Journal of Institute of Science and Technology, 24(2), 22-29 (2019)
ISSN: 2469-9062 (print), 2467-9240 (e)
Doi: http://doi.org/10.3126/jist.v24i2.27253

Research Article

FACTORS INFLUENCING FOOD INSECURITY IN NEPAL

Hem Raj Regmi[1*], Kedar Rijal[1], Ganesh Raj Joshi[1], Ramesh P. Sapkota[1], Sridhar Thapa[2]

[1]*Central Department of Environmental Science, Tribhuvan University, Kirtipur, Kathmandu, Nepal*
[2]*VAM Officer, UN World Food Programme, Chakupat, Lalitpur, Nepal*
[*]*Corresponding author:hregmi1@gmail.com*

(***Received:*** *September 3, 2019;* ***Revised****: November 13, 2019;* ***Accepted:*** *November 26, 2019)*

ABSTRACT

Nepal has been persistently encountering food insecurity and under-nutrition. It is therefore utmost important to determine the factors responsible for influencing food insecurity in Nepal. This study examines the factors determining food insecurity in Nepal applying binary logistic models for food poverty, household with inadequate food consumption and poor dietary diversity using data from Nepal Living Standard Survey 2010/11. Food security was determined to be strongly associated with education level and age of household head, household with higher female education level, larger farm size with higher ratio of irrigated land, better access to markets, roads and cooperatives, better household assets and remittance recipient households. Food insecure is relatively more prevalent in rural areas with higher dependent on rain-fed agriculture, higher dependency ratio and larger family size. Improving both physical and economic access to foods, together with investment in education and agriculture could help to reduce food insecurity and hunger from Nepal.

Keywords: Determinants, Food consumption score, Food insecurity, Living standards, Logistic regression

INTRODUCTION

Food security is considered as a multifaceted condition of complex analysis, which is defined in different ways by international organizations and researchers depending on their context and requirement. In early 80s, availability was considered as the major component of food security analysis, in which household food sufficiency was one of the major indicators for food security measurement (Adhikari, 2010). Later, Sen (1981) defined food security as ensuring access to food, not merely increasing supplies, should be considered as the major pillar of food security. In other words, food insecurity can exist, if people do not have adequate access to food (because of poverty), irrespective of food availability. Furthermore, food secure household can be identified when its household members do not live in hunger or fear of starvation. The recent and widely accepted definition of food security is deemed to exist "all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preference for an active and healthy life (FAO, 1996). Based on this definition, food security involves four aspects entitled the four dimensions of food security viz. availability, access, utilization and stability. Those four dimensions can be extracted and are, together, equally useful as a tool for food security analysis. Despite a universal definition of food security, measuring household food security in an accurate and efficient way is challenging. However, overall understanding of food security is important for better targeting and evaluation of public policy interventions (Maxwell *et al.*, 1999). Moreover, factors contributing to food insecurity would add value for design and implement programs related to enhance food security and livelihoods.

Food security has been paid wide attention by both government and international organizations, as the evidence revealed an estimated total of 821 million- around one out of every nine people- undernourished in 2017 (Egal, 2019), of which the undernourished people are estimated to be 14.8 % in South Asia and 28.3 % in low income countries, while in Nepal it is estimated about 10 % ranking 72nd in Global Hunger Index (ibid). Moreover, about 15 percent of households have inadequate food consumptions (CBS, 2018). In Nepal, more than one third (36 %) children under five are stunted, an indication of chronic under-nutrition and nearly one third (27 %) children are underweight (MoH, 2017). Realizing the fact, food and nutrition security has been considered as a key priority for many government and non-government organizations to achieve zero hunger by 2030 under the sustainable development goals (SDGs), particularly the Goal 2 which elaborates as 'end hunger, achieve food security and improved nutrition and promote sustainable agriculture'.

