Research Article:

HOUSEHOLD FOOD SECURITY STATE AND ITS DETERMINANT IN THE CHEPANG TRIBE IN CHITWAN: AN ORDERED PROBIT ANALYSIS

Sweta Pandey* and Krishna Prasad Thapaliya
Department of Rural Sociology and Development Studies, Faculty of Agriculture, Agriculture and Forestry University, Rampur, Chitwan, Nepal

*Corresponding author: sp.swetapandey01@gmail.com

DOI: https://doi.org/10.3126/jafu.v7i1.95626

Received date: 24 Feb 2026; **Revised date:** 20 May 2026; **Accepted date:** 05 Jun 2026; **Published date:** 10 Jun 2026

ABSTRACT

The livelihoods of the Chepang community depend largely on agriculture and natural resources, leaving them highly vulnerable to climate-induced shocks and food insecurity. Despite this vulnerability, empirical evidence assessing food security and its determinants among the Chepang population remains limited, particularly studies that account for varying levels of food insecurity. The present study addresses this gap by evaluating household food security using the widely adopted Food Consumption Score (FCS) and identifying its key determinants through an ordered probit regression model. A mixed-methods design was employed. Data were collected in 2024 from 120 randomly selected Chepang households in Kalika Municipality, Chitwan, complemented by one focus group discussion and five key informant interviews. The findings revealed that 42.50% of households achieved an acceptable food consumption level, while 21.67% were classified in the poor food consumption category based on the FCS. Results from the ordered probit model indicated that the gender of the household head and landholding size were significant determinants of household food security. Female-headed households were more likely to fall into the poor food consumption category ($p < 0.05$), whereas households with larger landholdings were significantly more likely to attain acceptable food consumption levels ($p < 0.01$). The study recommends policy interventions that enhance secure land access for asset-poor households and promote gender-inclusive capacity-building programs to strengthen food security and resilience among the Chepang community.

Keywords: Food insecurity, indigenous community, socio-economic factors, vulnerable

INTRODUCTION

The concept of food security has evolved considerably over time. The Rome Declaration on World Food Security defines food security as a condition in which "all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 1996). Since its introduction, the concept has undergone substantial refinement regarding its scope, dimensions, and measurement (Devereux & Maxwell, 2001). A significant shift occurred in the early 1980s when the focus of food security expanded from national and international food availability to encompass household- and individual-level access to food (Devereux et al., 2004). Similarly, the World Bank conceptualizes food security at the household level as the ability of all members to access sufficient food at all times for a healthy and active life. This definition highlights not only food availability and access but also the sustainability of such access over time.

Despite global progress in reducing hunger, food insecurity remains a persistent development challenge. According to FAO et al. (2025), the proportion of the global population experiencing hunger declined from 8.7% in 2022 to 8.5% in 2023 and further to 8.2% in 2024. Nevertheless, improvements have been unevenly distributed, with food insecurity remaining disproportionately concentrated in rural areas, while much of the observed progress has occurred in urban regions. These disparities underscore the continuing vulnerability of rural populations, particularly those dependent on agriculture and natural resources for their livelihoods.

In Nepal, food insecurity continues to pose a significant concern. Approximately 77.63% of the population resides in rural areas (World Bank, 2024), where livelihoods are highly susceptible to environmental, economic, and climatic shocks. The country ranked 72nd on the Global Hunger Index with a score of 14.8, indicating a moderate level of hunger (Welthungerhilfe, 2025). Nationally representative data reveal that 26.2% of households experience severe food insecurity (MoHP et al., 2022). Moreover, rising living expenses have intensified household vulnerability, as evidenced by the increase in the food poverty line from NRs. 29,936 to NRs. 35,029 over the past decade (NSO, 2024). While these national statistics provide an overall picture of food insecurity, they often obscure substantial disparities among socially and economically marginalized populations, particularly indigenous communities (Chuwan, 2024).

