

Hunger Level and Factors Associated with Household Food Security in Nepal: Analysis of Finding from Nepal Demographic and Health Survey 2016

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Abstract— Introduction: A major issue the world faces today is ensuring that households residing in different countries have access to enough food to maintain a healthy life. Food insecurity is highly prevalent in middle and low income countries. Malnutrition is the most serious consequence of food insecurity and poor nutrition can lead to reduced immunity, impaired physical and mental development and reduced productivity. This study examines the hunger level and factors associated with household food security in Nepal. **Methods:** This study used data from NDHS 2016. Total of 11,040 households were studied in this cross-sectional study. Food security and Hunger level were measured by using HFIAS and HHS, respectively. The association between Background characteristics and household food security was identified, using chi-square test and Binary logistic regression (Bivariate and multivariate). **Results:** This study revealed that 4.6% of households suffered from moderate to severe household hunger. After adjusting for background characteristics, ethnicity, family size, Household head's education, household wealth, Development region and province wise residence were significantly associated with household food security. However, sex of the household head, current marital status, presence of U-5 children at home, place of residence and ecological zone did not affect the household's food security significantly. **Conclusion:** The present study found that there is high food insecurity and which varies according to different socio-demographic characteristics. To improve food security in Nepal, intervention should focus on improving wealth and education especially for Dalit and those residing in the Karnali province, Sudurpaschim province and province 2.

Keywords— Food security, household hunger, associated factors, determinants, Nepal.

I. INTRODUCTION

Food security is defined 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”.¹ Hence, household food insecurity refers to lack of consistent household access to adequate quantities of healthy foods (2, 3).

Food security has four dimensions; adequate food availability, adequate access to food by all people, appropriate food utilization and consumption and Food Stability. The first dimension; adequate food availability is affected by food production, import capacity, food stocks, and food aid. Similarly, another dimension; food accessibility is affected by

purchasing power, income or wealth quintile of the population and Transport and market infrastructure, and the third dimension; food utilization and consumption is determined by food safety, hygiene and good practice, diet quality and diversity. The last dimension; food Stability is determined by weather variability, price fluctuation, political and eco factors (4).

Food insecurity is a major factor contributing to hunger and malnutrition (5). In 2016, worldwide about 815 million people were chronically hungry and undernourished (6, 7). Household food insecurity (HFI) adversely affects nutritional, physical and mental health outcomes of both children and adults and their productivity (5, 6, 8-11).

Nepal is one of the lower-middle income countries in the world. Susceptibility to natural disasters, including drought, earthquakes, floods, and landslides, vulnerability to fluctuations in global prices, poor infrastructure and social exclusion lead to food insecurity in the country (12).

Growing Food insecurity in Nepal will pose a challenge for achievement of SDG goal no. 2; Zero Hunger. However, Nepal has committed to achieve SDG goal no. 2 to bring hunger level zero by 2030. International organizations including the World Food Program are building up government capacity to reach the hunger goal to zero (13).

The interim constitution (2006-2007) of Nepal recognized food security as a fundamental human right of all citizens, which is reflected in the Three Year Interim Plan (2010-2013) (14). Similarly, National Nutrition policy and strategy 2008 pointed out that food insecurity is the major cause of malnutrition in Nepal and states the strategic approach to tackle nutritional problems and its consequences (15). The food and nutrition security objective of the thirteenth plan (2013/14 to 2015/16) is to increase the supply of basic foodstuffs by increasing the agricultural productivity and livestock products; and ensure the food security of vulnerable areas and groups by increasing their access to food items (16). Constitution of Nepal 2015 aims for food sovereignty of the people as per the law. The government of Nepal launched the MSNP-II (2018-2022) for continuation to the achievements of MSNP-I (2013-2017) to scale up nutrition specific as well as nutrition sensitive interventions (17).

The Nepal Food Security Monitoring system (NeKSAP) tracks the food security status of the country. This system is currently institutionalized by the Government of Nepal in collaboration with the Ministry of Agriculture and Livestock Development and National Planning Commission (18).

However, the government's failure to meet the target of agricultural growth and poverty reduction in the plan period has increased serious concern over the FI in Nepal (19).

In 2017, Undernourished people in the world was estimated to be almost 821 million and 769.4 million people around the globe had experienced severe food insecurity. Sub-Saharan Africa had the second highest proportion (236.5 million) of undernourished people after south Asia. However, a substantial proportion (345.9 million) of people in Sub-Saharan Africa had experienced severe food insecurity compared to any other region in the world (20).

In Kailali district of Nepal, More than two-thirds (69%) of households fall in the food insecure category (10). In 2020, Nepal ranked at 73rd position in global hunger index (GHI) with a score of 19.5, Nepal has a moderate level of hunger (21). In Nepal, about 36%, 27%, 10% of children were stunted, underweight, wasted respectively (27). Underweight among children below 24 month was 25% in a study conducted at Bajura district (22).

In U-5 children, odds of wasting increased with severity of household food insecurity (28).

Food security is the neglected topic in Nepal in terms of research and publication. Therefore, this study aims to generate reliable information regarding prevalence of hunger and determinants of household food security in Nepal. Findings from this study also might help the policy makers to track progress towards S.D.G goal no. 2; zero hunger.