Nepal has been persistently encountering with the food insecurity and under-nutrition contributing by insufficient consumption and poor dietary diversity. The Nepal Living Standard Survey 2010/11 showed that 25 % of households were considered as food poor, while 38 % of people were below the minimum daily requirement of calories required for a healthy life (CBS, 2011). Overall 35 % of people are chronically food-insecure in Nepal (NPC, 2013). Prevalence of food insecurity and hunger is more concentrated in the remote areas, together with certain economically and socially excluded groups and castes. Food insecurity is often characterized by the poor diet diversity and the literature shows that dietary diversity clearly leads to the positive impact on nutritional outcome

(Kumar *et al.*, 2017). The NLSS report showed about 72 % of average households consuming sufficient calories constituting from the staple food items, mainly rice, maize and wheat, while this figure is even higher to 87 % in the rural areas compared to the urban areas. Prevalence of food insecurity is higher in the economically excluded people, for example bottom quintile of income group has insufficient dietary energy consumption as compared to other income quintiles (CBS, 2011).

Nepal is highly diverse in terms of geography, culture, and religions, food security and livelihood patterns are also varied by ecological belts and culture. In Nepal, food insecurity is found to be more prevalent in rural area, mainly in the remote and low productive areas, where rain-fed subsistence agriculture is more pervasive. For instance, prevalence of severely food insecure[1] population in rural areas is about 12 % as compared to 9 % in urban areas; likewise about 14 % people are severely food insecure in the Mountain zone while it is about 9 percent in the Terai zone (MoH, 2017). It is often discussed that the underlying causes of food insecurity and under-nutrition in Nepal are low farm productivity, limited livelihood opportunities, and weak market connectivity caused by poor infrastructure, together with geographical heterogeneity, gender and caste disparities, as indicated by the high prevalence of food insecurity in the mountain and rural areas (MoALD *et al*., 2018). Thus, an understanding of household food insecurity in Nepal is critical for researchers, planners and policy makers.

Food security has been paid attention back in the world food crisis of 1972-74, beyond that, at least to the Universal Declaration of Human Rights in 1948 that had officially recognized the right to food as a core element of an adequate standard of living (Maxwell & Smith, 1992). However the interest on food security arose in the 1980s due to a concern of deteriorating basic needs during structural adjustment and the publication of entitlement theory in the early 1980. With the development of food security concept and analysis, several studies have been conducted to measure the food security and its determinants in different contexts and levels applying different quantitative and econometric methods.

Most studies in food security are often found in the context of developing countries. For example, Clover (2003), Smith (2007), Swaminathan (2008) and Oriola (2009) examined the food security in developing countries and found that growing global food production could help enhance GDP per capita, increase purchasing power and access to food, but did not significantly reduce hunger, malnutrition and famine. Studies often investigated the factors determining food security within the framework of the four dimensions viz. food availability, access, utilization and stability while some studies examined the major factors contributing food security. For instance, Iram and Butt (2004), Kidane *et al.* (2005), Kabbani and Wehelie (2005), and Ojogho (2010) identified the size and structure, gender, educational level, age and experience of household head as the major contributing factors to food insecurity, while some studies found land size and productivity, fertilizer application, ownership of cattle and household food production as major determinants of food security (Khan & Gill, 2009; Beyene & Muche, 2010; Tefera & Tefera, 2014). Bashir *et al.* (2013) carried out a meta-analysis to identify which determinants of food security have been focused and how well the causality is demonstrated.

In Bangladesh, gender and age of household head, income, education level and household size were the major determinants of household food security (Ali *et al.*, 2016). Ojha (1999) conducted a study on determinants of household food security under subsistence agriculture in the mountain district of Nepal using generalized least square multiple regression and found that cultivated land holding, livestock holding, proportion of economically active female household members to the total household size, and adoption of modern cereal crop varieties were major determinants of household food security. Maharjan and Joshi (2011) conducted food security analysis using logistic regression in Nepal and revealed that larger family size with higher dependency of population, high dependency on rain fed agriculture, female head household and small farm holders were relatively more food insecure.