Nepal is home to 125 indigenous nationalities, many of whom experience disproportionately high levels of food insecurity. Evidence suggests that indigenous populations worldwide face greater challenges in maintaining stable access to adequate and nutritious food than non-indigenous populations (Coleman-Jensen et al., 2021). Among these groups, the Chepang are recognized as one of Nepal's most marginalized indigenous communities and have historically experienced chronic food insecurity. Traditionally dependent on shifting cultivation (Khoriya farming), the Chepang adopted settled agriculture relatively late and continue to rely primarily on rain-fed subsistence farming on marginal lands (Piya et al., 2011) a highly marginalized indigenous nationality in Nepal. Their livelihoods remain closely linked to forest resources, with wild foods serving as an important component of household consumption despite the gradual transition to terrace-based agriculture (Piya et al., 2019).

The geographical and environmental conditions of Chepang settlements further exacerbate food insecurity. Rugged topography, poor soil quality, and increasing climate-related stresses limit agricultural productivity. Rice cultivation is generally not feasible, while yields of maize and millet, the principal crops grown on small upland terraces, remain low. Consequently, household agricultural production is often sufficient for only five to six months of annual consumption. During the remaining months, households rely heavily on daily wage labor, hunting, and the collection of wild foods such as wild yam, *Vyakur*, wild fruits, and *Chiuri* to meet their subsistence needs (Sharma & Aryal, 2018). Although Nepal's Right to Food and Food Sovereignty Act (2018) formally recognizes access to food as a fundamental human right, food insecurity remains pervasive among vulnerable groups such as the Chepang. Without strengthened social protection measures and targeted livelihood interventions, food insecurity within this community is likely to worsen, posing serious risks to both nutritional well-being and long-term resilience. Addressing food insecurity among the Chepang is therefore not only a matter of social justice but also a critical priority for inclusive and sustainable development in Nepal.

Existing empirical evidence consistently demonstrates the severity of food insecurity within the Chepang community. Aryal (2016) reported that only 6% of Chepang households in Dahakhani Village experienced year-round food security, whereas 94% faced varying degrees

of food insufficiency. Among food-insecure households, 19% experienced food shortages for approximately three months annually, while 81% reported food deficits lasting four months or longer. Similarly, Bhandari and Neupane (2021) found that 37.5% of Chepang households failed to meet their daily caloric requirements. Nutritional challenges are particularly pronounced among children, who exhibit high levels of chronic undernutrition and poor dietary diversity (Dhungel & Shakya, 2021) which includes wasting (low weight-for-height. Furthermore, Gurung (2022) documented more than half of Chepang households experienced inadequate food consumption and poor dietary diversity, highlighting the multidimensional nature of food insecurity within the community.

Despite these important contributions, the existing literature exhibits two notable limitations. First, relatively few studies have assessed household food security using internationally recognized and standardized indicators that capture the quality and diversity of food consumption (Bhandari & Neupane 2021; Sharma & Aryal, 2018). Second, previous analyses have predominantly employed binary analytical frameworks that classify households as either food secure or food insecure (Maharjan & Joshi, 2011). While useful, such approaches fail to capture variations in the severity of food deprivation and may therefore obscure important differences among households experiencing poor, borderline, or acceptable levels of food consumption (Kolog et al., 2023).

To address these gaps, this study pursues two primary objectives. First, it assesses household food security among the Chepang community using the Food Consumption Score (FCS), a widely recognized indicator that categorizes households into poor, borderline, and acceptable food consumption groups. Second, it identifies the socio-economic determinants of these food security states using an ordered probit model, which appropriately accounts for the ordinal nature of food security outcomes and captures the full spectrum of food deprivation. By providing empirical evidence from a highly marginalized indigenous community, the study contributes to the literature on food security and offers policy-relevant insights for designing targeted interventions aimed at improving food security and livelihood resilience among the Chepang population.

RESEARCH METHODS

Sampling technique

The study adopted a multi-stage sampling design to ensure adequate representation of the Chepang community. Initially, Kalika Municipality in Chitwan District was purposively selected as the study area owing to its high concentration of Chepang households. Subsequently, four wards (8, 9, 10, and 11) with the largest Chepang populations were selected, yielding a sampling frame of 1,447 households. A sample of 120 households was then drawn using simple random sampling. The required sample size was calculated using Cochran's (1977) finite population formula with a 95% confidence level and an 8.5% margin of error.