II. METHODOLOGY

This study used data from the Nepal Demographic and Health Survey 2016 (NDHS), a nationally representative, comprehensive survey carried out between June 2016 and January 2017. The study population for this study was each and every member of households, while only household heads were interviewed but their answers were on the behalf of all household members. A total of 11,040 households were included in the study. NDHS 2016 used an updated version of the sampling frame from the 2011 National Population and Housing Census, conducted by the Central Bureau of Statistics. Total of 11,473 households were selected from 383 clusters of urban and rural areas while 11,040 households were interviewed.

NDHS had used semi-structured questionnaires as a tool and Face-to-face interview technique for data collection. Electronic data collected on tablets through the computer-assisted personal interviewing (CAPI) system. Obtained DHS Data was analyzed into IBM SPSS V. 25 and Microsoft Excel 2013. Household recode was identified from data and needed variables were selected. Variables were recorded and computed as per need. Descriptive statistics identified the frequency of food insecurity, hunger and socio-demographic characteristics. The association between food security and each of the independent variables were examined by using the

chi-square test ($p < 0.05$) at 95% CI. Initially, the significant variables in the chi-square test were subjected to bivariate logistic regression analysis. Finally, the significant variables in bivariate logistic regression were introduced into multivariate logistic regression to measure the net effect size of the variables at 95 % CI and $p < 0.05$ was considered to be significant. The results of the Bivariate and Multivariate logistic regression analysis were expressed in terms of crude odds ratio (COR) and adjusted odds ratio (AOR), respectively. Hosmer and Lemeshow chi-square test was used to test the goodness of fit for the regression model and a finding of insignificance with p -value 0.330 ($p > 0.05$) was concluded that the model fits to data well. The values of Cox and Snell and Nagelkerke R^2 explain that the model explains 17.3% and 23% variations in the data, respectively. The sample-weight was taken into consideration during analysis.

NDHS adapted the standard questionnaires from the Household Food Insecurity Access Scale developed by USAID's Food and Nutrition Technical Assistance (FANTA) project and contextualized for the Nepalese population. The questionnaires were developed in English then translated into Nepali, Maithili and Bhojpuri and again questionnaires translated back to English to ensure consistency. Questionnaires were finalized after conducting the pretest in three districts. Only respondents aged 15 or more were included in the interview. Only Household heads were interviewed but their answers were on the behalf of all household members.

NDHS 2016 was approved by Nepal Health Research Council and human research ethics committee in ICF Macro International. Independent Review Boards of New Era and ICF Macro International had granted the approval for all the data collection tools and procedures for NDHS. Informed consent was taken from respondents. (27)

III. FINDINGS

Socio-Demographic Characteristics

TABLE 1: Distribution of the socio-demographic characteristics (n=11,040)

Socio-demographic Characteristics	Frequency (n)	Percent (%)	Mean±SD
Age of household head:			
≤50 years	6829	61.9	45.91±14.83
>50 years	4211	38.1	
Sex of household head:			
Male	7581	68.7	
Female	3459	31.3	
Marital status of household head:			
Married	9499	86.0	
Single	1541	14.0	
Ethnicity:			
Dalit	1413	12.8	
Brahmin/Chhetri	3048	27.6	
Newar	487	4.4	
Janajati	3373	30.6	
Other terai caste	2004	18.2	
Muslim and other	714	6.5	
Religion:			
Hindu	9374	84.9	
Muslim	671	6.1	
Buddhist	542	4.9	
Christian	264	2.4	
Kirat and other	189	1.7	

Family size:			
≤3	4108	37.2	4.43±2.30
>3	6932	62.8	
Presence of u-5 children in household:			
No	6876	62.3	
Yes	4164	37.7	
Educational level of household head:			
No education	4329	39.2	
Primary	2492	22.6	
Secondary	2947	26.7	
Higher	1272	11.5	
Wealth quintile:			
Poor	4459	40.4	
Middle	4305	39.0	
Rich	2276	20.6	
Place of Residence:			
Urban	6781	61.4	
Rural	4259	38.6	
Ecological Zone:			
Mountain	781	7.1	
Hill	5134	46.5	
Terai	5125	46.4	
Development region:			
Eastern	2590	23.5	
Central	3949	35.8	
Western	2245	20.3	
Mid-western	1339	12.1	
Far-western	915	8.3	
Province:			
Province 1	2004	18.2	
Province 2	2014	18.2	
Bagmati Province	2521	22.8	
Gandaki Province	1173	10.6	
Lumbini Province	1793	16.2	
Karnali Province	619	5.6	
Sudurpaschim Province	915	8.3	

Respondent Background Characteristics are stated in Table 2. Mean age of head of household was 45.91±14.83. Majority of households were headed by male (68.7%). Majority of the respondents were married (86.0%). Majority of them were janajati (30.6%) followed by Brahmin/Chhetri (27.6%). Most of the households followed Hinduism (84.9%). Mean family size was 4.43±2.30. Around 63% of households had >3 members in their family. Most of the households had no u-5 children in their family (62.3%). Large proportion of respondents had no any formal education (39.2%), followed by secondary level education (26.7%), primary level (22.6%) and higher education (11.5%). Majority of households fall in the poor wealth quintile (40.4%), followed by Middle (39.0%) and Rich (20.6%). Significant proportion of households were residing in urban area (61.4%), while remaining 38.6 % were residing in rural area. In terms of ecological zone, 46.5% of households belongs to Hill, followed by Terai (46.4%) and Mountain (7.1%). High proportion of households included in the study were from Central development region (35.8%), followed by Eastern (23.5%) and Western (20.3%). Majority of the households were from Bagmati province (22.8%), followed by Province 1 and 2 (18.2%).