The authors opined that programs targeting the small farm holders, increasing irrigation facilities and focusing on economically and socially deprived communities could significantly reduce food insecurity in Nepal. Joshi and Joshi (2017) carried out a study on determinants of household food security in two mountainous districts of Nepal using logistic regression and revealed that household food security was positively associated with male headed household, percentage of irrigated area, larger number of livestock owned by households, owner operator, while household size and time taken to reach nearest markets would negatively lead to food security.

This study intended to shed light on the trend and determinants of food security in Nepal; contrary to previous studies, it examined the overall trend of food security using national level surveys, while previous studies done by Ojha (1999), Joshi and Joshi (2017) were mostly concentrated on the particular area or district which could not provide macro level findings of food security. Moreover, the study aimed to use different type of food security indicators such as food poverty, household with inadequate food consumption using food consumption score and household with poor dietary

[1] *This information is based on Household Food Insecurity Access Scale drawn from Nepal DHS 2016.*

diversity in order to validate and explore more consistency in determinants of household food security in Nepal. Thus, this study intended to fill gaps of determinants of household food security at national level using various food security indicators such as food poverty, food consumption score and dietary diversity score to explore more factors contributing to food security.

MATERIALS AND METHODS

Choice of empirical model depends on the type of data and objectives of the study. Logistic regression technique is widely used to examine and describe the relationship between a binary response variable (e.g., 'success' or 'failure') and is often applied to analyze determinants of food security by Arene and Anyeji (2010), Felker-Kantor and Wood (2012), Joshi and Joshi (2017). Logistic regression has the advantage of allowing the evaluation of multiple explanatory variables by the extension of the basic principles (Huffman, 2015). The logistic regression model is based on the cumulative logistic probability function that uses logistic cumulative density function as specified by Pyndick and Rubinfeld (1991).

$$P_i = F(Z_i) = 1/(1 + e^{-(\alpha+\sum \beta_i X_i)}) \quad (1)$$

Where, P_i is the probability that a household is being food insecure (food poor and household with inadequate food consumption) or poor dietary diversity taken as dependent variable; X_i is the vector of explanatory variables which are household characteristics such as age, gender and education level of household heads, land size, access to markets and roads, ecological belts, livestock and remittances; α and β are the parameters to be estimated; ϵ is the base of the natural logarithm.

Logistic econometric model can be written in terms of the odds and log of odd for ease of interpretation of the coefficients. The odds ratio is the ratio of the probability that a household would be food secure (P_i) to the probability of a household not being food secure ($1 - P_i$). This can be interpreted as follows:

$$\frac{P_i}{1-P_i} = e^{Z_i} \quad (2)$$

Taking with natural logarithm, equation (2) yields:

$$\ln\left(\frac{P_i}{1-P_i}\right) = Z_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n \quad (3)$$

With taking into account of error term (ϵ), the logit equation becomes as follows:

$$Z_i = \alpha + \sum_{i=1}^{n} \beta_i X_i + \varepsilon_i \quad (4)$$

The parameters of the logit model, α and β, can be estimated applying the maximum likelihood (ML) method.

This study applied the logit model to estimate the probability of factors contributing to food security at household level. Binary dependent variables measure the household below food poverty line or household with inadequate food consumption using food consumption score and poor dietary diversity separately with a number of explanatory variables such as socio-economic variables like education level, household head characteristics, gender, dependency ratio and other household characteristics, regional dummy, proximities to market, roads and cooperatives, and remittance.