Data collection and analysis

This study employed a cross-sectional research design, with data collected between April and May 2024. Primary data were gathered through a household survey using a pre-tested semi-structured questionnaire, which captured information on household socioeconomic characteristics, institutional factors, and gender-disaggregated food security conditions. To complement and validate the survey findings, five key informant interviews (KIIs) were conducted with government officials, local leaders, and representatives of non-governmental organizations. In addition, one focus group discussion (FGD) comprising eight male and female participants was conducted to provide contextual insights into local food security challenges.

Secondary data was obtained from academic literature, the Kalika Municipality Profile, and publications of the Central Bureau of Statistics. Quantitative data were coded, entered into Microsoft Excel, and analyzed using STATA version 17 and Microsoft Excel. Qualitative data obtained from the FGD and KIIs were analyzed thematically and used to complement and contextualize the quantitative findings.

Analytical technique and empirical model

Unlike previous studies that have predominantly employed binary choice models to analyze food security outcomes (Abdullah et al., 2019; Abubakari & Abubakari, 2015), this study utilizes an ordered probit model. The Food Consumption Score (FCS) was adopted as the dependent variable because it is a widely recognized and standardized indicator that captures both dietary diversity and food consumption frequency over a seven-day recall period, thereby providing a comprehensive measure of household food security and nutritional status (World Food Programme, 2008). Based on established thresholds, the FCS classifies households into three ordered categories: poor, borderline, and acceptable food consumption.

Given the ordinal nature of the dependent variable, conventional binary response models are inappropriate because they fail to account for the inherent ranking of food security outcomes. Similarly, multinomial logit and multinomial probit models treat outcome categories as nominal and do not exploit the ordinal information contained in the data (Greene, 2002). Therefore, an ordered response model is more suitable for analyzing the determinants of household food security status.

Among the available ordered response models, the ordered logit and ordered probit are the most commonly applied. The ordered logit model assumes a logistic distribution of the error term, whereas the ordered probit model assumes a standard normal distribution. In practice, both models generally yield comparable results (Greene, 2002). However, the ordered probit model is widely employed in applied econometric research involving ordinal outcome variables and is particularly appropriate when the latent propensity underlying the observed categories is assumed to follow a normal distribution (Davidson & MacKinnon, 2004). Accordingly, this study adopts the ordered probit specification to examine the socioeconomic determinants of household food security among the Chepang community.

Following established econometric practice for ordinal variables, the study employs the ordered probit framework to analyse the factors influencing household food security (McKelvey & Zavoina, 1975).

The ordered probit model assumes an unobserved latent variable,

$Y_i^* = X_i\beta + \varepsilon_i$, i = 1, 2, …., N

where Y_i^* represents the unobserved food security status of household i, X_i is a vector of predictors, β is a vector of parameters, and ε_i is a standard normal error term.

We observe the categorical outcome Y_i, which is related to the latent variable through threshold parameters as:

$Y_i = j$ if $\mu_{j-1} < Y_i^* \leq \mu_j$, j = 0, 1, 2,…,J

where, u_j represents unobserved cut-off points that satisfy $\mu_{-1} = -\infty$, $\mu_0 = 0$, and $\mu_J = +\infty$

The probability of household i belonging to food security category j is expressed as:

$P(Y_i = j) = \Phi(\mu_j - Xi\beta) - \Phi(\mu_{j-1} - Xi\beta)$

where Φ(.) represents the standard normal cumulative distribution function. The empirical framework for food security measures is specified as:

$FS_{ij} = \alpha + \beta X_i + \varepsilon_i$

where FS_{ij} represents the household food security i in category j, X_i is a vector of socioeconomic and institutional characteristics expected to influence household food security, β is a vector of parameters to be estimated, and ε_i is the error term.

The empirical model incorporates ten explanatory variables selected based on a review of relevant literature (Kolog et al., 2023; Maharjan & Joshi, 2011) and information obtained from the primary survey. A detailed description of the dependent and independent variables is presented in Table 1.