Responses To Nine Hfias Questions

TABLE 2: Responses to Nine HFIAS Questions (n=11,040)

HFIAS questions	Options			
	Never	Rarely	Sometimes	Often
Q1: Worry about food	5831 (52.8)	2011 (18.2)	2266 (20.5)	931 (8.4)
Q2: Unable to eat preferred foods	5987 (54.2)	2462 (22.3)	2036 (18.4)	555 (5.0)
Q3: Eat just a few kinds of foods	6269 (56.8)	2450 (22.2)	1807 (16.4)	515 (4.7)
Q4: Eat Food that they really do not want to eat	6505 (58.9)	2399 (21.7)	1734 (15.7)	402 (3.6)
Q5: Eat a smaller meal	9035 (81.8)	1228 (11.1)	629 (5.7)	147 (1.3)
Q6: Eat fewer meals in a day	9634 (87.3)	893 (8.1)	418 (3.8)	95 (0.9)
Q7: No food of any kind in the household	10109 (91.6)	617 (5.6)	265 (2.4)	49 (0.4)
Q8: Go to sleep hungry	10471 (94.8)	384 (3.5)	159 (1.4)	25 (0.2)
Q9: Go a whole day and night without eating	10732 (97.2)	214 (1.9)	81 (0.7)	14 (0.1)

Responses to nine HFIAS questions are stated in Table 2. In the last 12 months (rarely, sometimes and often), 47.1 % of households worried that food would run out. 45.7% households were unable to eat preferred food because of lack of resources. 43.3% of households had to eat a limited variety of the food due to lack of resources. 41% of households had to eat foods that they really did not want to eat. Similarly, 18.1% of households had to eat a smaller meal. 12.8% of households had to eat fewer meals in a day, While 8.4% households had reported that there was no any kind of food to eat. 5.1% of households had to go to sleep hungry. At last, 2.7% of households had to go the whole day and night without eating.

Level of Household Food Insecurity

TABLE 3: Level of household's food insecurity (n=11,040)

Household food insecurity level	No. of households (n)	Percent (%)
Food secure	5305	48.1
Mildly food-insecure	2263	20.5
Moderately food-insecure	2394	21.7
Severely food-insecure	1078	9.8

Level of household food insecurity is stated in Table 3. More than half of the households included in the study suffered from Mild to severe food insecurity (52%), while around 48 % of households were food secure.

Prevalence of Household Hunger

TABLE 4: Prevalence of Household hunger (n=11,040)

Household hunger level	No. of households (n)	Percent (%)
Little to no household hunger	10531	95.4
Moderate household hunger	471	4.3
Severe household hunger	39	0.3

Household hunger level is reflected by Table 4. Significant proportion of households had experienced little to no hunger (95.4%) while 4.6 % of households had experienced moderate to severe levels of hunger.

Food Security Status of Households Based on Socio-Demographic Factors and Its Association

TABLE 5: Distribution of food security based on socio-demographic factors and its association (n=11,040)

Socio-demographic factors	Food security status		P-Value			
	Food Secure n (%)	Food insecure n (%)		Development region:		
Age of household head:						
≤50 years	3290 (48.2)	3539 (51.8)	0.739	Terai	2597 (50.7)	(53.0) 2528 (49.3)
>50 years	2015 (47.9)	2196 (52.1)		Eastern	1278 (49.3)	1312 (50.7)
Sex of household head:				Central	2070 (52.4)	1879 (47.6)
Male	3753 (49.5)	3828 (50.5)	<0.001	Western	1263 (56.3)	982 (43.7)
Female	1552 (44.9)	1907 (55.1)		Mid-western	356 (26.6)	983 (73.4)
Marital status of household head:				Far-western	337 (36.8)	578 (63.2)
Married	4627 (48.7)	4871 (51.3)	<0.001	Province:		
Single	677 (43.9)	864 (56.1)		Province 1	1025 (51.1)	979 (48.9)
Ethnicity:				Province 2	868 (43.1)	1146 (56.9)
Dalit	659 (46.6)	754 (53.4)	<0.001	<i>Table 5. cont.</i>		
Brahmin/Chhetri	1382 (45.3)	1666 (54.7)		Bagmati Province	1455 (57.7)	1066 (42.3)
Newar	265 (54.4)	222 (45.6)		Gandaki Province	643 (54.8)	530 (45.2)
Janajati	1564 (46.4)	1809 (53.6)		Lumbini Province	843 (47.0)	950 (53.0)
Other terai castes	1069 (53.3)	935 (46.7)		Karnali Province	133 (21.5)	485 (78.5)
Muslim and other	365 (51.2)	348 (48.8)		Sudurpashchim Province	337 (36.8)	578 (63.2)
Religion:						
Hindu	4475 (47.7)	4899 (52.3)	0.400			
Muslim	346 (51.6)	325 (48.4)				
Buddhist	261 (48.2)	281 (51.8)				
Christian	132 (49.8)	133 (50.2)				
Kirat and other	92 (48.7)	97 (51.3)				
Family Size:						
≤3	2100 (51.1)	2007 (48.9)	<0.001			
>3	3204 (46.2)	3728 (53.8)				
Presence U-5 children in household:						
No	3393 (49.3)	3483 (50.7)	<0.001			
Yes	1912 (45.9)	2252 (54.1)				
Educational level of household head:						
No education	1503 (34.7)	2825 (65.3)	<0.001			
Primary	1070 (42.9)	1422 (57.1)				
Secondary	1765 (59.9)	1183 (40.1)				
Higher	967 (76.0)	305 (24.0)				
Wealth quintile:						
Poor	1250 (28.0)	3209 (72.0)	<0.001			
Middle	2277 (52.9)	2028 (47.1)				
Rich	1778 (78.1)	498 (21.9)				
Place of Residence:						
Urban	3636 (53.6)	3146 (46.4)	<0.001			
Rural	1669 (39.2)	2589 (60.8)				
Ecological Zone:						
Mountain	294 (37.6)	487 (62.4)	<0.001			
Hill	2414 (47.0)	2721				