Data Source

The study used data from the Nepal Living Standard Survey 2010/11 (NLSS III) of the Central Bureau of Statistics, Nepal (CBS, 2011). NLSS III is the third national survey of Nepal conducted by the Central Bureau of Statistics, with technical and financial cooperation from the World Bank. The survey applied two-stage sampling procedure to select the 500 primary sampling units for the first stage of the 14 ecological strata, where size was measured from the number of households in the ward. For NLSS III, the number of households in each PSU was fixed as twelve, resulting the final sample size of 6000 households. For the purpose of this study, information included the food consumption by source, household income and expenditure, household size, and other social and demographic characteristics of household members, including physical and land characteristics. The study used food poverty which is defined as the amount in Nepalese Rupees required for food to sustain normal physical activity and good health using the approach of the cost of basic needs (CBN). If the household was below the food poverty line, then the household was considered as food insecure. Household with inadequate food consumption was drawn from the food consumption score (FCS). The household was considered as inadequate food consumption if the FCS of a household was equal or below 42. Likewise, poor dietary diversity was calculated, if the household consumed equal or below 4 food groups, out of 8 food groups, in a week recall period was considered as poor dietary diversity.

The descriptive statistics of the variables (Table 1) used in the logit model show that about 25 % households were food poor, while 18 % households were with inadequate food consumption and 7 % of households have poor dietary diversity. More than 65 % of sampled household were rural inhabitants. The average household size was 4.75, in which dependency ratio was 0.59 indicating a higher financial stress on working people. The average land size of the surveyed household was 0.86 hectare, of which only 36 % of land has irrigation facilities. Highest education level of female in the household seemed low in the sampled households. The average year of education was only 3 years.

Table 1. Descriptive Statistics of the variables used in the study

Variables	Variable Description	Mean	Standard Deviation
Food_poor	Food poverty, households do not have enough food to meet the energy and nutrient contents. 1= food poor and otherwise 0	0.25	NA
Food_insuffi	Households with inadequate diversified food consumption based on food consumption score. 1= household with inadequate food consumption and otherwise 0	0.18	NA
Poor_dds	Households with poor dietary diversity (consuming less or equal to four food groups in a week). 1= poor dietary diversity and otherwise 0	0.07	NA
Rurban	1= rural household and otherwise 0	0.65	NA
HHsize	Total number of household members	4.75	2.31
Depratio	Ratio of dependent (children 0-14& aged 60+ years) to economically active populations (age 15-59)	0.59	0.25
Head_age	Age of household head	45.99	14.13
Head_fem	Female headed household	0.27	NA
Head_edu	Education level of households in number of years completed	2.44	1.55
Max_edu_fem	Highest education level of female in the household in year	2.89	1.51
Wi30_droad	Households within 30 minutes access to dart road	0.56	NA
Wi30_markett	Households within 30 minutes access to local markets	0.52	NA
Wi30_coop	Households within 30 minutes access to cooperatives	0.60	NA
Landsize	Total land size in hectare	0.86	1.59
Share_irr	Ratio of irrigated land over total land	0.36	NA
Remireci	Household received any remittances or not	0.53	NA
Livestock	Household own livestock or not	0.69	NA
Mountains	Household residing in Mountain belt	0.07	NA
Hills	Household residing in Hilly belt	0.53	NA
Terai	Household residing in Terai belt	0.40	NA

NA: not applicable; Source: Nepal Living Standard Survey 2010/11 (CBS, 2011)

RESULTS AND DISCUSSION

The estimation of the logistic regressions to explore the factors determining household level food insecurity in Nepal is given in Table 2. The Log Likelihood χ^2 test results are significant, revealing that independent variables are associated with the dependent variables in the models. Likewise, the pseudo R^2 values estimated by using logit regression are 0.15, 0.11 and 0.12, respectively, which imply that about 11 to15 % of the likelihood of a household being food insecure is strongly explained by the included explanatory variables. Variables used to determine food insecurity in the model were mostly found to be significant with expected signs. Among variables used in the model, age of household head, education level of household head, highest education level of female members in the household, proximities to markets, motorable roads and cooperatives, land size with higher share of irrigated land and remittance recipient households were found to be significant and main determinants of food insecurity i.e. food poverty, household with inadequate food consumption and poor dietary diversity in the models.

