Effect of Old Age Allowance on Household Food Insecurity: Evidence from Rural Nepal

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Abstract

Background: Food insecurity remains a persistent challenge in rural Nepal despite the country's history of agricultural self-sufficiency. The government has implemented social safety nets, notably the old age allowance, as a key strategy to combat this issue. However, the effectiveness of such cash transfer programs in directly improving food security outcomes is not well-established.

Objectives: This study aims to investigate the impact of the old age allowance on household food insecurity in rural Nepal. It also seeks to identify other key socioeconomic determinants, including agricultural engagement, livestock ownership, migration, and cooperative membership, that influence food security status.

Methods: The study utilized primary data collected from a cross-sectional survey of 763 households across nine rural municipalities in five provinces of Nepal. Food insecurity was measured using the Food Insecurity Experience Scale (FIES). A logistic regression model was employed to analyze the association between receiving the old age allowance and the probability of household food insecurity, while controlling for other demographic and socioeconomic variables.

Findings: The results reveal that 26.9% of sampled households experienced some level of food insecurity. The logit regression analysis shows that receiving the old age allowance significantly reduces the probability of food insecurity by 8.3 percentage points. Other significant factors include agricultural livelihood and livestock ownership, which are

associated with lower food insecurity, while migration is linked to a higher probability of food insecurity. Cooperative membership also demonstrates a strong negative association with food insecurity.

Conclusion: The old age allowance plays a modest but significant role in enhancing food security among rural households in Nepal. However, its effectiveness is strengthened when combined with other factors such as agricultural livelihoods, livestock assets, and cooperative participation. The findings highlight the need for a multi-sectoral approach that integrates social protection with sustainable livelihood interventions to effectively address food insecurity.

Novelty: This study provides empirical evidence from a primary survey specifically quantifying the isolated impact of Nepal's largest social safety net—the old age allowance—on household food insecurity using a validated FIES scale. It offers a nuanced analysis by contrasting its effect with other critical determinants like migration and cooperative membership within the rural Nepali context.

Keywords: Food Insecurity Experience Scale (FIES), Logistic Regression, Nepal, Old Age Allowance, Rural Livelihoods

Introduction

Food security refers to the state of having sufficient, secure, and nutritious food, enabling them to maintain a healthy and active lifestyle. In contrast, the condition where people have insufficient availability and accessibility to nutritious food is known as food insecurity. In 1974, for the first time, the World Food Conference defined food security in terms of food supply as the "availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices." Over time, different definitions have been introduced, emphasizing the broad concept of food security. The World Food Summit in 1996 encompassed the four dimensions of availability, access, utilization, and stability and claimed that food security exists "when 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." Similarly, USAID (1992) characterized food security as a state in which "all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life."

Despite Nepal's history of self-sufficiency in food production, pertinent issues of undernourishment and persistent hunger prevail in certain regions of the country (Pain et al. 2015; Yu et al. 2010). The 2022 Demographic and Health Survey of Nepal reveals that approximately 13 percent of the population experienced moderate or severe food insecurity, with 1.3 percent facing severe food insecurity. This issue disproportionately burdens rural areas, recording a 16.2 percent incidence of food insecurity as compared to 10.6 percent in urban areas (MoHP, New ERA, & ICF, 2023). Disparities persist even at the regional level, with Karnali and Sudurpashchim provinces reporting the highest food inadequacy (14 to 16

percent), followed by Gandaki, Lumbini, Madhesh, and province 1 (12 to 14 percent), while Bagmati province has the lowest, less than 12 percent (WFP, 2023). The prevalence of food insecurity is also underscored by the Global Hunger Index Report 2023. The report classifies Nepal as having a moderate hunger level (15), ranking 69th globally, with 5.4 percent of the population undernourished, 7.7 percent of children wasted, 2.7 percent of child mortality, and 24.8 percent of children stunted.

Nepal has made significant strides in mitigating food insecurity, notably through the Right to Food Act, 2018, which recognizes food as a fundamental right. Building on lessons from the MDGs, Nepal actively supports the Sustainable Development Agenda 2030, particularly SDG 2, which aims to eradicate hunger. The country seeks to ensure year-round access to nutritious food, eliminate malnutrition, double agricultural productivity, and promote sustainable food systems (Chemjong & KC, 2020). Additionally, the Agricultural Development Strategy 2014 targets reducing food poverty from 24% in 2010 to 5% by 2030 (MOAD, 2014). Social safety allowances further reinforce these efforts.

These social safety nets are one of the vital initiatives to eradicate the issues of food insecurity (Khan et al. 2023; Badhan et al. 2019). It not only leads to improved food intake and a higher-quality diet but also empowers people to adjust to cyclical shifts and unexpected shocks by providing a consistent level of income throughout the year (Boukary et al. 2016; Holmes & Bhuvanendra, 2013; Bailey & Hedlund, 2012). Social safety nets, contributing to education, health, and income-generating activities, open ways to invest in the beneficiaries' future, helping them to manage risk and improve the welfare of the people, whereas they improve nutrition indicators for the non-beneficiaries through the stimulation of local demand for goods and services in the local community (Burchi, 2021; Hltf et al. 2011). While the continuous supply of money may potentially reduce their incentive to work, it is essential to note that developing countries offer a limited monetary value, due to which the controversial relationship between cash transfers and employment is somehow not seen (Burchi, 2021).

Among the SSNs, the old age allowance has experienced a significant surge in its allowance amount, emerging as the major stakeholder in the budget allocated for social safety programs. Commencing at Rs 100 Nepalese rupees per month in FY 1995/96 (NPC, 2020), the allowance has now reached Rs 4000 Nepalese rupees per month. Additionally, special criteria are allocated to Dalits and citizens from 5 districts of Karnali Province (Humla, Jumla, Mugu, Kalikot, and Dolpa) who receive Rs 2660 Nepalese rupees per month once they reach 60 years old. Old age allowance having 52.89 percent beneficiaries of the total beneficiaries alone accounts for 77.36 percent of the total social security allowance expenditure in the fiscal year 2022/23(Department of National ID and Civil Registration, 2023). So, the pivotal question arises regarding the effectiveness of these government funds in achieving their intended objectives of enhancing food security. Recognizing this gap in research, the present study aims to determine whether receiving allowances in the form of old age allowance has an impact on food insecurity within the context of rural Nepal using a regression analysis.