Table 5. shows that, the association between food security and Sex of household head, marital status of respondents, ethnicity, family size, presence of u-5 children in household, household head's education, household wealth, place of residence, ecological zone, development region and province was found to be statistically significant (P<0.05).

Male headed households were more food secure (49.5%) than female headed households (44.9%). Majority of married respondents were food secure (48.7%) than single one (43.9%). Significant proportion of Newar were food secure (54.4%) than other ethnic groups. A Higher proportion of households with family size of ≤3 were food secure (51.1%) than households with family size of >3 (46.2%). Households without u-5 children were more food secure (49.3%) than households with u-5 children (45.9%). Respondents with higher levels of education were more food secure (76.0%) compared to no education (34.7%). Not surprisingly, A large proportion of households in the rich wealth quintile were food secure (78.1%) than households in the poor wealth quintile (28.0%).

Further, the geographical distribution of food security. Urban households were more food secure (53.6%) than rural households (39.2%). The proportion of food secure households was higher in terai (50.7%) than in hill (47.0%) and mountain (37.6%) zones. Substantial proportion of households in the Western development region were food secure (56.3%) than households in the Mid-western region of Nepal (26.6%). High proportion of households in the Bagmati province were food secure (57.7%), while households in the Karnali province tended to be least food secure (21.5%).

Socio-Demographic Factors Relating to Likelihood Of Household Being Food Secure In Nepal

TABLE 6: Predicting the likelihood of household being food secure

Variables	COR	95% CI	P-value	AOR	95% CI	P-value
Sex of H.H.:						
(Ref. Female)						
Male	1.204	(1.111-1.305)	<0.001	1.021	(0.926-1.126)	0.679
Marital Status of						

H.H.:						
(Ref. Single)						
Married	1.211	(1.087-1.350)	0.001	1.120	(0.985-1.274)	0.085
Ethnicity:						
(Ref. Dalit)						
Brahmin/Chhetri	0.949	(0.836-1.077)	0.417	1.151	(0.998-1.328)	0.053
Newar	1.363	(1.108-1.675)	0.003	1.381	(1.098-1.737)	0.006
Janajati	0.989	(0.873-1.120)	0.859	1.046	(0.909-1.204)	0.527
Other Terai caste	1.309	(1.142-1.500)	<0.001	0.901	(0.769-1.055)	0.194
Muslim and other	1.201	(1.003-1.438)	0.046	1.153	(0.944-1.410)	0.164
Family Size:						
(Ref. ≤3)						
>3	0.821	(0.760-0.887)	<0.001	0.876	(0.797-0.964)	0.007
Presence of U-5 Child in family:						
(Ref. No)						
Yes	0.872	(0.807-0.942)	0.001	1.025	(0.936-1.122)	0.599
Educational level of H.H.:						
(Ref. No education)						
Primary	1.414	(1.278-1.564)	<0.001	1.260	(1.128-1.406)	<0.001
Secondary	2.805	(2.547-3.090)	<0.001	1.828	(1.638-2.041)	<0.001
Higher	5.949	(5.156-6.864)	<0.001	2.908	(2.473-3.420)	<0.001
Wealth quintile:						
(Ref. Poor)						
<i>Table 6. cont.</i>						
Middle	2.881	(2.636-3.148)	<0.001	2.431	(2.197-2.689)	<0.001
Rich	9.160	(8.133-10.31)	<0.001	6.029	(5.236-6.943)	<0.001
Residence:						
(Ref. Rural)						
Urban	1.793	(1.658-1.938)	<0.001	1.037	(0.948-1.135)	0.429
Ecological zone:						
(Ref. Terai)						
Mountain	0.588	(0.504-0.686)	<0.001	1.193	(1.000-1.423)	0.050
Hill	0.863	(0.799-0.933)	<0.001	0.963	(0.876-1.058)	0.430
Development region:						
(Ref. Eastern)						
Central	1.132	(1.025-1.250)	0.015	0.941	(0.835-1.059)	0.312
Western	1.321	(1.179-1.480)	<0.001	1.189	(1.045-1.353)	0.008
Mid-western	0.372	(0.322-0.430)	<0.001	0.466	(0.398-0.544)	<0.001
Far-western	0.599	(0.513-0.699)	<0.001	0.720	(0.606-0.856)	<0.001
Province:						
(Ref. Bagmati)						
Province 1	0.766	(0.681-0.862)	<0.001	0.915	(0.788-1.062)	0.243
Province 2	0.554	(0.493-0.624)	<0.001	0.603	(0.504-0.721)	<0.001
Gandaki Province	0.888	(0.773-1.021)	0.096	1.135	(0.966-1.334)	0.123
Lumbini Province	0.650	(0.575-0.734)	<0.001	0.702	(0.598-0.823)	<0.001