The model showed that households residing in rural area with larger family size and higher dependency ratio were likely to be more food insecure and have poor dietary diversity. This could be due to low employment opportunities leading to limited economic access to food in rural areas, coupled with high burden to active labour force (Bigsten *et al.*, 2002) and requiring greater expenditure to meet household consumptions (Rose, 1999). Likewise, age, sex and education level of household head were also found to be significant determinants of food insecurity and poor dietary diversity. Age and education level of household heads are significant and negative at one percent significant level, implying that food insecurity is more likely to be low in the household with the higher head's age and education attainments. These estimated coefficients are consistent with the results of Joshi and Joshi (2017) and Maharjan and Joshi (2011).

Moreover, food security and better dietary diversity are more likely to be better, if the household has higher education level of females. Educated women in the household could have better knowledge on food security outcomes such as diversified diets, health and sanitation, and allocation of household resources, together with possibilities of self-earning opportunities which may also improve household economic access to foods.

Table 2. Logit estimates for the determinants of food security

Variables	Food_poor		Food_insuffi		Poor_dds	
	Coefficients	Marginal effects	Coefficients	Marginal effects	Coefficients	Marginal effects
Rurban	0.25**	0.03**	0.41***	0.05***	0.23	0.01
	(0.11)	(0.01)	(0.11)	(0.01)	(0.17)	(0.01)
HHsize	0.28***	0.03***	0.01	0.01	0.17***	0.01***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.001)
Depratio	0.33***	-0.16***	0.11***	-0.06***	01.22***	-0.04***
	(0.04)	(0.02)	(0.04)	(0.02)	(0.05)	(0.01)
Head_age	-0.01***	-0.002***	-0.02***	-0.002*	-0.01***	-0.001**
	(0.003)	(0.00)	(0.003)	(0.00)	(0.004)	(0.00)
Head_fem	0.14	0.02**	-0.13	-0.02	-0.11	-0.02
	(0.10)	(0.01)	(0.10)	(0.01)	(0.15)	(0.02)
Head_edu	-0.21***	-0.03***	-0.33***	-0.04***	-0.33***	-0.01***
	(0.03)	(0.00)	(0.03)	(0.01)	(0.05)	(0.00)
Max_edu_fem	-0.15	-0.02***	-0.21***	0.13***	-0.22***	-0.01***
	(0.03)	(0.003)	(0.03)	(0.01)	(0.05)	(0.00)
Wi30_droad	-0.27***	-0.02*	-0.03	-0.03***	-0.15	-0.01**
	(0.08)	(0.01)	(0.07)	(0.01)	(0.11)	(0.002)
Wi30_market	-0.18*	-0.01	-0.22**	0.01	-0.13	-0.01*
	(0.11)	(0.01)	(0.10)	(0.02)	(0.13)	(0.002)
Wi30_coop	-0.22***	-0.03**	-0.18**	-0.02*	-0.23	-0.01
	(0.10)	(0.01)	(0.09)	(0.02)	(0.15)	(0.01)
Landsize	-0.14***	-0.02***	-0.20***	-0.02**	-0.05	0.00
	(0.04)	(0.00)	(0.04)	(0.01)	(0.05)	(0.001)
Share_irr	-0.29***	-0.03**	-0.03	-0.02***	-0.12	-0.01
	(0.11)	(0.01)	(0.10)	(0.02)	(0.15)	(0.01)
Remireci	-0.41***	-0.04***	-0.40***	0.01	-0.57***	-0.03***
	(0.08)	(0.01)	(0.08)	(0.02)	(0.11)	(0.01)
Livestock	0.25**	0.03**	0.28*	-0.05***	0.31*	0.01**
	(0.12)	(0.02)	(0.11)	(0.01)	(0.18)	(0.01)
Hills	-0.34***	-0.04**	-0.34***	-0.04***	0.16	0.01
	(0.13)	(0.02)	(0.13)	(0.01)	(0.21)	(0.01)
Mountains	-0.64***	-0.07***	-0.39***	-0.05***	0.35	0.02
	(0.28)	(0.02)	(0.14)	(0.01)	(0.22)	(0.01)
Constant	-1.5		0.87***		-1.8**	
	(0.25)		(0.25)		(0.35)	
LR χ^2	38.46***		613.30***		335.55***	
Pseudo R^2	0.15		0.11		0.11	
Total	5988		5988		5988	