Methodology

Study area and method

The nine rural municipalities from nine districts, located in the different ecological zones in five provinces, namely Sudurpashchim, Karnali, Lumbini, Bagmati, and Madesh Province in Nepal as shown in figure 1.
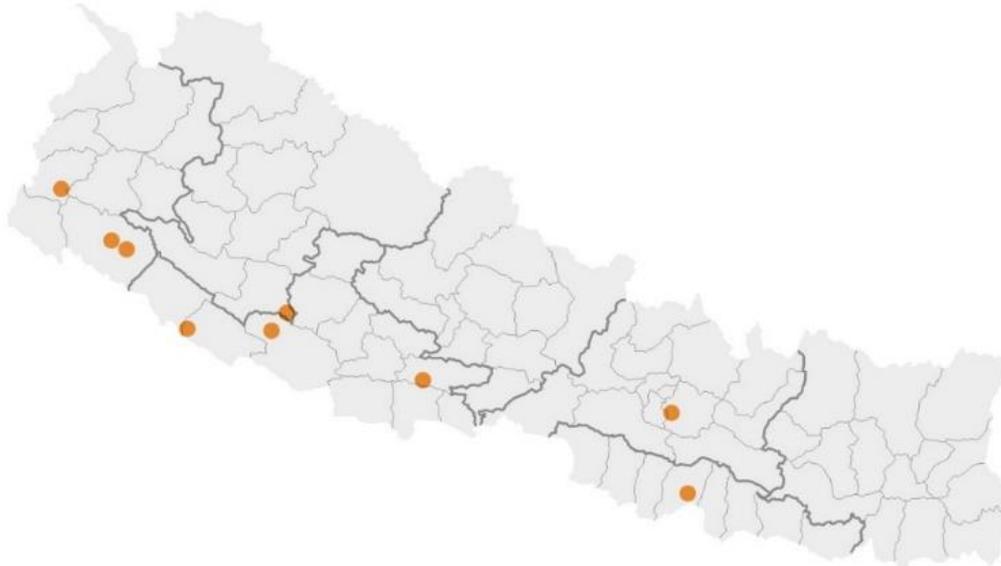
Figure 1: Sample of rural municipalities for the study

To ensure representativeness, districts were selected from each province based on population size and geographic diversity, covering both Hill and Terai regions. One rural municipality was randomly chosen per district, and within each, the ward housing the municipal office was purposively selected. Households were then randomly sampled from a comprehensive listing. Trained research assistants conducted interviews with household heads, collecting data on socio-demographics, agriculture, social safety nets, food insecurity, and dietary diversity.

Method of analysis

Food insecurity occurs when households face restricted access to food due to insufficient financial resources and other constraints. The extent of food insecurity was gauged through the utilization of the food insecurity experience scale survey module, which encompasses eight questions prompting individuals to self-report their conditions and experiences related to limited food access. The severity of food insecurity was measured by assigning a value of 1 for "yes" and 0 for "no" across eight dichotomous variables. The study aims to identify challenges associated with items related to food-secure, moderately food-insecure, and severely food-insecure households based on the Food Insecurity Experience Scale (FIES) reference used by the Food and Agriculture Organization (FAO).

Based on the methodology used by (Shair et.al. 2023) the FIES categorizes households as mildly food insecure if they indicate compromising on both the quality and quantity of food. Those classified as moderately food insecure are characterized by a reduction in food quantities or even skipping meals. Severe food insecurity involves experiences such as hunger or going

without eating for a day. A household is deemed food secure if they answer 'no' to all eight questions. Mild food insecurity is assigned if there is a 'yes' response to any of Q1-Q3, moderate food insecurity for a 'yes' to any of Q4-Q6, and severe food insecurity for a 'yes' to any of Q7-Q8 as shown in table 1.

Table 1: *Food Insecurity Experience Scale Questions*

During the last 30 days, was there a time when, because of lack of money or other resources:		
Question	*Statement*	*Response*
Q 1	You or any other member in your household were worried you would not have enough food to eat?	1= Yes, 0= No
Q 2	You or any other member in your household were unable to eat healthy and nutritious food?	1= Yes, 0= No
Q 3	You or any other member in your household ate only a few kinds of foods?	1= Yes, 0= No
Q 4	You or any other member in your household had to skip a meal?	1= Yes, 0= No
Q 5	You or any other member in your household ate less than you thought they should?	1= Yes, 0= No
Q 6	Your household ran out of food?	1= Yes, 0= No
Q 7	You or any other member in your household were hungry but did not eat?	1= Yes, 0= No
Q 8	You or any other member in your household went without eating for a whole day?	1= Yes, 0= No

Source: Questionnaire of IFPRI/IIDS Household Survey 2023

Specification of the model

Utilizing primary data gathered from field surveys and drawing insights from pertinent previous research, various independent variables have been identified to analyze their influence on food insecurity. Among these variables, the recipient of old age allowance holds significance as a major factor, alongside the incorporation of other demographic variables. The description of model employed in this study is outlined in table 2 and equation is:

$$FI_i = \beta_0 + \beta_1 \text{OLDAA}_i + \beta_2 \text{PIAGRI }_i + \beta_3 \text{OWNLIV}_i + \beta_4 \text{MIG}_i + \beta_5 \text{COPM }_i + \beta_6 \text{HHGEN }_i + \beta_7 \text{HSIZE} + \varepsilon_i$$

Variable	Description
FI	Food insecurity scale (if Mild, Moderate, and Severe level of food insecurity =1 and if food secure=0)
OLDAA	It is a dummy variable coded 1 if the household received money from old age allowance, 0 otherwise

PIAGRI	It is a dummy variable, coded 1 if the household's principal source of income is agriculture in the last 12 months, 0 otherwise
OWNLIV	It is a dummy variable, coded 1 if the household owned livestock, 0 otherwise
MIG	It is a dummy variable, coded 1 if the household's any member of the family stayed outside the house for a continuous period of one month or longer for work in the last one year, 0 otherwise
COPM	It is a dummy variable, coded 1 if the household's any member is a member of cooperatives, 0 otherwise
HHGEN	It is a dummy variable, coded 1 if the household head is male, 0 otherwise
HSIZE	It is a dummy variable to represent types of family, coded 1 if family size is less or equal to 5, 0 otherwise

