Received: 4 July 2018 | Revised: 12 December 2018 | Accepted: 10 January 2019

DOI: 10.1002/app5.270

ORIGINAL ARTICLE

WILEY ASIA & THE PACIFIC POLICY STUDIES Australian National University

An application of the Household Food Insecurity Access Scale to assess food security in rural communities of Nepal

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Funding information
Pokhara University Research Centre, Faculty Research, Grant/Award Number: 03/2072/73

Abstract

The state of food (in)security in rural communities of different ecological zones of the Kaligandaki Basin, Nepal, is assessed using a Household Food Insecurity Access Scale (HFIAS). The data were collected from 360 households using face-to-face interviews. The results show poor availability of food from subsistence production in the Middle-Mountains and Trans-Himalaya, whereas most households with sufficient purchasing power are able to access additional food from the market. Net food security is poor, with the highest level of insecurity in the Middle-Mountains, followed by the Trans-Himalaya and the Tarai. Although weaknesses were found in application of the HFIAS method due to respondent bias in subjective assessments of food insecurity in producer–consumer rural households, the method was found to be effective for rapidly incorporating utilization and stability elements into appraisals. Although not comprehensive, this approach has the potential to complement other forms of knowledge for designing targeted food policy in Nepal.

KEYWORDS
food security, HFIAS, Himalaya, Kaligandaki Basin, Nepal

1 | INTRODUCTION

Food insecurity is a global issue but is particularly acute in marginal regions of developing countries. South Asia has nearly half of the malnourished population of the world (Pandey, Dev, & Jayachandran, 2016). Although Nepal was previously self-sufficient in food production, undernourishment and chronic hunger remain significant problems in parts of the country (Adhikari & Bhole, 1999; Hobbs, 2009; Pain, Ojha, & Adhikari, 2015; Yu, You, & Fan, 2010). Some sources claim that the overall situation of food insecurity and chronic undernutrition in Nepal has steadily declined since the 1990s (CBS-NLSS, 2012; FAO & GoN, 2016). However, Hobbs (2009) noted a dramatic decline in food security; Pyakuryal, Roy, and Thapa (2010) found Nepal was the worst performing country in South Asia, and there is no doubt that a notable proportion of Nepali rural households regularly experience acute food insecurity (Pain et al., 2015). Moreover, the Global Hunger Index also suggests that the situation deteriorated rapidly between 2009 and 2016, with Nepal's position shifting from "moderate" to "seriously insecure" during that time (IFPRI, 2009, 2016).

Household food security through subsistence production remains vital in Nepal. The minimum amount of land needed to achieve that goal in the three major ecological zones of the Tarai (Meghauli), the Middle-Mountains (Lumle), and the Trans-Himalayan Valleys (Upper-Mustang), located at the northern frontier of the High Himalaya, is said to be 0.45, 0.55, and 0.64 ha, respectively (OCHA, 2008). However, even by those standards, about 52% of farming households would be operating areas marginal or insufficient for subsistence household food security (CBS, 2013). Arguably one of the other most pressing issues is that about one third of the Nepali population spends 75% of their income on food, whereas over 55% spend two thirds (CBS et al., 2013). Those levels of expenditure suggest that people who are food insecure have limited capacity to increase financial outlays should harvests fail or prices increase.

The Tarai, the Middle-Mountains, and the Trans-Himalaya have variable growing seasons, agricultural potential, and availability of irrigation, as well as a complex range of off-farm employment, food distribution, and consumption practices—all of which are important for food security outcomes (Yu & You, 2013). The Tarai is home to over 50% of Nepal's population on only 17% of country's land surface (CBS, 2012) and generates 56% of the country's agricultural production, with an overall regional grain surplus of almost 125%; in contrast, the Middle-Mountains are in food deficit, producing about 16% less food than required for the regional population, and the Himalayan valleys produce only three fourths of the food required for the region (Regmi, 2007).