Karnali Province	0.201	(0.164-0.248)	<0.001	0.396	(0.315-0.498)	<0.001
Sudurpaschim Province	0.427	(0.365-0.499)	<0.001	0.638	(0.527-0.771)	<0.001
Cox and Snell R ²				0.173		
Nagelkerke R ²				0.230		
Homer & Lomeshow (df=8)		Chi-square (X ²)=9.149 (P-value=0.330)				

Table 6. Shows the result of the Bivariate and Multivariate logistic regression model presented as crude odds ratios (COR) and adjusted odds ratios (AOR), respectively. AOR >1 indicates the factor is associated with increased likelihood (higher odds) of households being food secure while AOR <1 indicates the factor is associated with decreased likelihood (lesser odds) of households being food secure. Ethnicity was one of the predictors of food security. In this model, Dalit was treated as the reference category. All of the AOR are above 1 except for other terai castes, so the Dalits have a lower odds of being food secure than other ethnic groups. But the relationship is statistically significant only for Newar. Newar were 38.1% more likely to be food secure than Dalits (AOR: 1.381, CI: 1.098-1.737).

The relationship between Family size and food security was significantly negative. Households with family size of >3 were 12.4% less likely to be food secure compared to households with family size of ≤3 (AOR: 0.876, CI: 0.797-0.964).

Household head's education was positively associated with food security. Households having a primary level of education increases the chances of household food security by 1.260 times (26.0%) (AOR: 1.260, CI: 1.128-1.406). Similarly, H.H having secondary and higher level of education increases the chances of food security by 1.828 times (82.8%) (AOR: 1.828, CI: 1.638-2.041) and 2.908 times (190.8%) (AOR: 2.908, CI: 2.473-3.420), respectively.

Household wealth had a positive influence on food security. Those households fall in the middle wealth quintile were 2.431 times (143.1%) more likely to be food secure than households in the poor wealth quintile (AOR: 2.431, CI: 2.197-2.689) while households in the rich wealth quintile were 6.029 times (502.9 %) more likely to be food secure than their counterparts poor (AOR: 6.029, CI: 5.236-6.943).

Geographically, residence in the Western, Mid-western and Far-western region were significantly associated with food security. Households residing in the Mid-western region of Nepal were most vulnerable, being 53.4% less likely to be food secure than their counterparts in the Eastern region of Nepal (AOR: 0.466, CI: 0.398-0.544). Similarly, those from Far-western development region of Nepal were 28.0% less likely to be food secure than their counterparts from the Eastern development region (AOR: 0.720, CI: 0.606-0.856). While households from the Western development region were 1.189 times (18.9%) more likely to be food secure than households from the Eastern development region (AOR: 1.189, CI: 1.045-1.353).

Provincially, residents in the Karnali province had the lowest odds of being food secure compared to any other province. In this model Bagmati province served as the

baseline category. The relationship is statistically significant for all provinces except for Province 1 and Gandaki Province. Households in the Karnali province were most vulnerable, being 60.4% less likely to be food secure than their counterparts in the Bagmati province (AOR: 0.396, CI: 0.315-0.0.498). Similarly, those from Province 2 were 39.7 % less likely to be food secure than their counterparts from Bagmati province (AOR: 0.603, CI: 0.504-0.721). While households from Sudurpaschim Province were 36.2% less likely to be food secure than households from Bagmati province (AOR: 0.638, CI: 0.527-0.771).

Variables such as, sex of head of the household, marital status, presence of u-5 children in household, place of residence and ecological zone did not affect the food security after adjusting with other variable's or factors.

IV. DISCUSSION

The topic of food security is widely studied in developed nations (45). This study documents the hunger level and factor associated with household food security in Nepal, using nationally representative data. In this section, some of the key findings will be discussed.

First, ethnicity was an important predictor of food security. Food security was common among almost all ethnic groups. However, every other ethnic group had a higher odds of being food secure as compared to Dalit. Similarly, Studies of Nepal found that the household food insecurity was high among Dalit (19, 30). Social exclusion plays a vital role in food insecurity among Dalit. Dalit of Nepal have a very Low access to economic opportunities, education, employment, property ownership and economic institutions because of caste based discrimination. They are often concentrated in rural areas serving as landless agricultural laborers (46). Studies from India also suggested that food insecurity and malnutrition were particularly acute among Dalit (47, 48). In Nepal, social policy has been directed toward reducing disparities between Dalits and other ethnic groups. Since 1997, the government has funded programs and activities aiming to improve the quality of life of Dalits. These activities include scholarship programs for Dalit children, income generation activities for Dalit men and women, and mass communication programs to raise public awareness on caste based discrimination. However, these programs are often poorly funded and implemented (46).