Table 2: Description of the variables

Data analysis and management

After data collection, we conducted data compilation and verification. All analyses were performed using STATA 17. Descriptive statistics were presented in frequency tables, while logistic regression was applied to examine relationships between outcome and independent variables. Findings are reported as (dy/dx), representing the marginal change in the dependent variable with respect to changes in independent variables. To address potential biases, multicollinearity was assessed using Variance Inflation Factor (VIF), with a cut-off value of 2.
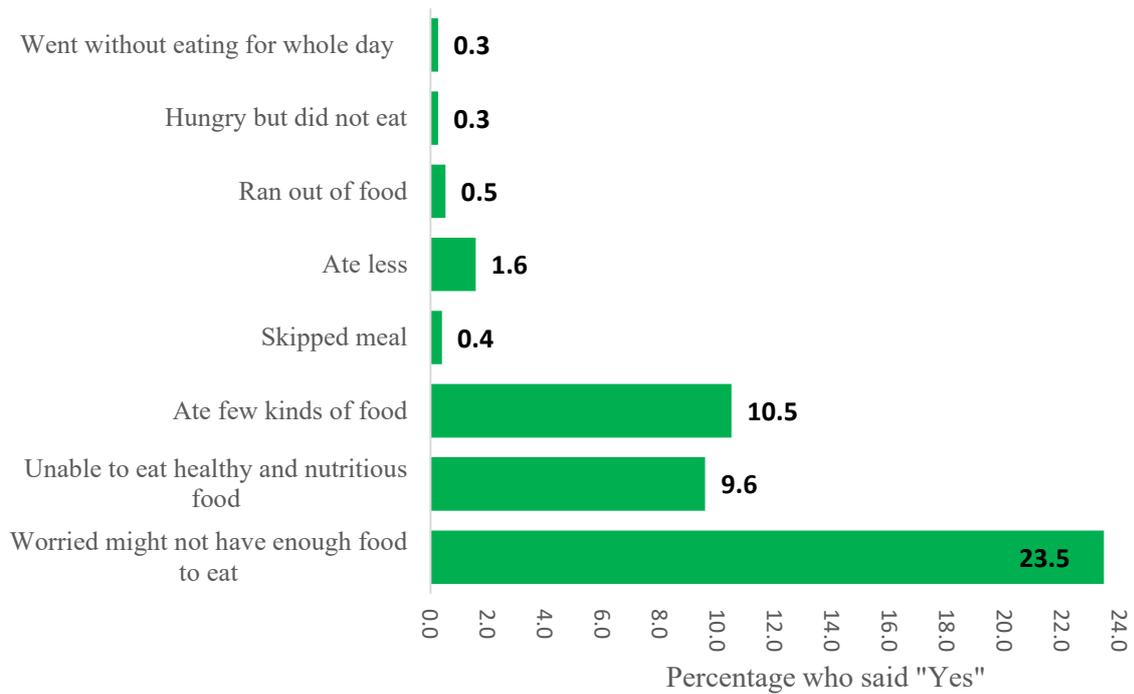
Results

Descriptive results

Figure 2 and 3 depicts response and level of food insecurity across studied households. Table 3 presents household-level food insecurity across rural municipalities. Bethanchowk reports the lowest food insecurity (~3%), while Chandranagar has the highest (~86%). Mild food insecurity is most prevalent in Chandranagar and least in Bethanchowk. Barahatal has the highest moderate food insecurity (6.36%), while Chandranagar, Khajura, and Tinau report none. Severe food insecurity is limited to 1% of households in Dangisaran and Barahatal. Caste-wise, households outside Brahmin/Chhetri, Janjati, Newar, and Dalit groups face the highest mild food insecurity (67.74%), while severe food insecurity is negligible among Brahmin/Chhetri and Janjati households. Male-headed households are more food secure, with <1% experiencing severe food insecurity, whereas no female-headed households fall into this category. Non-agricultural households experience higher mild and moderate food insecurity, while agricultural households are more secure. Households with migrants show higher mild and severe food insecurity, whereas those without migrants are generally more food secure. Similarly, households not receiving old age allowances face greater food insecurity across all levels. (Table 3: Descriptive statistics of household food insecurity; Figure 2: (a) Household food insecurity response; (b) Level of household food insecurity)

**Table 3:** Descriptive statistics of household food insecurity

	None		**Mild**		**Moderate**		**Severe**	
	No of House holds	**(%)**	**No of House holds**	**(%)**	**No of House holds**	**(%)**	**No of House holds**	**(%)**
Rural Municipality								
Alital R. M.	43	91.49	4	8.51	0	0	0	0
Barahatal R.M.	59	53.64	43	39.09	7	6.36	1	0.91
Bardagoriya R.M.	105	90.52	9	7.76	2	1.72	0	0
Bethanchowk R.M.	93	96.88	1	1.04	2	2.08	0	0
Chandranagar R.M.	13	13.68	82	86.32	0	0	0	0
Dangisharan R.M.	75	80.65	14	15.05	3	3.23	1	1.08
Kapurkot R.M.	43	75.44	12	21.05	2	3.51	0	0
Khajura R.M.	59	74.68	20	25.32	0	0	0	0
Tinau R.M.	56	80	14	20	0	0	0	0
Caste/ Ethnicity								
Brahim/ Chhetri	281	81.45	54	15.65	9	2.61	1	0.29
Janjati	185	69.03	78	29.1	4	1.49	1	0.37
Dalits	56	67.47	25	30.12	2	2.41	0	0
Other	19	30.65	42	67.74	1	1.61	0	0
Newar	5	100	0	0	0	0	0	0
Household head's gender								
Female HH	136	68.69	57	28.79	5	2.53	0	0
Male HH	410	72.57	142	25.13	11	1.95	2	0.35
Type of households								
Agricultural	468	76.97	128	21.05	10	1.64	2	0.33
Non-agricultural	78	50.32	71	45.81	6	3.87	0	0
Livestock								
Having	431	78.22	109	19.78	9	1.63	2	0.36
Not having	37	64.91	19	33.33	1	1.75	0	0
Migration								
Family members migrated	226	64.2	121	34.38	4	1.14	1	0.28
Family members not migrated	320	77.86	78	18.98	12	2.92	1	0.24
Old age allowance								
Recipient	164	78.47	40	19.14	4	1.91	1	0.48
Non-recipient	382	68.95	159	28.7	12	2.17	1	0.18