**** p<0.01, ** p<0.05, * p<0.1, S.E. value is inside the bracket. For FCS, values are in F-test and R-squared. Source: Nepal Living Standard Survey 2010/11 (CBS, 2011)*

Table 2 exhibits that proximities to markets, motorable roads and cooperatives are significant and negatively associated with food insecurity at 95 % and 90 % confidence intervals, respectively, revealing that

households with near to markets, motorable roads and cooperatives can help improve both availability and access to foods, including other employment opportunities in farm and off-farm sectors that further help to improve their economic access to diversified foods. However, these coefficients are not significant for poor dietary diversity. As remoteness and less productive land with insufficient food production seemed to be the major barrier of food security, mainly in rural hill and mountain districts of Nepal. Food security outcomes would be better with improved access to markets, roads and cooperatives by reducing the demand for food by supplying foods from outside to meet food security.

The results in Table 2 shows that the size of cultivated land with higher ratio of irrigated land is negative and significant associated with food insecurity at 99 % confidence interval, meaning that larger land with better irrigated facilities lead to a better food security situation at the household level. Larger farm size with higher ratio of irrigated land could have higher productivity and varieties of crops with less dependency on rainfall which might help improve household food security with diversified foods. While on the contrary, small farm size with less productive land depending on rain-fed agriculture may not produce sufficient food to meet the household food demand, thereby resulting in inadequate food consumptions and poor dietary diversity. The coefficient of livestock is significant and positive with food insecurity, meaning that the probability of being food insecure is higher with household having livestock.

This result seems to be surprising as the livestock was one of the major household assets and often used as household coping strategy. Possible explanation could be that livestock raising is more prevalent in the remote and rural areas and often used for manure for the farmland with relatively few milking animals such as buffaloes and cows reared. Moreover, it may be due to the fact that livestock market is thin and underdeveloped in rural areas. So, the livestock rearing might not help much to reduce household liquidity constraints and smooth food consumption. However, this result needs to be analyzed with caution.

Moreover, remittance receiving households from their migrant members was significant and negative with food insecurity at 99 % confidence interval, implying that the probability of being food secure was higher in the remittance recipient households as compared to non-recipient households. Remittance could help to reduce liquidity constraints and increase economic access to foods, thereby improving food security and dietary diversity. The findings from study[2] using food consumption score as dependent variation with a number of explanatory variables used in the logistic regression models are mostly significant and consistent with the results from logit models, indicating that the factors influencing food insecurity are robust and consistent with various models. This result was consistent with the finding from Chitwan, Nepal (Regmi *et al.*, 2014) and Bangladesh (Regmi & Paudel, 2016).

The results from Table 2 on marginal effects are mostly consistent and show similar signs with the probability coefficients. For instance, food insecurity is likely to reduce by 2 to 3 %, if the household has proximity to roads within 30 minutes. This will likely increase the availability of foods. Likewise, an increase of one-hectare farm land will likely reduce food poverty and household with inadequate food consumption by 2 % and 3 %, respectively.

Overall food security seems to be strongly associated with household characteristics such as family size, gender, age and education levels, together with land ownership, household income, remittance and improved access to markets and roads. These results reaffirm with other similar studies in Nepal and abroad, and are consistent with analytical approach and hypotheses that applied for this exercise.