Second, Family Size was negatively associated with household food security. A finding similar to earlier studies, Studies conducted in Nepal found that family size had a negative and significant association with food security (19, 32). Study carried out in Iran by using the same analytical technique found that households with family size of >3 were 26% less likely to be food secure compared to households with family size of ≥ 3 (41). Similarly, a study from Pakistan suggested that an increase of an additional family member decreases the chances of food security by 41.8% (34). Similarly, a study of India found that an increase in one family member increases the chances of household food insecurity by 49% (42). Other studies of also suggested the negative effect of family size on household food security (23, 24, 26, 35). The

observed relationship between the family size and food security is may be due to rise in the price of food or temporary joblessness, the bigger the household size is the lower the amount of food each household member consumes (41).

Third, the educational level of the household head is a protective factor for household food security. Studies carried out in Nepal found that the household head's educational level was positively associated with food security (31, 32). Study from Pakistan also found that households having a middle and intermediate level of education will increase the chances of food security by 99.9% and 177.1%, respectively (34). Study of Faisalabad district of Pakistan found that having a graduation level of education increases the odds of a household becoming food secure by 21 times compared to having no education (35). Other studies also pointed out the positive effect of higher education on household food security (25, 33, 37, 38, 49, 50). The observed relationship between education level and food security may be due to the H.H with higher education having higher income and therefore can provide enough food much more easily than others (41). The household heads education largely contributes to working efficiency, competency, diversifying income, and adopting technologies to ensure better living conditions (32). In recent years, Nepal has made significant efforts to increase girl's enrollment in school. In 2016, "Girl summit" had committed to support the education of boys and girls by improving the community and school environment (51). India and Bangladesh have launched financial incentive programs in order to increase girl's enrollment and retention in schools (52, 53).

Fourth, as expected, Household wealth was positively associated with food security. A finding is consistent with the previous studies, Studies of Nepal found that, the household assets (livestock holding, size of landholding) and income were found to have a positive and significant relationship with food security (19, 31, 32). Similarly, Study of Iran found that those households in the poorest economic index were 7.80 times more likely to be food insecure compared to households in the richest economic index (39). A study carried out in Pakistan found that an increase of Rs.1000 in monthly income of a household increases the chances of food security by 1.105 times (34). Similarly, study conducted in Pakistan by using categorical variables found that households belonging to the income group Rs. 5001-10000 were 15 times more likely to become food secure compared to households who belonged to the income group of Rs. 0-5000 (35). Study of India also found that with the increase of 1000 INR in monthly income increases the chances of households to become food secure by 30% (42). Other studies also pointed out the positive influence of household wealth/socioeconomic status and income on household food insecurity (24, 26, 36, 37, 43, 44). The observed relationship between household wealth and food security may be due to better income and higher economic status making it easier to provide enough food for all family members (41). So, the household who have large agricultural land has better production which gives a better chance for the household to be food secured (32). Policies could be designed to raise the economic status of poor household's. For example,

in recent years, many developing countries in Africa have tested Unconditional Cash Transfer (UCT) programs. Alone in sub-Saharan Africa, there are now over 123 UCT programs (54). Study assessing the impact of UCT found that these programs significantly improve dietary diversity and food security (55). A study from Zambia found that UCT increased household per capita consumption expenditures by 20% and reduced food insecurity significantly (56). In Nepal, Several NGOs and INGOs have been working in the educational, Health and Agricultural sector (57). They could help in the UCT program.

Fifth, Development region and Province wise residence is a predictor of food security in Nepal. In multivariate logistic regression, Mid-western development region and Karnali province were most vulnerable. A finding consistent with other research (14, 30). Out of Nepal's 75 districts, Five of the ten least food secure districts are from karnali province. These district include: Humla (0%), Dolpa (5.3%), Jumla (15.6%), Kalikot (17.6%), Dailekha (18.3%). The remaining five district are distributed in Sudurpaschim province (Baitadi: 19%, Bajura: 19.3%), Lumbini province (Rolpa: 10.5%, Pyuthan: 19.5%) and Province 1 (Khotang: 19.1%). The observed high food insecurity in Karnali province and Mid-western region may be due to two main causes' i.e. unexpected causes (drought, flood, landslide, and crop failure) and temporary causes (financial problems) (14). Study also found high poverty in the Midwestern and far western region of Nepal (30, 31). Less odds of food security in province 2 may be due to lowest HDI (0.51). A significant proportion of marginalized people resides in province 2 (58).

Lastly, one surprising result in our study is the statistically insignificant relationship between the sex of the household head and food security in multivariate logistic regression. Our result is similar to previous research where female headed households were more susceptible to food insecurity but relationship was insignificant (32). Head of the female headed households could be Grandmothers, widows, divorced women or married women whose husbands were not at home. Future qualitative research might be able to better describe the food insecurity experiences of female headed households.

V. CONCLUSION

The results demonstrated that almost 5% of households had experienced moderate to severe hunger. Ethnicity, family size, households head's education, household wealth and Development region, Province wise residence were the significant determinants or predictors of food security in Nepal. The findings are generally consistent with previous research.

This study also suggests that education and wealth improvement is necessary for addressing household food security. Social policies could be piloted in least food secure districts and districts with proportionally large Dalit population such as Baitadi, Dolpa, Jumla or Humla with the aims to improve wealth. The findings should be useful to policymakers and social work practitioners in order to achieve S.D.G. by 2030. This study also concludes that, Special

attention needed for Karnali, Sudurpaschim province and province 2 of Nepal.