(R.M: Rural Municipality; HH: Household head) **Source**: Authors calculation

Source: Created by author, Household Survey, 2023)

Figure 2: Household food insecurity response
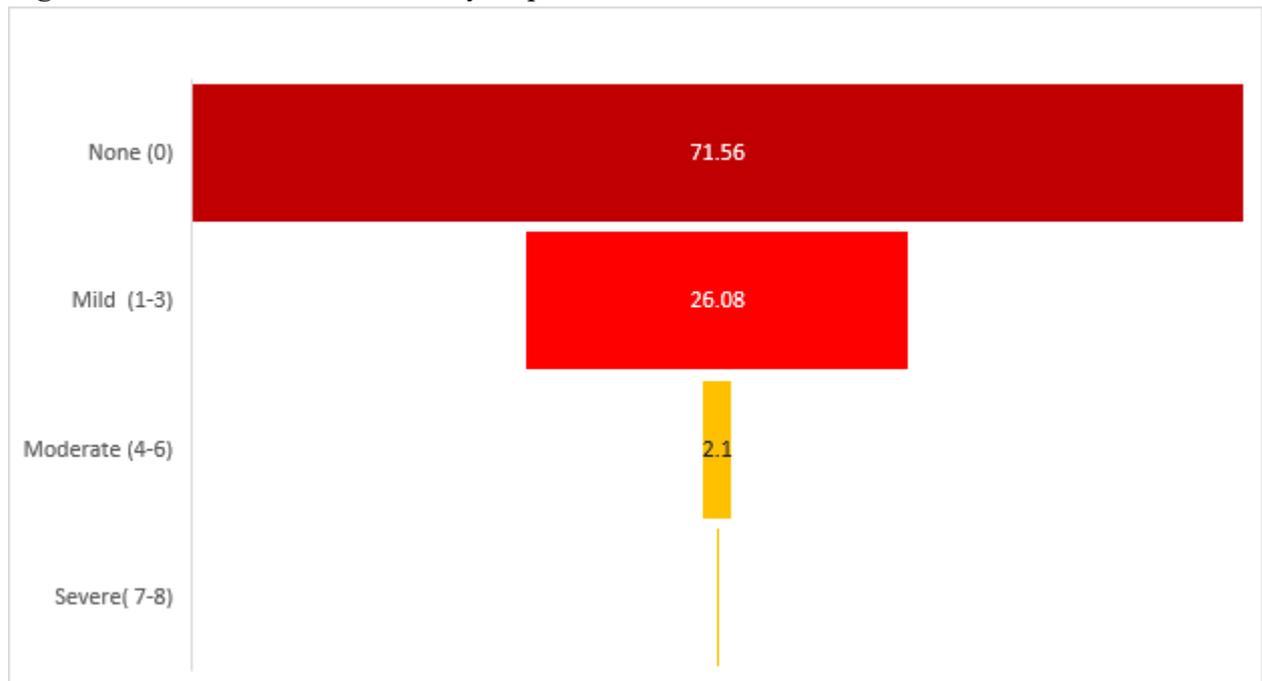
Source: Created by author, Household Survey, 2023)

Figure 3: Level of household food insecurity

Empirical results

Social safety net programs, funded by the federal government and administered locally, provide unconditional cash transfers on a quarterly basis. These programs significantly contribute to household income and influence food expenditure patterns. The presence of various social safety nets can shape household consumption preferences. The logit model exhibits convergence through decreasing log-likelihood iterations. The estimated marginal effects (dy/dx) in table 4 indicate how a one-unit change in independent variables affects the probability of food insecurity, with standard errors and p-values denoting statistical significance. With 763 observations, the models yield similar log-likelihood values, suggesting a good fit. Significance levels are denoted by asterisks (*** high, ** moderate, * low, none for non-significant). Overall, the results in table 4 confirm the robustness of the model in explaining food insecurity.

Table 4: Logit regression output

Variables	dy/dx
OLDAA	-0.083** (0.034)
PIAGRI	-0.090** (0.019)
OWNLIV	-0.100** (0.013)
MIG	0.099*** (0.003)
COPM	-0.232*** (0.000)
HHGEN	-0.012 (0.74)
HSIZE	-0.047 (0.21)
Number of observations	763
Log likelihood	-400.654
LR chi2(7)	109.8
Prob > chi2 0.0000	0.000
Pseudo R2	0.12

Source: Author's calculation using STATA 17

The analysis reveals a statistically significant association between old age allowance and food insecurity. A negative marginal effect of -0.083 suggests that a one-unit increase in financial assistance slightly reduces the probability of food insecurity. Although significant at the 0.05 level, the effect size is small. This aligns with findings from Khan et al. (2023), Boukary et al. (2016), Burchi (2021), Hltf et al. (2011), and Holmes & Bhuvanendra (2013) on the positive impact of social security on food security. Households primarily reliant on agriculture exhibit a lower probability of food insecurity, as indicated by a negative marginal effect of -0.090. This suggests that agricultural engagement provides better food access and income security. Despite being statistically significant at the 0.05 level, the effect is moderate, consistent with Moucheraud et al. (2019), who found cultivation linked to lower food insecurity.

Conversely, migration increases food insecurity, with a positive marginal effect of 0.099. This implies that migration, often driven by economic hardship, may heighten household vulnerability. While the relationship is statistically significant, its effect is moderate. This

contradicts studies by Jayaweera & Verma (2024), and Regmi et al. (2019), who found migration improving food security via remittances.

