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Does Kitchen Garden and Backyard Livestock Farming Help Combat Food Insecurity?

-An example of Nepalese households-

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1. Introduction

Household food insecurity has been recognized as a big threat. Many households in the developing countries as well as in some of the developed countries suffer shortages of food for at least a few months of the year. Moreover, lack of nutritious food is one of the major problems in the developing countries. Intake of food with protein, vitamins, and other important nutrient essential for healthy life is negligible. For example, consumption of foods like vegetable, fruit, and meat is very low.

There is some scope for improvement in this situation. It is assumed that kitchen gardens, which are used to grow nutritious agricultural crops like vegetables, could play a positive role. Some past literature also indicated the presence of small kitchen gardens to be helpful to increase food security (Talukder et al. [14]). In general kitchen garden refers to a small piece of land around one's dwelling where small-scale crop cultivation is practiced, usually vegetable, fruit, and spice crops. Gautam et al. [7] reported that home gardens in Nepal usually comprise around 2-4% of the total land of the farmer (size: 17-5000 m^2). These gardens provide small-scale products which are usually consumed at home, improving household nutrition. Similarly, livestock farming was also assumed to have a positive role in the household nutrient intake. For example, backyard poultry farming has been found to increase household food security by several researchers (Fattah [5]; Sonaiya [13]). Moreover, these activities are considered to be of great importance for urban households, increasing food security of this population (Maxwell [9]).

There is a pool of literature on food insecurity. But we found only a few studies dealing with food insecurity in much detail incorporating ideas from food poverty, kitchen gardening, and backyard livestock farming. In this context, the aim of our research is to find the food-poor households and then determine the factors affecting the levels of household food consumption. Our main objective is to find the role of kitchen gardens and livestock holdings in the food security of such households.

2. Methodology

1) Sampling and data collection

We used data from the Nepal Living Standard Survey 2003/04 (NLSS II). The Central Bureau of Statistics conducted NLSS II as a follow up survey of 1995/96 (NLSS I). The survey followed the Living Standards Measurement Survey methodology, an approach developed by the World Bank and applied in more than 50 developing countries. NLSS II used a two-stage stratified sampling scheme to select a nationally representative random cross-section sample of 4008 households. However, it should be noted that 96 out of 4008 households could not be enumerated. Moreover, we further dropped 2 samples for the analysis in this research, thus reducing the final sample size to 3910. Data collection was carried out from April 2003 to April 2004 in an attempt to cover a complete cycle of agricultural activities as well as to capture seasonal variations in different variables (see CBS [2] for further details on sampling and data collection). There was a 74-page household questionnaire with 19 sections and 10 appendices for collecting comprehensive and multi-topic data. The integrated household questionnaire covered data on consumption, incomes, assets, housing, education, employment, and a lot more topics related to the living standard of the household.

2) Data analysis

Data were analyzed with the help of poverty analysis developed by Foster et al. [6], commonly known as FGT (Foster, Greer, and Thorbecke) poverty index given by:

$$P_i = \left(\frac{1}{N}\right)\sum_{i=1}^{q}\left(1-\frac{y_i}{z}\right)^{\alpha}, \qquad (\alpha \geq 0) \qquad (1)$$

Where, P_i represents the poverty index and $\alpha = 0$ transforms to the Head Count Ratio (HCR) denoted by H, $\alpha = 1$ transforms to the Poverty Gap Ratio (PGR) denoted by P_1, and $\alpha = 2$ transforms to the Squared Poverty Gap Ratio (SPGR) denoted by P_2. The equations for deriving these indices are as follows:

$$H = \frac{q}{N} \qquad (2)$$

$$P_1 = \sum_{y_i<z} \frac{(z-y_i)}{Nz} \qquad (3)$$

$$P_2 = \left(\frac{1}{N}\right)\sum_{y_i<z}\left(\frac{z-y_i}{z}\right)^2 \qquad (4)$$

Where, q = number of food-poor households, N = total number of households, y_i = average per capita food expenditure of poor, and z = food poverty line.

Similarly, inequality analysis was done with the help of the Gini index given by:

$$G = 1 - \sum_{i=1}^{n} (R_i - R_{i-1})(y_i + y_{i-1}) \quad (5)$$

Where, G = Gini index, R_i = rank order of the household according to per capita food expenditure levels, and y_i = per capita food expenditure of the household.