To facilitate interpretation of the ordered probit estimates, marginal effects were computed to assess the impact of explanatory variables on the probability of a household belonging to a specific food security category. For continuous variables, marginal effects measure the change in predicted probability associated with a one-unit increase in the explanatory variable, holding other factors constant. In the case of binary (dummy) variables, marginal effects capture the discrete change in predicted probability when the variable shifts from 0 to 1.

Table 1. Summary statistics of variables

Variables	Descriptions	Mean	Median	S.D	Min	Max
Outcome variable: FCS	Food consumption score	34.48	34.75	12.57	12	69.5
Independent variable:						
Age	Age of household head in years	42.83	44.5	11.08	22	68
Gender	Household head gender, Female = 1, Male = 0	0.14	1	0.35	0	1
Education	Schooling years of the household head	2.55	0	3.94	0	15
Proportion of economically active members	Ratio of economically active members (age from 15-59) to total family members	0.58	0.57	0.16	0.28	1
Land	Total land holding (hectare)	0.24	0.24	0.10	0.06	0.47
Agriculture	Primary occupation as agriculture = 1 and Other = 0	0.81	1	0.39	0	1
Membership in CBO	Membership in CBO; Yes = 1 and No = 0	0.55	1	0.49	0	1
Credit	Access to credit; Yes = 1 and No = 0	0.35	0	0.48	0	1
Extension and Training	Access to extension and Training; Yes = 1 and No = 0	0.13	0	0.34	0	1
Information	Access to climate information; Yes = 1 and No = 0	0.5	1	0.5	0	1

Note: S.D indicates standard deviation, and Min and Max represents minimum and maximum value respectively.

Food Consumption Score (FCS)

FCS is estimated by assessing how frequently the variety of food groups was consumed by a household during the seven days preceding the survey. The frequency of intake for each food category is weighted by its nutritional value, as shown in the table below.

Table 2. Food categories and their weights to determine the FCS

Food groups	Weight
Main staples	2
Pulses	3
Vegetables	1
Fruit	1
Meat/fish/eggs	4
Milk and dairy products	4
Sugar, honey	0.5
Oils and Fats	0.5

Source: (World Food Programme, 2008)

The World Food Programme has established three thresholds for food consumption that are used to distinguish between households: acceptable (>35), borderline (21.5-35), and poor (0-21). $\text{FCS} = \sum_{i=1}^{8} xi.pi$

xi represents frequency of consumption for each food group i, pi represents weight of food group i

RESULTS AND DISCUSSION

Household food security status

The distribution of the Food Consumption Score (FCS) among the sampled households shows that 21.67% fall into the poor food consumption category, while 35.83% and 42.5% are classified as borderline and acceptable, respectively (Table 3). These findings indicate that a substantial proportion of Chepang households experience varying degrees of food deprivation, ranging from moderate vulnerability to relatively adequate food consumption.

Regarding the gender of the household head, the results show a predominance of male-headed households across all FCS categories, reflecting the sample composition in which 103 out of 120 households were male-headed, and 17 were female-headed. Accordingly, interpretation within gender groups provides a more meaningful comparison. Among male-headed households, 47.57% fall within the acceptable FCS category, whereas only 11.76% of female-headed households achieve the same classification. Conversely, 52.94% of female-headed households are in the poor FCS category, compared to 16.50% of male-headed households, indicating a relatively higher concentration of food insecurity among female-headed households.

Table 3. Gender distribution of Food Consumption Score

FCS	Male	Female	Total
Poor	17 (16.50)	9 (52.94)	26 (21.67)
Borderline	37 (35.92)	6 (35.29)	43 (35.83)
Acceptable	49 (47.57)	2 (11.76)	51 (42.50)
Total	103 (100)	17 (100)	120 (100)

Note: n represents absolute household frequencies, and figures in parentheses indicate percentages

In addition, key policy-relevant variables, including access to credit facilities and the combined availability of credit and extension services, exhibit a higher proportion of households in the acceptable food consumption category (Table 4), suggesting a positive association between institutional support mechanisms and improved food security outcomes.