Livestock ownership significantly enhances food security, with a positive marginal effect of 0.158. The low p-value and confidence interval excluding zero confirm its robustness. This aligns with Danso et al. (2024), Bhandari (2022), Regmi et al. (2019), and Moucheraud et al. (2019), who reported livestock reducing food insecurity risks. Cooperative membership is also linked to lower food insecurity, with a negative marginal effect of -0.23. This suggests that cooperatives provide resource-sharing, bargaining power, and support networks that enhance food security. These findings align with Guyalo & Ifa (2023) and Kehinde & Kehinde (2020). However, household head gender and household size are not significant predictors of food insecurity. This contradicts Belete & Bayu (2023), who found a significant impact of social safety nets on female-headed farm households. The household size result aligns with Pandey & Bardsley (2019) but contrasts with Azam et al. (2022) and Regmi et al. (2019), who found a significant effect.

Measure of fit for the Logit regression

The models appear to explain a similar proportion of variance in the outcome variable, as indicated by comparable McFadden's R2, Maximum Likelihood R2, and other pseudo-R2 measures. The differences in log-likelihood between the intercept-only model and the full model D (631) and the likelihood ratio chi-square statistics LR(7) are also quite similar between the two models. Overall, Logit model seem to provide satisfactory goodness-of-fit statistics and explanatory power for the given data.

Table 5: Measure of fit for Logit regression

Measure of fit	
Log-Lik Intercept Only:	-455.56
Log-Lik Full Model:	-400.66
D(755):	801.30
LR(7):	109.81
Prob > LR:	0
McFadden's R2:	0.12
McFadden's Adj R2:	0.10
Maximum Likelihood R2:	0.13
Cragg & Uhler's R2:	0.19
McKelvey and Zavoina's R2:	0.19
Efron's R2:	0.14
Variance of y*:	4.06
Variance of error:	3.29
Count R2:	0.74
Adj Count R2:	0.10
AIC:	1.07
AIC*n:	817.30

BIC:	-4209.82
BIC':	-63.35

Source: Author's calculation using STATA 17

In the logit model comparing the log-likelihood values of the intercept-only model and the full model indicates that the full model provides a better fit to the data. The log-likelihood for the full model (-400.76) is higher than that of the intercept-only model (-455.56), suggesting that the predictors included in the full model contribute to explaining the variation in the outcome variable. Furthermore, the likelihood ratio (LR) test confirms that the full model significantly improves the fit compared to the intercept-only model. The LR statistic (109.6) and its associated p-value (0.000) indicate that the improvement in fit is statistically significant. Additionally, McFadden's R2, along with other similar indicators such as Maximum Likelihood R2, Cragg & Uhler's R2, McKelvey and Zavoina's R2, and Efron's R2, all suggest similar results regarding the proportion of variance explained by the model. McFadden's R2 of 0.120 implies that the model explains approximately 12% of the variance in the dependent variable. Finally, Count R2 provides insight into the model's predictive accuracy. With a Count R2 of 0.744, the model predicts 74.4% of the observations correctly, indicating a relatively high level of predictive performance.

Pearson χ^2 goodness-of-fit test

The Pearson χ^2 goodness-of-fit test is a test of the observed against the expected number of responses using cells defined by the covariate patterns. In this test, the Pearson chi-squared statistic is calculated, which measures the discrepancy between the observed frequencies of food insecurity and the frequencies predicted by the model. The test reveals as shown in table 6, that the probability is 0.29 which is greater than a predefined significance level of 0.05, it suggests that there is no significant evidence to reject the null hypothesis that the model fits the data adequately. Also, the number of covariate patterns apart to the number of observations, make the applicability of the Pearson Chi square test reliable. Therefore, based on this test, the model appears to provide a reasonable fit to the observed data regarding food insecurity

Table 6: Output of Pearson test

Particulars	Output
Number of observations	763
Number of covariate patterns	103
Pearson chi2(98)	102.28
Prob > chi2	0.29

Source: Author's calculation using STATA 17

Receiver Operating Characteristic (ROC) Analysis

The ROC graphs as shown in figure 4, is obtained from the sensitivity versus one minus specificity as the cutoff value and calculated the area under it. Sensitivity is the fraction of observed positive-outcome cases that are correctly classified whereas specificity is the fraction of observed negative-outcome cases that are correctly classified. The ROC curve is a trade-off between the sensitivity and 1-specificity for various threshold values of a classification model.

The area under the ROC curve (AUC) quantifies the overall discriminative ability of the logistic regression model. An AUC value closer to 1 indicates better discrimination, while an AUC of 0.5 suggests the model performs no better than random chance.

Area under ROC curve = 0.7321
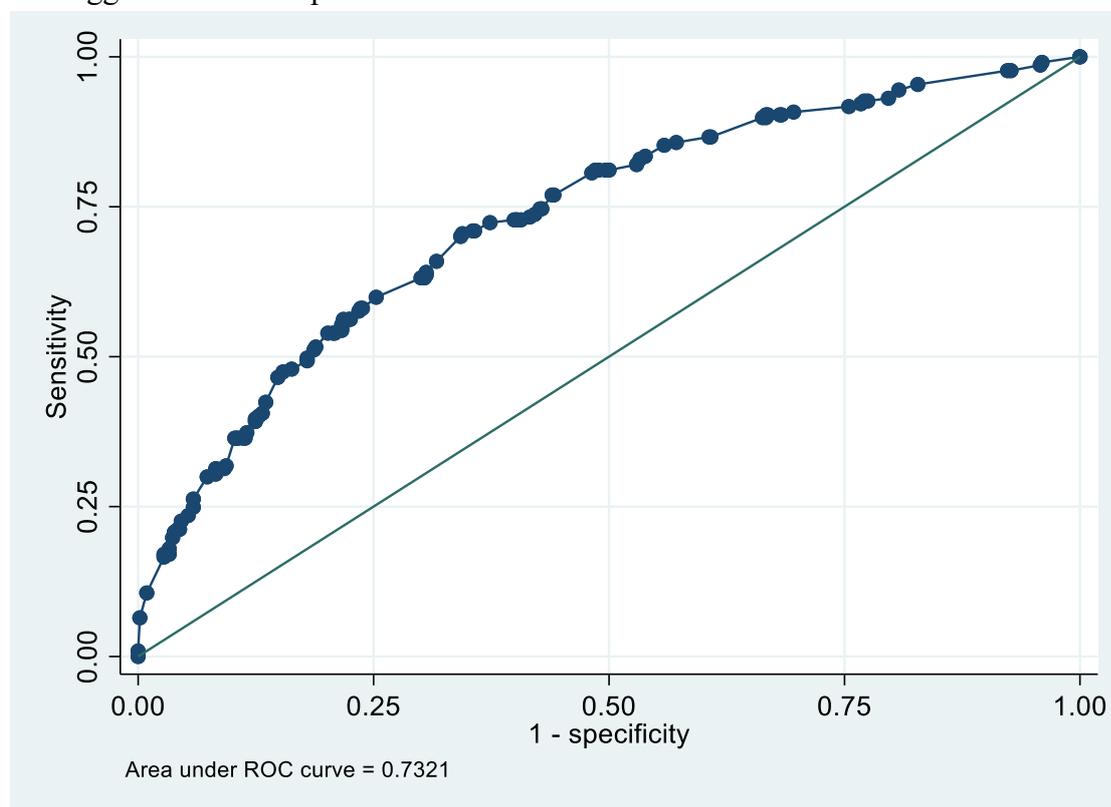
(Source: Author's calculation using STATA 17)