Finally, factors affecting household food insecurity were analyzed with the help of regression models, using the ordinary least squares method.

3) Description of variables

From the definition of food security, it could be understood that achieving food security requires that the aggregate availability of physical supplies of food be sufficient, that the households have adequate access to those food supplies through their own production, market, or other sources, and that the utilization of those food supplies is appropriate to meet the specific dietary needs of individuals (Riely et al. [12]). This implies that the indicator of household food security must measure household access to food, which may include home production as well as buying from the market. It also includes ideas from the dietary needs of the individuals.

For our regression analysis, the dependent variable is the variable representing the food security situation of the household in one or another way[1)]. It is represented as the natural log of per capita food expenses of the household, comprising food bought from the market, food received in kind, and home-produced food. Since the level of expenses determines the availability of the food to the household members, it is assumed to represent the food security condition of the household. As stated in the first paragraph of this section, the dependent variable also captures the concept of food accessibility and hence is chosen as an indicator of food security.

On the other hand, we used several variables that might influence the level of household food consumption. Age, gender, number of schooling years, and caste of the household head (categorized into Brahmin, Chhetri, and Others, where other castes were taken as base) are important demographic indicators used in our analysis. Family size, occupation of the household members, area of land cultivated, wealth or asset levels, urbanization of the area, topographical or spatial differences between the area (three categories viz. Mountain, Hill, and Terai/Plains, where Terai is taken as the base), are also considered to influence household food consumption. On top, as indicated in the objective of our research we included two variables each representing a household's possession of livestock and kitchen garden. We consider these variables to have a large influence on food security. Dependent and independent variables that we used in our regression analysis are listed and briefly described in Table 1.

Table 1: Dependent and independent variables used in regression analysis

Variable	Unit	Description	Mean#
Food expenses	Log of NRS	Log of per capita food expenses of the HH per year	8.86
Age	Years	Age of head in years	45.49
Education	Years	Number of years of schooling of the HH head	3.78
Land	Hectare	Area of land cultivated by the HH	0.70
Asset	M-NRS	Monetary value of all the asset holdings of the HH	1.02
Brahmin	Dummy	Here, 1= HH head is from the Brahmin caste, 0 = otherwise	0.15
Chhetri	Dummy	Here, 1= HH head is from the Chhetri caste, 0 = otherwise	0.16
Female	Dummy	Here, 1 = HH head is female, 0 = otherwise	0.19
Urban	Dummy	Here, 1= HH is in the urban area , 0 = otherwise	0.30
Mountain	Dummy	Here, 1= HH is in the mountain region , 0 = otherwise	0.10
Hill	Dummy	Here, 1= HH is in the hilly region, 0= otherwise	0.48
Family size	Integer	Number of HH members	5.50
Occupation	Dummy	Here, 1= One or more of the HH members has non-farm occupation, 0= otherwise	0.62
Livestock	Dummy	Here, 1= HH possess livestock, 0 = otherwise	0.73
Kitchen garden	Dummy	Here, 1= HH have a kitchen garden, 0 = otherwise	0.64

Note: NRS = Nepalese Rupees (currency of Nepal where US$ 1 ≈ NRS 65 ≈ ¥ 110, approximately); HH = household(s); M-NRS = Million NRS; # = based on full sample

3. Results and Discussion

First of all, we analyzed various poverty indicators so as to find out the food poverty situation of the households. Food-poor households were determined by using the food poverty line expenditure, estimated to be around NRS 4966.40 for average prices of Nepal in 2003/04 (see CBS [3] for discussion on poverty line derivation), which is calculated based on calories provided by major food basket and their respective price. The food poor include those households having per capita food consumption expenditures below the basic minimum dietary food requirements for healthy life, in other words, the food insecure households.