REFERENCES

1. Coates J, Swindale A, Bilinsky P. Household Food Insecurity Access Scale (HFIAS) for measurement of food access: indicator guide: version 3. 2007.
2. Gibson MJF. Food Security—A Commentary: What Is It and Why Is It So Complicated? 2012;1(1):18-27.
3. World Bank. Policy Study. Washington DWB. Poverty and Hunger: Issues and Options for Food Security in Developing Countries. 1986.
4. Ministry of Agricultural Development (MOAD) CBoScatFaAOF. Food and Nutrition security in Nepal : A status report. 2016.
5. Bain LE, Awah PK, Geraldine N, Kindong NP, Siga Y, Bernard N, et al. Malnutrition in Sub-Saharan Africa: burden, causes and prospects. 2013;15(1).
6. Schmeer KK, Piperata BAJM, Nutrition C. Household food insecurity and child health. 2017;13(2):e12301.
7. World Bank PSWa, DC: World Bank. Poverty and Hunger: Issues and Options for Food Security in Developing Countries. 1986.
8. Gholami A, Khazae-Pool M, Rezaee N, Amirkalali B, Ghahremanlo A, Moradpour F, et al. Household food insecurity is associated with health-related quality of life in rural type 2 diabetic patients. 2017;20(6).
9. Sreeramareddy CT, Ramakrishnareddy N, Subramaniam MJPhn. Association between household food access insecurity and nutritional status indicators among children aged < 5 years in Nepal: results from a national, cross-sectional household survey. 2015;18(16):2906-14.
10. Osei A, Pandey P, Spiro D, Nielson J, Shrestha R, Talukder Z, et al. Household food insecurity and nutritional status of children aged 6 to 23 months in Kailali District of Nepal. 2010;31(4):483-94.
11. Singh A, Singh A, Ram JFJ, bulletin n. Household food insecurity and nutritional status of children and women in Nepal. 2014;35(1):3-11.
12. USAID. Food Assistance Fact sheet Nepal. 2019.
13. FAO I, security UJTsof, world nit. World Food Programme, WHO. 2019.
14. Ministry of Health and Population (MOHP) [Nepal] NE, and ICF International Nepal Demographic and Health Survey 2011. Kathmandu, Nepal: Ministry of Health and Population, New ERA, and ICF International, Calverton, Maryland.; 2012.
15. Nutrition Section CHD, Department of Helath Services, Ministry of Health and Population. National Nutrition Policy and Strategy 2008.
16. Government of Nepal Npc. The Thirteenth Plan (2013-2016). 2013.
17. Government of Nepal Npc. Multi-sector Nutrition plan 2018-2022. 2018.
18. Nepal Food Security Monitoring System. In: Commission. MoADMaNP, editor.
19. Maharjan KL, Joshi NPJJoMS. Determinants of household food security in Nepal: A binary logistic regression analysis. 2011;8(3):403-13.
20. Organization WH. The state of food security and nutrition in the world 2018: building climate resilience for food security and nutrition: Food & Agriculture Org.; 2018.
21. Klaus von Grebmer JB, Miriam Wiemers, Keshia Acheampong, Asja Hanano, Brona Higgins, Réiseal Ní Chéilleachair, Connell Foley, Seth Gitter, Kierstin Ekstrom, and Heidi Fritschel. Global Hunger Index: one decade to zero hunger - linking health and sustainable food system. 2020. Oh wow gajjab
22. Nyaupane K, Bist A, Amgain K, Sigdel K. Factor associated with underweight among children below 24 months of age. Journal of Chitwan Medical College. 2023 Jun 30;13(2):30-5.
23. Omotesho O, Adewumi MO, Fadimula K. Food security and poverty of the rural households in Kwara State, Nigeria. 2008.
24. Asmelash MJJoae, development r. Rural household food security status and its determinants: The case of Laelaymychew Woreda, Central Zone of Tigray, Ethiopia. 2014;6(5):162-7.
25. Chinnakali P, Upadhyay RP, Shokeen D, Singh K, Kaur M, Singh AK, et al. Prevalence of household-level food insecurity and its determinants in an urban resettlement colony in north India. 2014;32(2):227.
26. Bashir MK, Schilizzi S, Pandit R. The determinants of rural household food security in the Punjab, Pakistan: an econometric analysis. 2012.
27. Ministry of Health NNEal. Nepal Demographic and Health Survey 2016. Kathmandu, Nepal: Ministry of Health, Nepal. 2017.