Figure 4: ROC curve

In the output above, the ROC is reported as 0.7321. This indicates that the logistic regression model has a moderate discriminative ability in distinguishing between individuals who are food insecure and those who are not. While not perfect, an ROC of 0.7321 suggests that the model performs better than random chance in its predictive accuracy.

Discussion

This study investigates the impact of Nepal's old age allowance on household food insecurity in rural areas using both descriptive and empirical analyses. Our findings contribute to the growing body of literature on the role of social safety nets in reducing food insecurity. The descriptive analysis highlights significant variations in food insecurity across rural municipalities. Bethanchowk has the lowest food insecurity rate, whereas Chandranagar experiences the highest prevalence. These disparities may stem from differences in local agricultural productivity, economic opportunities, and market accessibility (Khurshid and Gohar, 2025; Villacis et al. 2022). The high food insecurity rate in Chandranagar could indicate structural vulnerabilities, such as limited employment opportunities (McIntyre et al., 2014; Etana and Tolossa, 2017), lower agricultural productivity, or weaker social safety nets (Khan et al., 2023; Bahru, 2020). Conversely, Bethanchowk's relatively lower food insecurity could

result from better agricultural output, diversified income sources, or improved access to social welfare programs.

Our study further reveals that caste, gender, household occupation, and migration status significantly influence food security outcomes. Households belonging to marginalized caste groups (excluding Brahmin/Chhetri, Janjati, and Newar) exhibit the highest levels of mild food insecurity. This suggests disparities in resource access, land ownership, and employment opportunities (Singh et al. 2021; Rai and Smucker, 2016), aligning with previous studies demonstrating the impact of social stratification on economic vulnerability and food security (Chuwan, 2024; Schotte et al. 2017).

Gender also plays a role in food security. Male-headed households are less likely to experience severe food insecurity. However, our logit regression analysis suggests that gender is not a statistically significant predictor, contradicting studies that emphasize the vulnerability of female-headed households (Ndagire, 2021; Icheria, 2019). This discrepancy may be due to variations in financial resource access or the effectiveness of government support programs that mitigate food insecurity risks for female-headed households.

Another critical distinction lies between agricultural and non-agricultural households. Non-agricultural households show a higher prevalence of mild and moderate food insecurity, reinforcing the idea that reliance on agriculture provides resilience against food insecurity. This finding aligns with previous research (Headey and Martin, 2016; IMF, WFP, UNCTAD, 2011; Joshi et al. 2006), suggesting that agricultural households benefit from homegrown food supplies and reduced dependency on volatile market prices.

Empirical analysis through logit regression confirms that the old age allowance significantly reduces the probability of food insecurity. A one-unit increase in the monthly allowance amount is associated with a modest but statistically significant reduction in food insecurity. This finding supports global evidence highlighting the positive impact of social protection programs on household food security (Akurugu et al. 2022; Devereux, 2016; Slater et al. 2014). The financial support provided by the old age allowance may improve purchasing power, ensuring a more stable food supply. However, the relatively small effect size indicates that while the allowance contributes to food security, it is not a standalone solution and should be complemented by other interventions such as livelihood programs and agricultural support.

Additionally, the study finds that households engaged in agriculture are less likely to experience food insecurity, as evidenced by the negative marginal effect of agricultural income in the logit model. This supports the argument that access to land and agricultural production stabilizes food sources and reduces dependency on market fluctuations (Richardson, 2010; Baiphethi & Jacobs, 2009). Similarly, livestock ownership significantly enhances food security. Households with livestock are more likely to be food secure, possibly due to direct access to animal-based food products and the financial benefits of selling livestock or dairy products. These results align with previous research emphasizing livestock's role in strengthening household resilience against food insecurity (Datta & Behera, 2024; Myeki & Bahta, 2021).

A particularly noteworthy finding is the positive association between migration and food insecurity. Households with migrating members tend to experience higher food insecurity,

contradicting studies suggesting that migration improves food security through remittances (Obi et al. 2020; Regmi & Paudel, 2017; Sunam & Adhikari, 2016). A potential explanation is that many rural Nepali households may not receive sufficient remittances to offset the loss of labor, particularly in agriculture-dependent communities. Additionally, the initial costs of migration could impose financial strain on households, temporarily increasing their vulnerability to food insecurity.

Another key finding is that cooperative membership is significantly associated with lower food insecurity. Households participating in cooperatives are more likely to be food secure, consistent with prior studies (Guyalo & Ifa, 2023; Kehinde & Kehinde, 2020). Cooperatives provide access to credit, shared resources, and collective bargaining power, all of which enhance household resilience against food shortages. This suggests that promoting cooperative membership could be an effective strategy for improving food security in rural Nepal.

The statistical robustness of our logit model, as indicated by McFadden's R^2 and the likelihood ratio test, suggests that the included predictors provide a reasonable explanation for variations in food insecurity. Additionally, the ROC analysis confirms the model's moderate predictive ability. However, the relatively low McFadden's R^2 value (0.12) suggests that unobserved factors also contribute to household food insecurity. Future studies should consider incorporating additional variables such as seasonal variations in food availability, local market accessibility, and dietary diversity to enhance model accuracy.