The agricultural development policies of Nepal, particularly since 1997 with the Agriculture Perspective Plan 1997-2017 (APROSC/Nepal and JMA/USA, 1995), Tenth Plan 2002-2007 (GoN/NPC, 2002), The National Agriculture Policy 2004 (GoN, 2004), and the Interim Plan Approach Paper 2013 (GoN/NPC, 2013) have emphasized a system of uniform, area-specific crop production, also known as One Village–One Product. So households are gradually shifting from subsistence farming to targeted production for cash income. Although research evidence is lacking, One Village–One Product has been criticized for failing to recognize the importance of local contexts, especially where agriculture is performed on remote hillslopes or in narrow valleys,

and mechanized agriculture is rarely profitable. That situation has increased local dependencies on food supplied from distant locations, with households having little control over prices received for their produce or paid for food, whereas risks increase as the diversity of their food production and consumption systems decline (Adhikari & Bhole, 1999). Changing environmental and socio-economic conditions could worsen that situation (Åse, Chaudhary, & Vetås, 2010; Pandey & Bardsley, 2015). Clearly then, food security is affected by a range of ecological, social-cultural, economic and political factors, and their interconnections with agricultural and food systems (Adger et al., 2007; Jiang, 2008). In such a context, Nepali food security policy goals are complex, with potentially serious impacts on health, labour, wealth, mobility and intergenerational well-being (FAO, 2008).

This study aims to answer three research questions: (a) Do small-scale farming communities across the three ecological zones of the Kaligandaki Basin have adequate food availability through subsistence production? (b) If they do not produce enough food for their own households, what is their economic situation for market access? (c) Would the application of a variation on the Household Food Insecurity Access Scale (HFIAS) method improve knowledge on the food security situation to inform policy? To begin to answer those questions, we briefly discuss the conceptual complexities of food security and its assessment in Nepal.

2 | CONCEPTUALIZING FOOD SECURITY

An early, widely accepted definition for food security provided by USAID (1992) and WFS (1996) was "a situation when all people at all times have both physical and economic access to sufficient, safe and nutritious, food to meet their dietary needs and food preferences for an active, productive and healthy life." More recently, the FAO (2002) included the "social" access dimension in the definition, stating that food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets dietary needs and food preferences for an active and healthy life. That evolution of the concept of food security has led to the comprehensive framing of the availability, access, utilization, and stability dimensions (Qureshi, Dixon, & Wood, 2015; Table 1). However, the measurement of these key dimensions is not simple (Table 1), and there are many approaches that are advocated globally (Jones, Ngure, Pelto, & Young, 2013), including such direct measures as Dietary Energy Supplies (CBS et al., 2013), variations on the entitlement approach (Sen, 1981), assessments of local capabilities to generate food security (Burchi & De Muro, 2016), and our interest here, the HFIAS.

The HFIAS was developed in an attempt to manage the complexity of food security issues (Bilinsky & Swindale, 2010; Coates, 2004; Coates, Swindale, & Bilinsky, 2007). The HFIAS includes nine food security related questions (see Section 3.3), which are categorized in three broad groups: (a) anxiety and uncertainty of food supply, (b) insufficient quality of food (food variety and preferred items), and (c) impacts of food deficiencies (insufficient food intake and its physical consequences). Thus, instead of attempting to measure the four dimensions of availability, access, utilization, and stability separately, the HFIAS is a subjective rapid rural appraisal method that analyses respondents' perceptions of household food security experiences over the previous 4 weeks (1 month). Respondents' answers are used to synthesize a rank indicator value of food security that collectively represents all four dimensions for a household. In other words, the approach relies on individual perceptions of food (in)security, which can provide considerable efficiency power but could be criticized for failing to allow for the potential inaccuracies or biases associated with short-term self-reporting (Headey & Ecker, 2013).

TABLE 1 The multiple food system elements relevant to a comprehensive understanding of food security (FAO & SAARC, 2008)

Dimensions of food security	Elements and variable of measurement
Availability	• Resources for food (natural, human, and physical) • Production of food (food production, food imports, market integration)
Access	• Production of food, income (purchasing power, social safety nets, food-for-work schemes, community support) • Consumption (intrahousehold distribution, dietary practices, nutrition knowledge, supplementary feeding, childcare)
Utilization	• Consumption and absorption (health, sanitation, safe water, food quality)
Stability	• Food availability and access instability, such as environmental risks to food production (climate shocks, pests, natural resource degradation, loss of productive assets) • Economic shocks, market and entitlement risk (deteriorating terms of trade, collapse of safety nets, price hikes) and associated effects on production, income, and consumption of food, nutrition and health risks (epidemics, erosion of social services).

Moreover, the HFIAS was developed for households accessing food from the marketplace, and its relevance for producer-consumers remains uncertain.

