops, while 25% were using fruits as complementary to their major dish. Local drinks were comprises of coffee and homemade beer usually serve as gap filler to overcome food shortage. In most of the cases, coffee drink were used to cover household meal especially breakfast. **Table 3** below shows response on composition of food consumed by the surveyed households.

Table 3. Households food composition

Food composition	Household			Percentage
	Food secure	Food insecure	Total	
Cereals	80	76	156	100
Fish	80	45	125	80
Root crops	43	55	98	63
Vegetables	44	52	96	62
Pulses	72	63	135	87
Fruits	16	23	39	25
Animal products	12	37	49	31
Local drinks	42	34	76	49

Obs. 156

Source: Computed from data of 2011/12 household survey

3.4. Household food energy intake

Given the equivalent male adult scale weight, energy composition of foods commonly used in the study area, the total available food to a given household per day was computed to know the food energy intake of average household in kilo calorie. The result reflected, households commonly get food energy from own production and through purchases in the proportion of 82% and 18%, respectively. The amount of available food to food secure household was highest compared to the food insecure once, showing statistical significance of the mean. On the contrary, the food energy requirement of food insecure household was beyond the food secure once indicating more AE for the former, with mean difference inr energy required significant at 5% level.

Table 4. Average energy intake (kcal)

Indicator		Food insecure households	non-fishing households	Food secure fishing households	Combined	t-value
Available energy	food	9283		31234	20540	-8.5***
Required energy	food	14145		12523	13314	2.03**

Significant at 5% level * Significant at 1% level

Source: Computed from data of 2011/12 household survey

3.5. EMPRICAL RESULTS

This section examines the impact of fishing on food energy intake of average household based on the outcome of the propensity score matching (PSM). In the first step, we employed the logit model to obtain the propensity score. The purpose was not to identify particular relationships, but rather to maximize the predictive power of the model. Matching was done on 11 covariates, which were found to generate best balance between the treated and control group (fishing and non-fishing households). The covariates were used to generate propensity scores for the non-fishing households living in the area, determining which would probably have participated had they had interest in the activity. The Logit estimate of determinants of food energy intake of fishing households were presented in the **Table 5** below.

Table 5. Logit estimate of determinants of food security status

Covariates	Coefficient	P-value
Gender of household head (1/0)	-0.53	0.80
Household family size	-0.55	0.10*
Education level of household head (grade level)	1.20	0.02**
Livestock holding (TLU)	-0.73	0.03**
Farmland holding (ha)	0.08	0.92
Irrigation area (ha)	-0.30	0.78
Access to formal finance (1/0)	1.12	0.40
Access to market(km)	-5.30	0.00***
Access to telephone service (1/0)	-5.00	0.02**
Participation in <i>Equib</i> contribution (1/0)	8.90	0.02**
Home improvement cost in Birr	-0.001	0.30
Constant	11.50	0.02**
Number of obs =156	Food secure fishing HH= 80	Food insecure non-fishing HH= 76
Pseudo R ² =0.71		
LR chi ² (12) =158.10		

*Significant at 10% level, ** significant at 5% level *** significant at 1% level

Source: Computed from data of 2011/12 household survey

Fishing and non-fishing households were matched using Kernel Based Matching (KBM) and Nearest Neighbor Matching (NNM). To ensure maximum comparability of the two groups, the sample were restricted to the common support region, defined as the values of propensity scores where both treated and control cases can be found. As presented in **Table 6** below, the unmatched sample failed to satisfy the balancing properties, in that food secure fishing households were significantly different in several aspects from the food insecure non-fishing households (Column 1). However, using KBM and NNM most (90%) of the covariates supported insignificant difference among the two groups, showing good much. Hence, matched samples are adequate to perform an impact analysis, whereas the unmatched samples are not.

Table 6. Balancing test of matched samples

Covariates	1. Unmatched samples			2. Kernel based matching (KBM)			3. Nearest Neighbor Matching (NNM (4))		
	Treatment HH	Control HH	Diff: p-value	Treatment HH	Control HH	Diff: p-value	Treatment HH	Control HH	Diff: p-value
Gender of household head (1/0)	0.86	0.99	0.00***	1.00	0.90	0.33	1.00	0.90	0.33
Household family size	5.90	5.51	0.15	6.20	5.98	0.81	6.20	6.05	0.87
Education level of household head (grade)	2.94	0.34	0.00***	2.10	1.10	0.23	2.10	1.10	0.23
Livestock holding (TLU)	4.28	16.27	0.00***	4.82	9.22	0.22	4.82	7.83	0.38
Farmland holding (ha)	1.90	3.28	0.00***	1.83	2.13	0.63	1.83	1.85	0.97
Irrigation area (ha)	0.60	1.38	0.00***	0.38	0.78	0.25	0.38	0.66	0.41
Access to formal finance (1/0)	0.45	0.80	0.00***	0.30	0.52	0.35	0.30	0.45	0.51
Access to market(km)	0.79	0.13	0.00***	0.90	0.40	0.05**	0.90	0.40	0.05**
Access to telephone service (1/0)	0.60	0.13	0.00***	0.20	0.38	0.40	0.20	0.45	0.26
Participation in <i>Equib</i> contribution (1/0)	0.60	0.80	0.01***	0.20	0.42	0.31	0.20	0.35	0.48
Home improvement cost in ETB	2,329.00	571.25	0.00***	5,131.50	2,110.00	0.26	5,131.50	2,110.00	0.26

*significant at 10% level, **significant at 5% level, ***significant at 1% level

Source: Computed from data of 2011/12 household survey

As presented in **Table 7** below, low standardized bias, and the joint insignificant p-values of the likelihood ratio tests suggested absence of systematic difference in the distribution of covariates between the groups after matching. Thus, the result helped to evaluate fishing impacts on food energy intake of food secure and food insecure with similar observed characteristics.