28. Nepali S, Simkhada P, Davies IG. Association Between Wasting and Food Insecurity Among Children Under Five Years: Findings from Nepal Demographic Health Survey 2016. 2020.
29. McIntyre L, Wu X, Kwok C, Emery JHCJoPH. A natural experimental study of the protective effect of home ownership on household food insecurity in Canada before and after a recession (2008–2009). 2017;108(2):e135-e44.
30. Khatri-Chhetri A, Maharjan KLJoID, Cooperation. Food insecurity and coping strategies in rural areas of Nepal. 2006;12(2):25-45.
31. Joshi NP, Maharjan KL, Piya LJJoCISS, Society. Determinants of income and consumption poverty in far-western rural hills of Nepal. 2012;2:51-61.
32. Joshi G, Joshi NJSJoA. Determinants of household food security in the eastern region of Nepal. 2016;14(2):174-88.
33. Sultana A, Kiani AJAjobM. Determinants of food security at household level in Pakistan. 2011;5(34):12972-9.
34. Bashir MK, Schilizzi S, Pandit R. The determinants of rural household food security for landless households of the Punjab, Pakistan. 2012.
35. Bashir MK, Naeem MK, Niazi SAKJWASJ. Rural and peri-urban food security: a case of district Faisalabad of Pakistan. 2010;9(4):403-11.
36. Abdulla AMJEJoFS, Technology. Determinants of household food security and coping strategies: The case of Bule-Hora District, Borana Zone, Oromia, Ethiopia. 2015;3(3):30-44.
37. Omidvar N, Ghazi-Tabatabaie M, Sadeghi R, Mohammadi F, Abbasi-Shavazi MJJoh, population., nutrition. Food insecurity and its sociodemographic correlates among Afghan immigrants in Iran. 2013;31(3):356.
38. Sheykholeslam R, Abdollahi Z, Salarkia N, Kavehi Z, Abdollahi M, Kalantari NJTWFP. Food security assessment of urban Afghan refugee populations in Pakdasht, Iran. 2008;38.
39. Asadi-Lari M, Jahromi LM, Montazeri A, Rezaee N, Mehrizi AAH, Shams-Beyranvand M, et al. Socio-economic risk factors of household food insecurity and their population attributable risk: A population-based study. 2019;33:119.
40. Sharafkhani R, Dastgiri S, Gharaaghaji Asl R, Ghavamzadeh SJF, sciences n. Factors influencing household food security status. 2011;2011.
41. Tabrizi JS, Nikniaz L, Sadeghi-Bazargani H, Farahbakhsh M, Nikniaz ZIJjoph. Socio-demographic determinants of household food insecurity among Iranian: a population-based study from northwest of Iran. 2018;47(6):893.
42. Sidhu R, Kaur I, Vatta KJAERR. Food and nutritional insecurity and its determinants in food surplus areas: the case study of Punjab state. 2008;21(347-2016-16789):91-8.
43. Dharmaraju N, Mauleshbhai SS, Arulappan N, Thomas B, Marconi DS, Paul SS, et al. Household food security in an urban slum: Determinants and trends. *J Family Med Prim Care*. 2018;7(4):819-22.
44. Gopichandran V, Claudius P, Baby L, Felinda A, Mohan VJTNmjoI. Household food security in urban Tamil Nadu: a survey in Vellore. 2010;23(5):278-80.
45. Burgess D, Shier MLJISW. Food insecurity and social work: a comprehensive literature review. 2018;61(6):826-42.
46. Bhattachan KB ST, Bhattachan YK. Caste Based Discrimination in Nepal, New Delhi: Indian Institute of Dalit Studies. 2009; vol. 2009.
47. Schmid M, Egeland G, Salomeyesudas B, Satheesh P, Kuhnlein HJEjocn. Traditional food consumption and nutritional status of Dalit mothers in rural Andhra Pradesh, South India. 2006;60(11):1277-83.
48. Schmid M, Salomeyesudas B, Satheesh P, Hanley J, Kuhnlein HJAPjocn. Intervention with traditional food as a major source of energy, protein, iron, vitamin C and vitamin A for rural Dalit mothers and young children in Andhra Pradesh, South India. 2007;16(1):84.
49. Amaza P, Umeh JC, Helsen J, Adejobi A. Determinants and measurements of food insecurity in Nigeria: Some empirical policy guide. 2006.
50. Kaiser LL, Melgar-Quiñonez H, Townsend MS, Nicholson Y, Fujii ML, Martin AC, et al. Food insecurity and food supplies in Latino households with young children. 2003;35(3):148-53.
51. UNICEF. Nepal hosts its first girl summit to end child, early and forced marriage. UNICEF-NEPAL; 2016.
52. Krishnan A, Amarchand R, Byass P, Pandav C, Ng NJJfjeih. “No one says “No to money”—a mixed methods approach for evaluating conditional cash transfer schemes to improve girl children’s status in Haryana, India. 2014;13(1):1-10.
53. Hossain NJTjods. School exclusion as social exclusion: the practices and effects of a conditional cash transfer programme for the poor in Bangladesh. 2010;46(7):1264-82.
54. Huang C, Singh K, Handa S, Halpern C, Pettifor A, Thirumurthy HJHp, et al. Investments in children’s health and the Kenyan cash transfer for orphans and vulnerable children: evidence from an unconditional cash transfer scheme. 2017;32(7):943-55.
55. Pega F, Liu SY, Walter S, Pabayo R, Saith R, Lhachimi SKJCDoSR. Unconditional cash transfers for reducing poverty and vulnerabilities: effect on use of health services and health outcomes in low-and middle-income countries. 2017(11).
56. Hjelm L, Handa S, de Hoop J, Palermo T, Zambia C, Teams MEJSS, et al. Poverty and perceived stress: Evidence from two unconditional cash transfer programs in Zambia. 2017;177:110-7.
57. Karkee R, Comfort JFfiph. NGOs, foreign aid, and development in Nepal. 2016;4:177.
58. Subedi MJNJoCS. Caste/ethnic dimensions of change and inequality: implications for inclusive and affirmative agendas in Nepal. 2016;16(1):1-16.