Policy Implications

Based on our findings, several policy recommendations emerge:

• Strengthening Social Safety Nets: While the old age allowance significantly reduces food insecurity, its effect remains modest. Increasing the social security benefit amount, ensuring timely distribution, and expanding coverage to vulnerable populations could enhance its effectiveness.

• Promoting Agricultural and Livestock-Based Livelihoods: Given that agricultural households and livestock owners are more food secure, policies should focus on sustainable farming, livestock insurance, and agricultural productivity improvements to bolster food security.

• Enhancing Migration-Related Support: Since migration appears to increase food insecurity, policies should aim to maximize the benefits of remittances through financial literacy programs for migrant families, improved remittance channels, and reintegration programs for returning migrants.

• Encouraging Cooperative Membership: As cooperative participation correlates with better food security outcomes, expanding rural cooperative networks and providing incentives for membership could help households gain better access to credit and agricultural inputs.

• Targeted Interventions in High-Risk Municipalities: Given the stark differences in food insecurity rates across rural municipalities, localized interventions through local government to high-risk areas may be more effective than broad, nationwide policies.

Limitations

The study has several limitations that should be considered when interpreting the findings. First, it examines nine rural municipalities across five provinces, which may not fully capture food insecurity in more remote or urban areas. Second, its cross-sectional design limits causal inferences between the old age allowance and food insecurity. Third, reliance on self-reported data introduces potential biases. Additionally, factors like seasonal food shortages, climate variability, and local market dynamics were not considered. Lastly, findings may not generalize to all rural areas, especially isolated ones. Future research should use longitudinal data and incorporate these factors for a more comprehensive analysis.

Conclusion

In conclusion, our research sheds light on the complex web of factors influencing food insecurity among our sampled population. Our findings reveal significant associations between various socioeconomic factors and the likelihood of experiencing food insecurity. Notably, we uncovered a link between the old age allowance and reduced food insecurity, suggesting that higher financial assistance correlates with a lower probability of experiencing food insecurity. Similarly, household engagement in agriculture emerged as a promising avenue for mitigating food insecurity, with farming activities providing better access to food resources and alternative income sources. Livestock ownership also emerged as a key factor in enhancing household resilience against food shortages, highlighting the importance of sustainable livestock management practices. Additionally, membership in cooperative groups was associated with improved food security, offering households access to shared resources and support networks. However, the migration status presented a contrasting dynamic, with migration potentially exacerbating household vulnerability to food insecurity. Our findings underscore the multifaceted nature of food security challenges and the need for comprehensive interventions that address various socioeconomic factors to effectively alleviate food insecurity among households. Moving forward, this study emphasizes the importance of holistic approaches that integrate sustainable livelihood strategies and community-based initiatives to ensure food security for all.

References

Akurugu, S., Damba, O. T., & Mohammed, A. R. (2022). Effect of social protection programmes on household food security: a case of the Livelihood Empowerment Against Poverty (LEAP) programme in the Tolon District of Ghana. SN Social Sciences, 3(1), 6.

Azam, M., Naz, S., Shafi, M. M., Afridi, M. J., & Waheed, A. (2022). What Determines Food Security among the Farm Households of Khyber Pakhtunkhwa, Pakistan? A Binary Logistic Regression Analysis. Sarhad Journal of Agriculture, 38(5), 346–354.

Badhan, S., Haque, S., Akteruzzaman, M., Zaman, N., Nahar, K., & Yeasmin, F. (2019). Role of social safety net programmes for ensuring food security and reducing poverty in char area of Jamalpur district in Bangladesh. Progressive Agriculture, 30(1), 75–85.

Bahru, B. A., Jebena, M. G., Birner, R., & Zeller, M. (2020). Impact of Ethiopia's productive safety net program on household food security and child nutrition: a marginal structural modeling approach. SSM-population health, 12, 100660.

Bailey, S., & Hedlund, R. (2012). The impact of cash transfers on nutrition in emergency and transitional contexts: A synthesis paper. Retrieved from https://www.calpnetwork.org/wp-content/uploads/2012/12/the-impact-of-cash-transfers-on-nutrition-in-emergency-and-transitional-contexts-synthesis-paper.pdf

Baiphethi, M. N., & Jacobs, P. T. (2009). The contribution of subsistence farming to food security in South Africa. Agrekon, 48(4), 459-482.

Belete, B., & Bayu, T. (2023). Does Social protection improve female-headed households' food security in Ebinat district, Ethiopia. Cogent Economics and Finance, 11(1).

Bhandari, P. (2022). Land and Livestock Ownership and Household Food Security in Nepal. November 2022, 259–277. https://doi.org/10.1007/978-3-031-09555-9_15

Boukary, A. G., Diaw, A., & Wünscher, T. (2016). Factors affecting rural households' resilience to food insecurity in Niger. Sustainability (Switzerland), 8(3), 1–10.

Burchi, F. (2021). Effects of social protection on food consumption and nutrition. Handbook on Social Protection Systems, 596–607. https://doi.org/10.4337/9781839109119.00076

Chemjong, B., & KC, Y. (2020). Food Security in Nepal: A Review. Rupantaran: A Multidisciplinary Journal, 4(1), 31–43. https://doi.org/10.3126/rupantaran.v4i1.34015

Chuwan, N. K. (2024). Exploring variation of influences of caste and ethnicity in rural mountain household food security in Nepal. BARUN Journal, 1, 10-19.

Danso, G., Abiodun, A., Asale, M. A., & Baiyegunhi, L. J. S. (2024). Effects of livestock ownership typology on household food security in rural Lesotho. GeoJournal.

Devereux, S. (2016). Social protection for enhanced food security in sub-Saharan Africa. Food policy, 60, 52-62.

Etana, D., & Tolossa, D. (2017). Unemployment and food insecurity in urban Ethiopia. African Development Review, 29(1), 56-68.

Guyalo, A. K., & Ifa, L. T. (2023). Impact of agricultural cooperatives on the food security status of households in Oromia regional state, Ethiopia: The case of Halu Woreda. Cogent Economics & Finance, 11(2), 2237716.