Table 7. Covariate balancing indicators before and after matching (food secured fishing household)

Indicators	Before matching	After matching	
		1. KBM	2. NNM (4)
Mean standardized difference (bias)	80.6	39	33.3
Pseudo R ²	0.71	0.92	0.87
χ^2 P-value of LR	0.00***	0.11	0.14

significant at 5% level, *significant at 1% level

Note: NNM = nearest neighbor matching; KBM = kernel-based matching

Source: Computed from data of 2011/12 household survey

As indicated in **Table 8** below, due to matching exercise the sub-sample comprises of **86** households using KBM and NNM. These were observations whose propensity scores fall in the common support region.

Table 8. Number of observations within common support

Samples	KBM	NNM (4)
Food insecure non-fishing households	76	76
Food secure fishing households	10	10
Total	86	86

Note: NNM = nearest neighbor matching; KBM = kernel-based matching

Source: Computed from data of 2011/12 household survey

Consequently, the impact of fishing on food energy intake of the household were computed based on matched sample, which was presented in **Table 9**. Using the Average Treatment Effect on the Treated (ATT) that measures the average difference between food energy intake (kcal) of food secure fishing household and the food insecure non-fishing household of the corresponding match, there appear to be statistically significant difference of changes in income between the two. Thus, our findings confirmed that there were substantial increment in average food energy intake of household's as a result of participation in the fishing activities.

Table 9. Estimation of average fishing impact using propensity score matching methods

	KBM	NNM (4)
Average fishing impact (ATT)	27375	27213
Standard error	10827**	10823**

**Significant at 5% level

Source: Computed from data of 2011/12 household survey

The sensitivity of our finding to hidden biases were examined using the Rosenbaum bound approach, as presented in **Table 10** below. Accordingly, we can conclude that the estimates of the average fishing impacts reported in Table 9 above were insensitive to hidden bias, thus the findings result were a reliable indicator of the impact of fishing on household food energy intake.

Table 10. Sensitivity analysis

Gamma (Γ) sensitivity parameter	Wilcoxon Signed Rank P-value					Hodges-Lehmann point estimate			
	L. Bound Value	P-	U. Bound Value	P-		L. Bound Est.	HL	U. Bound Est.	HL
1	0		0			16,094		16,094	
1.5	0		0			13,732		19,086	
2	0		0.0000009			12,377		22,025	
2.5	0		0.000004			11,418		25,194	
3	0		0.00002			10,748		27,578	

Source: Computed from data of 2011/12 household survey

4. CONCLUSION

In this paper, we used descriptive analysis, food security index and propensity score matching to examine the impacts of fishing on food security status of 156 households. We used cross sectional data of the 2011/12 agricultural production season.

Using an equivalent male adult scale weight, the average family size of food secure household and food insecure household were 5.9AE and 6.7AE, respectively. The mean difference was significant at 5% level. Consequently, the available food energy to food secured household was 31234kcal while it was 9283kcal to the food insecure once. On the contrary, the required food energy was 14145kcal to food insecure households and 12523kcal to the food secure fishing households, with mean difference significant at 5% level.

According to the study result, household food consumption were largely dependnet on cereal grain (100%), pulses ingredient (87%), fish product (80%), root crops (63%) and vegetables (62%). Consumption of animal products were reported by 31% of respondents indicating difficulty of getting such products. Animal products were mostly sold rather than using for home consumption.

In the effort to analyze the impact of fishing on food security of households, this study has identified and elaborated the potential self-selection biases that emerge from simple comparisons of food energy intake of food secure fishing households with food insecure non-fishing counterparts. These biases have to do with the attributes of the study area as well as the attributes of household themselves. Thus, the research has shown how one might use the propensity score matching method to evaluate the impact of fishing. The matching was undertaken between food secure fishing households and food insecure non-fishing partners, considering specific household characteristics. This careful selection and matching process ensures a relatively unbiased estimate of

the true impacts of fishing on household food security.

Accordingly, the result of impact analysis verified the significance of fishing on food security of average household using the matched samples. The stability of the matching result were tested using the Rosenbaum Sensitivity test for presence of hidden bias. Hence, the finding has confirmed an absence of hidden bias due to unobserved confounder that support the positive treatment effect of fishing activity.

Hence, based on the study results the following suggestions were drawn;

- Promote income diversification opportunities among household to bring more income improvement.
- Carryout massive awareness promotion on using family planning services to improve household food security situation.
- Encourage in-depth investigation of household food security situation for better understanding and realistic planning.

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