CONCLUSION

The logit models used three dependent variables food poverty, household with inadequate food consumption (food consumption score less or equal to 42) and poor dietary diversity (less or equal 4 out of 8 food groups in a 7-day recall period) with explanatory variables household characteristics, land size and livestock, household income and remittance. Food security situation together with adequate consumption of diversified foods is more likely to be better with the household having better education level and higher age of household head and higher education level of female members, proximities to markets, roads and cooperatives, and larger farm size with higher ratio of irrigated land. On the contrary, food insecurity would be relatively more prevalent in the household living in rural area with larger family size and higher dependency ratio.

Marginal effects of logit models are consistent and in line with probability coefficients. The results from linear regression model using food consumption score as dependent variable were also found to be significant and consistent with logit models. The results imply that policy needs to address poor access to foods with improving household access to foods, together with access to markets and roads, and improved irrigation facilities for higher

[2] *We run linear regression model taking food consumption score as dependent variable with same explanatory variables used in logit models to test the consistent and robustness of the results and variables.*

productivity as well as other non-farm activities for improving livelihood.

ACKNOWLEDGEMENT

The authors would like to thank the Central Bureau of Statistics, Nepal for providing data and allowing them for the analysis.

REFERENCES

Adhikari, J. (2010), Food Insecurity, Conflict and Livelihood Threats in Nepal. In: B. R. Upreti & U. Müller-Böker (Eds.), *Livelihood insecurity and social conflict in Nepal*. South Asia Regional Coordination Office, Swiss National Centre of Competence in Research (SNCCR) North-South. Kathmandu, Nepal.

Ali, S., Noor, M. T., & Alam, K. J. (2016). The determinants of food security among households in Rangpur City, Bangladesh: A logistic regression approach. *IOSR Journal of Economics and Finance*, *7*(4), 51-56.

Arene, C., & Anyaeji, C. (2010). Determinants of food security among households in Nsukka metropolis of Enugu state, Nigeria. *Pakistan Journal of Social Sciences*, *30*(1), 9-16.

Bashir, M. K., Schilizzi, S., & Pandit, R. (2013). Regional sensitivity of rural household food security: The case of Punjab, Pakistan. *The Journal of Animal and Plant Sciences*, *23*(4), 1200-1206.

Beyene, F., & Muche, M. (2010). Determinants of food security among rural households of central Ethiopia: an empirical analysis. *Quarterly Journal of International Agriculture*, *49*(4), 299-318.

Bigsten, A., B.Kebede, Shimelis, A., & Taddesse, M. (2002). Growth and poverty reduction in Ethiopia: Evidence from household panel surveys. *World Development*, *31*(1), 87-106.

CBS. (2011). *Nepal living standard survey-2010/11*. Central Bureau of Statistics, Government of Nepal, Kathmandu.

CBS. (2018). *Annual household survey-2016/17*. Central Bureau of Statistics, Government of Nepal, Kathmandu.

Clover, J. (2003). Food security in sub-Saharan Africa. *African Security Review*, *12*(1), 1-10.

Egal, F. (2019). Review of the state of food security and nutrition in the world-2019. *World Nutrition*. https://doi.org/10.26596/wn.201910395-97

FAO. (1996). The Rome declaration on world food security. *Population Development Review*, *22*, 807-809.

Felker-Kantor, E., & Wood, C. H. (2012). Female-headed households and food insecurity in Brazil. *Food Security*, *4*(4), 607-617.

Huffman, J. E. (2015). Logistic regression analysis. In *Biostatistics for medical and biomedical practitioners*. https://www.sciencedirect.com/topics/medicine-and-dentistry/logistic-regression-analysis

Iram, U., & Butt, M. (2004). Determinants of household food security: An empirical analysis of Pakistan. *International Journal of Social Economics*, *31*(8), 753-766.

Joshi, G. R., & Joshi, B. (2017). Household food security: trends and determinants in mountainous districts of Nepal. *Future of Food: Journal on Food, Agriculture and Society*, *5*(2), 42-55.