Table 4. Distribution of Food Consumption Score by Key Policy-Relevant Variables

Variables	Category	Poor FCS n(%)	Borderline FCS n(%)	Acceptable FCS n(%)	Total n(%)
Credit facility	Yes	4(9.3)	15(34.9)	24(55.8)	43(35.8)
	No	22(28.6)	28(36.4)	27(35.1)	77(64.2)
Extension / Training	Yes	0(0.0)	5(31.3)	11(68.8)	16(13.3)
	No	26(25.0)	38(36.5)	40(38.5)	104(86.7)

(Field Study, 2024) Note: n represents absolute household frequencies; figures in parentheses indicate percentage.

Determinants of household food security: Results from an ordered probit model

The results of the ordered probit regression on the determinants of household food security are presented in Table 5. The discussion primarily focuses on marginal effects, as coefficient estimates in nonlinear models do not directly convey the magnitude of changes in probabilities associated with explanatory variables. Diagnostic tests indicate no evidence of multicollinearity, with a mean Variance Inflation Factor (VIF) of 1.49, suggesting that the explanatory variables are statistically independent.

The gender of the household head exhibits a statistically significant and negative association with food security status. Marginal effects indicate that female-headed households are 14.0 percentage points more likely to fall into the poor food consumption category and 5.2 percentage points more likely to be in the borderline category, while their probability of attaining acceptable food consumption decreases by 19.3 percentage points. This finding is consistent with evidence from previous studies (Akadiri et al., 2018). Affordable and nutritious food at all times have presented very important policy concerns in the drive towards achieving the first two of the Sustainable Development Goals (Maharjan & Joshi, 2011; Shin, 2020), which suggests that male-headed households tend to exhibit relatively higher levels of food security. Such disparities are largely attributed to gender-based differences in access to productive resources, inputs, and livelihood opportunities (Mason et al., 2015; World Bank et al., 2009).

Landholding size emerges as a significant positive determinant of food security. A one-unit increase in land size reduces the probability of a household being in the poor food consumption category by 43.4 percentage points and increases the likelihood of being in the acceptable category by 5.9 percentage points. This underscores the central role of land as a critical productive asset in agrarian livelihoods, enabling households to achieve greater food self-sufficiency (Kolog et al., 2023).

In contrast, household age and membership in community-based organizations (CBOs) are associated with a reduced probability of attaining acceptable food consumption. Other variables, including years of schooling of the household head, primary reliance on agriculture, access to credit, availability of extension and training services, and access to climate information, exhibit positive but statistically insignificant relationships with food security status. The insignificance of education contrasts with earlier studies (Akadiri et al., 2018; affordable and nutritious food at all times—have presented very important policy concerns in the drive towards achieving the first two of the Sustainable Development Goals (Mutisya et al., 2016), suggesting that in marginalized and geographically excluded communities, the quality and relevance of education may be insufficient to translate into improved livelihood or food security outcomes without complementary structural support (Tirivayi et al., 2016). Similarly, the insignificant effect of extension services aligns with evidence that conventional top-down extension systems are often ineffective when poorly tailored to the needs of marginalized households (Ragasa & Mazunda, 2018). Although access to credit is positively associated with food security, its effect remains

statistically insignificant, potentially reflecting the predominance of informal and unproductive credit use in rural settings (Bidisha et al., 2017).

Notably, while access to extension services and credit facilities was statistically significant in the bivariate Fisher's exact tests ($p = 0.022$ and $p = 0.020$, respectively), their significance diminishes in the multivariate ordered probit framework. This suggests that their independent explanatory power is reduced once structural factors such as landholding size and gender of the household head are controlled for. In contrast to Addai et al. (2024) using cross-sectional data from a household survey from Ghana. We employ an endogenous switching regression (ESR, membership in organizations is negatively associated with food security in this study, which may reflect ineffective participation, limited institutional responsiveness, or informational asymmetries within local organizations (Al-Amin et al., 2019).