Nepali food security policy has mostly relied on data from traditional measurements of food availability from domestic production and imports and levels of utilization based on macronutrient outcomes such as daily intake of kilocalories (CBS et al., 2013). There are limitations to such an approach, including a lack of understanding of inequities of access across time and space, culture, and livelihood situations. An annualized HFIAS method could possibly complement the national approach to provide that information, so we use it in association with food availability and access data within three household clusters across the three ecological zones of the Kaligandaki Basin to analyse if knowledge on food security could be improved.

3 | METHODS

3.1 | Study area

The three household clusters are located in the different ecological zones in the Kaligandaki Basin, Nepal (Figure 1). The Meghauli cluster lies in the Tarai,[1] in the hot and humid tropical belt below 300 m.a.s.l. The population of the cluster is 14,149 (7,808 females) in 3,086 households, with over 60% of the land used for farming. The Lumle cluster is located within the cool, wet temperate zone (between 1,200 and 1,800 m.a.s.l.) in the Middle-Mountains. The population of the cluster is 4,258 (2,348 females) in 1,056 households, with only 17%, of land used

[1]Further geographical subdivision of the Tarai is possible, including the Inner-Tarai (where Meghauli lies), Bhabar (southern foothills of the Chure range) and the Tarai (northern transitional part of Indo-Gangetic plain), but the Tarai is also treated as a single entity in many studies.

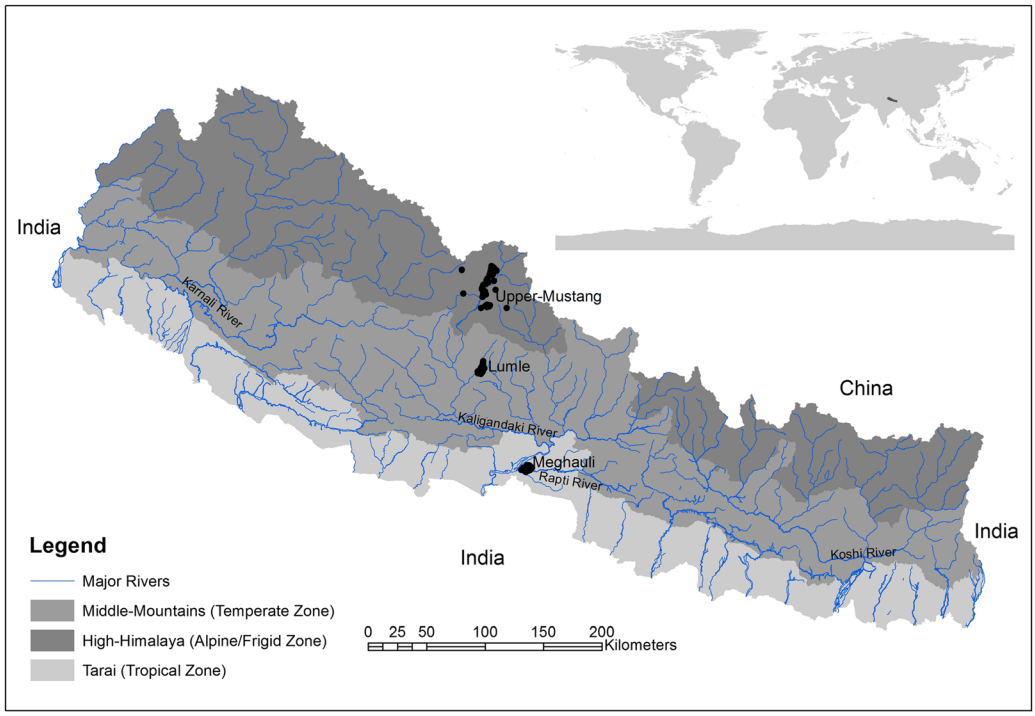

FIGURE 1 Location of study sites in Nepal: Meghauli, Lumle, and Upper-Mustang (Trans-Himalaya)

for agriculture. The Upper-Mustang cluster is located in the cold, dry Trans-Himalaya[2] (between 3,000 and 4,000 m.a.s.l.). The cluster is sparsely populated and includes 2,456 (1,294 females) people in 752 households with very limited farmland in river valleys.