Table 2: Food poverty

Parameter	CBN method	1/2 Median	2/3 Median
HCR	24.73	6.88	20.56
PGR	5.51	1.20	4.21
SPGR	1.81	0.32	1.32
Poverty line	4966.40	3459.00	4612.00
Gini index	28.22	-	-
Avg. FPCE (all)	7999.04	-	-
Avg. FPCE (poor)	3859.28	-	-

Note: Avg. = average; FPCE = per capita food expenditure; CBN = Cost of Basic Needs

Results showed around 24.73% of the households to be food poor (Table 2). It showed that one out of four households in Nepal could not meet the basic standard and lacks nutritious food to sustain a healthy life. On the other hand, PGR, a measure of the poverty deficit of the entire population, was found to be around 5.51%, where the notion of poverty deficit captures the resources that would be needed to lift all the poor out of poverty through perfectly targeted cash transfers. Similarly, SPGR was found to be around 1.81%, which captures changes in consumption expenditure within the poor. This is often described as the measure of the severity of poverty and takes the square of the distance separating the poor from the poverty line into account. The poverty gap is weighted by itself so as to give more weight to the very poor. Said differently, it takes into account the inequality among poor. Since, the values of PGR and SPGR are low, food-poor households seem to be close to poverty line;

hence we can say that food poverty is not very severe. Thus, with the appropriate policy targeting and with some efforts, food poverty could be tackled to a large extent. For comparison purposes, we also calculated values for food poverty based on a poverty line of half median and two-third median expenditure. On the other hand, estimates from the gini index showed that there exists some inequality in food consumption expenditure (the gini index was found to be around 28%). This low value of the inequality index showed a relatively weak gap in the distribution of food consumption expenditures. It may be due to the fact that households ought to prioritize food consumption in the first place and that the income elasticity of food is relatively low (changes in food consumption are low relative to changes in other factors like income of the household).

Owing to the differences in food consumption expenditures and food poverty levels, factors affecting household food security conditions were estimated (Table 3). Our aim is to analyze the factors affecting per capita food consumption expenditure, which is used in our case as the indicator/proxy variable for determining food security. For comparison purposes we estimated three models: a full sample model comprising all the households, and two limited sample models comprising urban and rural households. The fitness of the model is found to be around 30% (R-square value). The relatively low fit of the models may be due to that fact that sample size is large and that it is cross-sectional data covering only a single layer. However, theoretical literature argues that low R-square does not necessarily mean bad fit (Gujarati, [8]). Results showed that the selected variables have almost similar effects in all three models. Increase in age and education of household head, and increase in land and asset holdings of the household were found to increase food consumption and hence food security. Higher caste groups represented by Brahmin and Chhetri also have higher food consumption than lower caste households. Results also showed female headed households to have better food security compared to male counterparts. This might be because households with females as head have their male counterparts on temporary migration[2)] which helps them earn more income, resulting in increased consumption levels. Food consumption in urban areas also seems to be higher than in rural areas, as seen in the full sample model. In our analysis we used the average Nepal price that adjusted for the price differences in different areas. Thus, the problem of price differences between the rural and urban areas does not apply in our case. Therefore, food consumption could be said to be higher in the urban areas. Topography was found to have different effects among the three models. For the full sample model and rural model, households in the mountain and hill region have lower food consumption levels, which is significant too. But in the case of the urban model, these areas have higher food consumption levels, but not significantly. As is obvious, large family size leads to low per capita food consumption and it is significant too. Again households with some members having occupation in the non-farm sector showed a changed pattern. Although it is insignificant in all the models,

it has negative effects in the full sample as well as in the rural model but it has positive effects in the urban model. Because non-farm employment could help urban households to overcome food shortages it is positive here, but having agriculture as the primary occupation may be important for the rural households to fight food insecurity.

Having livestock was not found to have significant effects in any of the three models. So, we could not say that livestock plays an important role in household food security. Moreover, it has negative effects in the full sample as well as the rural model but for the limited sample of urban households it has non-negative effects. Kitchen gardens, on the other hand, have a strong influence on household food security. All of the three models showed that households have better food consumption levels if they have a kitchen garden. The contribution of this small piece of land neighboring the house has a high impact on the household food security. This places an important value for the availability of kitchen garden. It seems to be especially important for urban households, where its contribution is more than for the full sample as well as the rural model. Most probably, rural households who are usually farmers have a relatively large amount of land holdings and hence the availability of a kitchen garden has less impact on these households compared to urban counterparts where its impact is high due to a lack of other land holdings.