Kabbani, N., & Wehelie, Y. (2005). Survey results on hunger and food insecurity in Yemen. In E. Mine Cinar (Ed.) *Topics in Middle Eastern and North African economics: Proceedings of the Middle East Economic Association*. Chicago, IL: Middle East Economic Association & Loyola University.

Khan, R. E. A., & Gill, A. R. (2009). Determinants of food security in rural areas of Pakistan (Paper No. 17146). *Munich Personal RePEc Archive*. Retrieved from https://mpra.ub.uni-muenchen.de/17146/

Kidane, H., Alemu, Z. G., & Kundlhande, G. (2005). Causes of household food security in Koredegaga Peasant Association, Oromiya Zone. *Ethiopia Agricultural Economics Journal*, *4*, 543-560.

Kumar, A., Kumar, P., & Joshi, P. K. (2017). Food consumption pattern and dietary diversity in Nepal: implications for nutrition security. *Indian Journal of Human Development*, *10*(3), 397-413.

Maharjan, K. L., & Joshi, N. P. (2011). Determinants of household food security in Nepal: A binary logistic regression analysis. *Journal of Mountain Science*, *8*(3), 403-413.

Maxwell, S., & Smith, M. (1992): *Household food security- conceptual indicators and measurements: A technical review*. UNICEF, New York and IFAD, Rome. p. 52.

Maxwell, D., Ahiadeke, C., Levin, C., Armar-Klemesu, M., Zakariah, A., & Lamptey, G. M. (1999). Alternative food security indicators- revisiting the frequency and severity of coping strategies. *Food Policy*, *24*, 411-429.

MoH. (2017). *Nepal demographic and health survey 2016*. Ministry of Health, Kathmandu, Nepal.

MoALD, CBS, WFP & FAO. (2018). *SDGs and food insecurity in Karnali: Results from the food insecurity experience scale*. Ministry of Agriculture and Livestock Development, Central Bureau of Statistics, World Food Programme and Food and Agriculture Organization, Kathmandu, Nepal.

NPC. (2013). *Nepal thematic report on food security and nutrition*. National Planning Commission, Kathmandu. http://www.npc.gov.np/en/category/periodic_plans

Ojha, E. R. (1999). *Dynamics and development of highland ecosystems*. Kathmandu: Walden Book House.

Ojogho, O. (2010). Determinants of food insecurity among arable farmers in Edo State, Nigeria. *Agricultural Journal*, *5*(3), 151-156.

Oriola, E. O. (2009). A framework for food security and poverty reduction in Nigeria. *European Journal of Social Sciences*, *8*(1), 132-139.

Pyndick, R. S., & Rubinfeld, D. L. (1991). *Econometric models and economic forecasts* (3rd Ed.). New York: McGraw-Hill.

Regmi, M., & Paudel, K. (2016). Impact of Remittance on Food Security in Bangladesh. In *Food security in a food abundant world* (pp. 145-158). UK: Emerald Publishing Ltd.

Regmi, M., Paudel, K. P., & Williams, D. (2014). Migration and remittance and their impacts on food security in Nepal. *Journal of Agricultural and Applied Economics*, *4*, 393-395.

Rose, D. (1999). Economic determinants and dietary consequences of food insecurity in the United States. *The Journal of Nutrition*, *129*(2), 517S-520S.

Sen, A. (1981). *Poverty and famines: An essay on entitlement and deprivation*. Oxford University Press, Oxford.

Smith, J. (2007). Food Security in Sudan. In *Darfur-overview*, Sudan. http://www.unicef.org/infobycountry/sudan_darfuroverview.html

Swaminathan, M. S. (2008). Can science and technology feed the world in 2025? *Field Crops Research*, *104*(3), 3-9.

Tefera, T., & Tefera, F. (2014). Determinants of household food security and coping strategies for food shortfall in Mareko district, Guraghe zone, Southern Ethiopia. *Journal of Food Security*, *2*(3), 92-99.