The finding suggests that structural inequalities in access to productive resources continue to dominate household food security outcomes among the Chepang community. Therefore, the study highlights the need for policy approaches that move beyond generalized agricultural support and instead address deeper issues of land access, gendered resource inequality, and social exclusion.

As a robustness check, Fisher's exact test was employed to examine the association between food consumption categories and key explanatory variables. The results indicate statistically significant associations between FCS and gender ($p = 0.002$), access to credit ($p = 0.020$), access to agricultural extension services ($p = 0.022$), and awareness of climate change ($p = 0.001$). However, no significant association was observed for primary income source ($p = 0.360$) and CBO membership ($p = 0.358$). While Fisher's test does not provide information on the direction or magnitude of effects, the results broadly corroborate the ordered probit findings, confirming that household food security status is significantly influenced by key socio-economic and institutional factors.

Table 5. Determinants of food security using FCS: Ordered probit regression result

Variables	Coefficient	Marginal effects (dy/dx)		
		Poor	Borderline	Acceptable
Age	-0.010	0.002	0.001	-0.002
	(0.015)	(0.003)	(0.001)	(0.004)
Gender	-0.681*	0.140*	0.052	-0.193*
	(0.325)	(0.065)	(0.031)	(0.092)
Education	0.024	-0.005	-0.001	0.006
	(0.050)	(0.010)	(0.003)	(0.014)
Proportion of economically active members	1.210	-0.249	-0.093	0.034
	(0.672)	(0.137)	(0.057)	(0.187)
Land	0.210**	-0.434**	-0.016*	0.059**
	(0.469)	(0.009)	(0.004)	(0.011)
Agriculture	0.093	-0.019	-0.007	0.026
	(0.261)	(0.053)	(0.020)	(0.073)
Membership in CBO	-0.097	0.020	0.007	-0.027
	(0.221)	(0.045)	(0.017)	(0.062)
Credit	0.055	-0.011	-0.004	0.015
	(0.244)	(0.050)	(0.018)	(0.069)
Extension and Training	0.611	-0.126	-0.047	0.173
	(0.437)	(0.087)	(0.034)	(0.119)
Information	0.395	-0.081	-0.030	0.112
	(0.230)	(0.045)	(0.021)	(0.064)
Number of observation	120			
Wald chi2 Prob > chi2	48.96			
Log pseudo likelihood	-98.028			
Pseudo R2	0.231			
cut1	0.097 (0.982)			
cut2	2.407(0.999)			

Notes: Robust standard errors are enclosed in parentheses. ** and * denote significance thresholds at the 1% and 5%, levels, respectively.

CONCLUSION

This study examined household food security status and its determinants among the Chepang community using the Food Consumption Score (FCS) and an ordered probit model. The findings reveal substantial food security challenges, with only 42.5% of households achieving acceptable food consumption levels, indicating widespread vulnerability and persistent food deprivation within the study population.

The econometric results identify the gender of the household head and landholding size as the only statistically significant determinants of food security. Female-headed households are significantly more likely to fall into the poor food consumption category, highlighting persistent gender-based disparities in access to productive resources and livelihood opportunities. In contrast, landholding size is positively associated with improved food consumption outcomes, underscoring the critical role of land as a key productive asset in sustaining food security among marginalized agrarian households.

These findings suggest that conventional rural development programs may have limited effectiveness unless accompanied by policies that strengthen equitable access to productive assets and address the socio-economic marginalization of indigenous communities. Accordingly, policy interventions should prioritize improving equitable access to land and strengthening women's access to productive resources, including land rights, inputs, and livelihood support systems. Such targeted and inclusive strategies are essential for enhancing household food security and building long-term resilience in this marginalized population.

ACKNOWLEDGEMENTS

The authors extend their sincere gratitude to the Chepang community for their invaluable participation in this study. Our sincere thanks go to the USAID Higher Education project for its financial support.

AUTHOR'S CONTRIBUTION

SP: Conceptualization, Methodology, Data curation, Formal analysis, Resources, Visualization, Funding acquisition, Writing – original draft; **KPT:** Visualization, Writing – review & editing, Supervision.

CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

ETHICAL APPROVAL AND PERMITS

This study utilized non-interventional semi-structured interviews with voluntary participants; formal ethical approval was not required. Nevertheless, the research adhered to strict ethical standards by obtaining informed consent from all respondents and ensuring the total confidentiality of their data.

REFERENCES

Abdullah, Z. D., Shah, T., Ali, S., Ahmad, W., Din, I. U., & Ilyas, A. (2019). Factors affecting household food security in rural northern hinterland of Pakistan. *Journal of the Saudi Society of Agricultural Sciences, 18*(2), 201–210. https://doi.org/10.1016/j.jssas.2017.05.003

Abubakari, F., & Abubakari, F. (2015). Determinants of household food security and climate change impacts on agriculture in Ghana. *Academic Research Journal of Agricultural Science and Research, 3*(7), 178–183. https://doi.org/10.14662/ARJASR2015.015

Addai, K. N., Ng'ombe, J. N., & Temoso, O. (2024). Can farmer organization membership improve household food security and nutrition? Evidence from Northern Ghana. *World Food Policy, 10*(2), 180–202. https://doi.org/10.1002/wfp2.12076

Akadiri, S. S., Nwaka, I. D., & Jenkins, G. P. (2018, January). *Are female-headed households less food secure? Evidence from Nigeria and Ethiopia* [Conference presentation]. Allied Social Science Association Annual Conference, Philadelphia, PA, United States.

Al-Amin, A. K. M. A., Akhter, T., Islam, A. H. M. S., Jahan, H., Hossain, M. J., Prodhan, M. M. H., Mainuddin, M., & Kirby, M. (2019). An intra-household analysis of farmers' perceptions of and adaptation to climate change impacts: Empirical evidence from drought-prone zones of Bangladesh. *Climatic Change, 156*(4), 545–565. https://doi.org/10.1007/s10584-019-02511-9

Aryal, B. (2016). State of food (in)security in Chepang community: A case of Dahakhani VDC, Chitwan. *Economic Literature, 11*(1), 60–68. https://doi.org/10.3126/el.v11i0.14868

Bhandari, B., & Neupane, S. P. (2021). Harnessing underground crops for better food and nutrition security among Nepal's indigenous: LI-BIRD's story. *Grow Further – A Food-Secure Future*. https://www.growfurther.org/harnessing-underground-crops-for-better-food-and-nutrition-security-among-nepals-indigenous-li-birds-story/

Bidisha, S. H., Khan, A., Imran, K., Khondker, B. H., & Suhrawardy, G. M. (2017). Role of credit in food security and dietary diversity in Bangladesh. *Economic Analysis and Policy, 53*, 33–45. https://doi.org/10.1016/j.eap.2016.10.004

Chuwan, N. K. (2024). Exploring variation of influences of caste and ethnicity in rural mountain household food security in Nepal. *Barun Journal, 1*(1), 10–19. https://doi.org/10.3126/barunj.v1i1.76408

Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). John Wiley & Sons.

Coleman-Jensen, A., Gregory, C., & Singh, A. (2021). Household food security in the United States. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2504067

Davidson, R., & MacKinnon, J. G. (2004). *Econometric theory and methods*. Oxford University Press.

Devereux, S., Baulch, B., Hussein, K., Shoham, J., Sida, H., & Wilcock, D. (2004). Improving the analysis of food insecurity. In *Food insecurity measurement, livelihoods approaches and policy: Applications in FIVIMS*. Institute of Development Studies (IDS).

Devereux, S., & Maxwell, S. (Eds.). (2001). *Food security in sub-Saharan Africa*. ITDG Publishing.

Dhungel, K. U., & Shakya, N. (2021). Under nutrition among Chepang children of Chitwan, Nepal. *Janaki Medical College Journal of Medical Science, 9*(1). https://doi.org/10.3126/jmcjms.v9i1.38339

FAO, IFAD, UNICEF, WFP, & WHO. (2025). *Addressing high food price inflation for food security and nutrition: In brief to the state of food security and nutrition in the world 2025*. https://doi.org/10.4060/cd6015en

Food and Agriculture Organization. (1996). *Rome Declaration on World Food Security and Plan of Action*. https://www.fao.org/4/w3613e/w3613e00.htm

Greene, W. H. (2002). *Econometric analysis* (5th ed.). Prentice Hall.