Table 3: Regression analysis[3)]

Variable	Full sample		Rural sample		Urban sample	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Age	0.005	***10.02	0.005	***9.60	0.005	***4.68
Education	0.025	***14.45	0.024	***10.55	0.026	***9.43
Land	0.061	***8.59	0.064	***7.70	0.027	*1.81
Asset	0.038	***12.73	0.055	***8.61	0.033	***9.28
Brahmin	0.144	***7.10	0.183	***7.26	0.092	***2.67
Chhetri	0.053	***2.73	0.051	**2.31	0.083	**2.14
Female	0.068	***3.63	0.067	***3.12	0.095	***2.59
Urban	0.060	***3.22	-	-	-	-
Mountain	-0.061	**-2.51	-0.092	***-3.66	0.166	1.30
Hill	-0.102	***-6.97	-0.165	***-9.39	0.035	1.29
Family size	-0.070	***-25.35	-0.067	***-21.62	-0.084	***-14.35
Occupation	-0.002	-0.14	-0.001	-0.02	0.021	0.58
Livestock	-0.028	-1.45	-0.026	-1.05	0.006	0.18
Kitchen garden	0.047	***3.14	0.035	**2.00	0.081	***2.83
Constant	8.817	***240.90	8.797	***204.64	8.851	***124.46
R^2		0.31		0.28		0.34
Adjusted R^2		0.30		0.27		0.33
F-value		***125.18		***80.28		***44.75
Sample size		3910		2747		1163

Note: * = significant at 10%; ** = significant at 5%; *** = significant at 1%

4. Conclusion

Similar to other developing countries, food insecurity is one of the problems in Nepal. Around one-fourth of the households from the NLSS II data were found to be food poor. However,

analysis of the severity and depth of poverty as well as analysis of inequality in per capita food consumption expenditures showed food-poor households to be close to the poverty line as well as these being less disparity in food consumption. Thus, we can say that food poverty is not very severe and although it may not be eradicated immediately it could be tackled with the appropriate policy measures.

Food security seems to be determined by several variables. Among these we considered two variables to be of much concern. Having some livestock animals was assumed to have strong influence on household food security, which could not be supported by the insignificance of this variable in our research. Although livestock seems to have non-negative effects for urban food security, it is still insignificant here. On the other hand, having a kitchen garden seems to increase per capita food consumption expenditures and ensures security against food shortages. It may specially be important in the case of the provision of nutrient-rich foods like vegetables, which are the common product of a kitchen garden. Since the coefficient for kitchen garden variable is higher in the case of the limited model of the urban households, it could also be said to be of much value for these households.

From the results of this research it could be recommended to the households to maintain a kitchen garden to the extent possible. The government should prioritize urban agriculture, maybe by providing improved seeds for kitchen garden crops within reasonable price and quality, and with other appropriate policy approaches. We recommend further research for finding the scope of urban agriculture in the developing countries like in Nepal.

Notes:

1) Collecting data for a complete analysis of food security is virtually impossible (Maxwell [10]). Food security is probably too complex to ever be adequately captured by a single indicator, since there are several indicators of food security all related to it, yet none of them capture the concept accurately or completely (Maxwell et al. [11]; Bickel et al. [1]). To get around this difficulty, most analyses rely on measuring food consumption (Maxwell [10]). Moreover, the most common indicators of food security revolve around measures of food consumptions (Maxwell et al. [11]). One of the indicators in this context is food expenditure (Riely et al. [12]). Measures of consumption and poverty are usually used as proxy measures for finding out the food security condition (Maxwell et al. [11]). Household food consumption provides information on whether households have used their capacity to acquire food (that is, food access), to actually obtain that food (FANTA and FAM [4].

2) Data showed that female headed households receive on average a higher amount of remittance (around NRS 27,773) compared with male headed counterparts (around NRS 8,139).

3) Results from the multicollinearity analysis showed the value within the allowed range (average and highest variance inflation factor for the full samples are 1.30 and 1.68, for the rural samples are 1.22 and 1.35, and for the urban samples 1.25 and 1.48). Hence, we can say that there is no correlation among the independent variables used in the regression models.

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