Headey, D. D., & Martin, W. J. (2016). The impact of food prices on poverty and food security. Annual review of resource economics, 8(1), 329-351.

Hltf, U. N., Social, U. N., & Floor, P. (2011). Social Safety Nets and the Food Security Crisis. Fao 2009, 1–4. https://www.fao.org/fileadmin/user_upload/ISFP/Social_safety_nets.pdf

Holmes, R., & Bhuvanendrah, D. (2013). Social protection and resilient food systems: The role of cash transfers. London, UK: Annual Report, Overseas Development Institute.

Icheria, B. K. (2019). An investigation into food security among female-headed households in Kenya: A case of VOI division in Taita-Taveta County. University of Pretoria (South Africa).

IMF, OECD, UNCTAD, & WFP. (2011). Price volatility in food and agricultural markets: Policy responses. FAO: Roma, Italy.

Jayaweera, R., & Verma, R. (2024). Food Security: The impact of migrants and remittances in Sri Lanka. Discover Food, 4(1). https://doi.org/10.1007/s44187-023-00070-8

Joshi, P. K., Joshi, L., & Birthal, P. S. (2006). Diversification and its impact on smallholders: Evidence from a study on vegetable production. Agricultural Economics Research Review, 19(2), 219-236.

Kehinde, A., & Kehinde, M. (2020). Impact of Credit access and Cooperative membership on Food Security of Rural Households in Southwestern, Nigeria. Journal of Agribusiness and Rural Development, 57(3). https://doi.org/10.17306/j.jard.2020.01337

Khan, Y., Daraz, U., & Bojnec, Š. (2023). Enhancing food security and nutrition through social safety nets: a pathway to sustainable development. Sustainability, 15(19), 14347.

Khurshid, N., & Gohar, A. M. (2025). Integrated analysis of local agricultural practices, community-led interventions, and climate change impacts on food insecurity in rural Azad Kashmir. Scientific Reports, 15(1), 8375.

McIntyre, L., Bartoo, A. C., & Emery, J. H. (2014). When working is not enough: food insecurity in the Canadian labour force. Public health nutrition, 17(1), 49-57.

Ministry of Health and Population [Nepal], New ERA, and ICF. (2023). Nepal Demographic and Health Survey 2022. Kathmandu, Nepal: Ministry of Health and Population.

Ministry of Home Affairs (MoHA). Department of National ID and Civil Registration. (2023). Singhadarbar, Kathmandu.

MOAD. (2014). Ministry of Agricultural Development, Government of Nepal. Agriculture Development Strategy (ADS)., 303. http://goo.gl/qf19b4

Moucheraud, C., Chandyo, R. K., Henjum, S., Strand, T. A., Ulak, M., Fawzi, W. W., Locks, L. M., Webb, P., & Thorne-Lyman, A. L. (2019). Engagement in Agriculture Protects Against Food Insecurity and Malnutrition in Peri-Urban Nepal. Current Developments in Nutrition, 3(1). https://doi.org/10.1093/cdn/nzy078

National Planning Commission (NPC). (2019). 15th Five Year Development Plan (2019/20-2023/24): Health and Nutrition.

National Planning Commission (NPC). (2020). National Social Protection Integration Framework. Kathmandu: National Planning Commission.

Ndagire, L. (2021). Food security inequality between female and male-headed households: evidence from Northern and South Western Uganda.

Obi, C., Bartolini, F., & D'Haese, M. (2020). International migration, remittance and food security during food crises: the case study of Nigeria. Food Security, 12(1), 207-220.

Pain, A., Ojha, H. R., & Adhikari, J. (2014). Social inequality and food insecurity in Nepal: risks and responses. In New Challenges to Food Security (pp. 221-240). Routledge.

Pandey R, Bardsley DK. (2019). An Application of the Household Food Insecurity Access Scale to assess food security in rural communities of Nepal. Asia Pac Policy Stud. 2019;6:130–150.   https://doi.org/10.1002/app5.270

Rai, P., & Smucker, T. A. (2016). Empowering through entitlement? The micro-politics of food access in rural Maharashtra, India. Journal of Rural Studies, 45, 260-269.

Regmi, H. R., Rijal, K., Joshi, G. R., Sapkota, R. P., & Thapa, S. (2019). Factors Influencing Food Insecurity in Nepal. Journal of Institute of Science and Technology, 24(2), 22–29.

Regmi, M., & Paudel, K. P. (2017). Food security in a remittance based economy. Food Security, 9, 831-848.

Richardson, R. B. (2010). Ecosystem services and food security: Economic perspectives on environmental sustainability. Sustainability, 2(11), 3520-3548.

Schotte, S., Zizzamia, R., & Leibbrandt, M. (2017). Social stratification, life chances and vulnerability to poverty in South Africa.

Shair, W., Mir, S. A., Hussain, S., & Bukhari, S. (2023). Effect of safety net program on household food   insecurity in Pakistan. Journal of Policy Research, 9(1), 131-141.

Singh, D. R., Sunuwar, D. R., Shah, S. K., Sah, L. K., Karki, K., & Sah, R. K. (2021). Food insecurity during COVID-19 pandemic: A genuine concern for people from disadvantaged community and low-income families in Province 2 of Nepal. Plos one, 16(7), e0254954.

Slater, R., Holmes, R., & Mathers, N. (2014). Food and nutrition (in-) security and social protection.

Sunam, R., & Adhikari, J. (2016). How does transnational labour migration shape food security and food sovereignty? Evidence from Nepal. In Anthropological Forum (Vol. 26, No. 3, pp. 248-261). Routledge.

Villacis, A. H., Mayorga, J., & Mishra, A. K. (2022). Experience-based food insecurity and agricultural productivity in Nigeria. Food Policy, 113, 102286.

WFP. (2023). WFP Nepal 2022 Annual Country Report – Overview. https://reliefweb.int/report/nepal/wfp-nepal-2022-annual-country-report-overview

Yu, B., You, L. & Fan, S. (2010). Toward a typology of food security in developing countries. Discussion Paper 00945, January 2010. International Food Policy Research Institute (IFPRI), Development Strategy and Governance Division.