Gurung, C. B. (2022). Understanding dynamics of food insecurity and vulnerability in Chepang community. *Journal of Advanced Academic Research, 9*(2), 83–96. https://doi.org/10.3126/jaar.v9i2.48845

Kolog, J., Asem, F., & Mensah-Bonsu, A. (2023). The state of food security and its determinants in Ghana: An ordered probit analysis of the household hunger scale and household food insecurity access scale. *Scientific African, 19*, e01579. https://doi.org/10.1016/j.sciaf.2023.e01579

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. https://doi.org/10.1007/s11629-011-2001-2

Mason, R., Ndlovu, P., Parkins, J. R., & Luckert, M. K. (2015). Determinants of food security in Tanzania: Gendered dimensions of household headship and control of resources. *Agriculture and Human Values, 32*(3), 539–549. https://doi.org/10.1007/s10460-014-9568-5

McKelvey, R. D., & Zavoina, W. (1975). A statistical model for the analysis of ordinal level dependent variables. *The Journal of Mathematical Sociology, 4*(1), 103–120. https://doi.org/10.1080/0022250X.1975.9989847

Ministry of Health and Population (MoHP), New ERA, & ICF. (2022). *Nepal Demographic and Health Survey 2022*. https://dhsprogram.com/pubs/pdf/FR379/FR379.pdf

Mutisya, M., Ngware, M. W., Kabiru, C. W., & Kandala, N. B. (2016). The effect of education on household food security in two informal urban settlements in Kenya: A longitudinal analysis. *Food Security, 8*(4), 743–756. https://doi.org/10.1007/s12571-016-0589-3

Nepal Statistics Office. (2024). *Nepal Living Standards Survey IV, 2022–23*. https://nsonepal.gov.np/content/13188/13188-information-regarding-distribu/

Piya, L., Maharjan, K. L., & Joshi, N. P. (2011). Forest and food security of indigenous people: A case of Chepangs in Nepal. *Journal of International Development and Cooperation, 17*, 113–135.

Piya, L., Maharjan, K. L., & Joshi, N. P. (2019). Annual subsistence cycle: Integration of farming and gathering. In L. Piya, K. L. Maharjan, & N. P. Joshi (Eds.), *Socio-economic issues of climate change: A livelihood analysis from Nepal* (pp. 75–87). Springer. https://doi.org/10.1007/978-981-13-5784-8_7

Ragasa, C., & Mazunda, J. (2018). The impact of agricultural extension services in the context of a heavily subsidized input system: The case of Malawi. *World Development, 105*, 25–47. https://doi.org/10.1016/j.worlddev.2017.12.004

Sharma, G., & Aryal, B. (2018). Household economies of Chepang people in Chitwan. *Economic Literature, 13*, 39–48. https://doi.org/10.3126/el.v13i0.19149

Shin, Y. (2020). *How the gender of the household's head influences household food security in developing countries* (Master's thesis, Seoul National University). SNU Open Repository.

Tirivayi, N., Knowles, M., & Davis, B. (2016). The interaction between social protection and agriculture: A review of evidence. *Global Food Security, 10*, 52–62. https://doi.org/10.1016/j.gfs.2016.08.004

Welthungerhilfe. (2025). *Global Hunger Index 2025: Nepal*. https://www.globalhungerindex.org/nepal.html

World Bank. (2024). *Nepal: Rural population (% of total population)*. The Global Economy. https://www.theglobaleconomy.com/Nepal/rural_population_percent/

World Bank, Food and Agriculture Organization, & International Fund for Agricultural Development. (2009). *Gender in agriculture sourcebook*. World Bank. https://doi.org/10.1596/978-0-8213-7587-7

World Food Programme. (2008). *Food consumption analysis: Calculation and use of the food consumption score in food security analysis*. World Food Programme. https://documents.wfp.org/stellent/groups/public/documents/manual_guide_proced/wfp197216.pdf