3.2 | Study method

The research followed a quantitative approach, involving the use of a face-to-face interview schedule with household respondents. The fieldwork was conducted from April to September 2013. A total of 360 households were sampled from the 4,849 households within the three clusters using probability sampling (Table 2). In order to determine whether a holistic analysis of food security within rural households could be generated with the integration of complex interview data from differing perspectives on food security, the corresponding author conducted the fieldwork with four experienced survey assistants. The interview schedule involved questions for household heads relating to the demographic and economic status of households, size and type of landholdings, irrigation facilities and cropping intensity, sufficiencies of food production and annual income, along with the nine questions to assess food (in)security for each month to develop an annualized HFIAS.

[2]The Trans-Himalaya incorporates the northern frontier valleys of the High Himalaya and southern frontier of the Tibetan Plateau. This topography is not continuous so it is categorized as "High Himalaya" in broader physiographic divisions. The Trans-Himalaya is not distinguished from the High Himalaya in the map of the study area, although the location of the research clusters are presented.

TABLE 2 Demographic characteristics of the population in Meghauli, Lumle, and Upper-Mustang, Nepal (Source: Field Survey, 2013)

Demographic characteristics	Meghauli	Lumle	Upper-Mustang
Total number of households (CBS, 2012)	3,086	1,056	752
Number of sample households (percent of the total households that was sampled)	153 (5%)	141 (13.4%)	66 (8.8%)
Proportion of female-headed households	30.7%	28.4%	28.8%
Total population	894	827	392
Male	470	407	212
Female	424	420	180
Household size	5.8	5.9	5.9
Sex ratio (number of male per 100 female)	110.8	96.9	117.8
Below 15 years of age	22.6%	27%	18.6%
15–59 years	67.1%	62.9%	71.7%
60 years and above	10.3%	10.1%	9.7%
Dependency ratio	49.0	61.2	39.5
Proportion of households with local seasonal migrants (proportion of men and women)	44.9% (87.4%, 12.6%)	64.8% (81.3%, 18.7%)	31.3% (80.4%, 19.6%)
Proportion of households with foreign outmigrants (proportion of men and women)	10.1% (94.4%, 5.6%)	12.0% (94.9%, 5.1%)	7.1% (89.3%, 10.7%)

Dependency ratio is defined as the ratio between economically active (working age) population mostly aged 15 to 59 years and the nonworking population (aged below 15 and 60 and over) as adopted by Central Bureau of Statistics, Nepal (CBS, 2012). That definition has limitations. For example, remittance earners (retired and over 60 years of age) in many cases, such as the retired military of British Gorkhas, may earn more than many working age individuals.

A de facto definition of household head was used that is the "actual decision-maker of the household at the time of the fieldwork, whether he or she is the owner of the property or not." Controlled sampling of informants aimed for at least one third of "female-headed" households. However, due to temporary absences and cultural evaluations, men were often still named as the head of household even though the de facto head was currently a woman. The resulting samples were 153 (30.7% women) households in Meghauli, followed by 141 (28.4% women) in Lumle and 66 (28.8% women) in Upper-Mustang (Table 2).

3.3 | Method of analysis

Food security was determined from three parameters: availability (as assessed by physical availability of food), access (economic access to marketed food), and the annualized HFIAS. Here, the availability of food equates with the level of household production sufficiency. Access was identified by the level of food from the marketplace or bartered within the community. Households utilize a range of resources to access food including labour, land and forest resources, and livestock and monetary resources, which are summarized under Livelihood Capital Indices:

Human, Social, Natural, Financial, and Physical to assess their relationships with food security outcomes. These indices were calculated for individual households using a max-min method of converting actual answers to index values relative to other households. Although availability and access dimensions currently frame Nepali food security policy, they may insufficiently demonstrate the actual situation. To test that hypothesis, the annualized HFIAS method was also applied by asking nine different questions of households (Coates, 2004; Coates et al., 2007):

1. In the past 4 weeks,[3] how often did you worry that your household would not have enough food?
2. In the past 4 weeks, how often were you or any household member not able to eat the kinds of food you preferred because of a lack of resources?
3. In the past 4 weeks, how often did you or any household member have to eat a limited variety of foods due to a lack of resources?
4. In the past 4 weeks, how often did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?
5. In the past 4 weeks, how often did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?
6. In the past 4 weeks, how often did you or any member have to eat fewer meals in a day because there was not enough food?
7. In the past 4 weeks, how often was there ever no food to eat of any kind in your household because of lack of resources to get food?
8. In the past 4 weeks, how often did you or any household member go to sleep at night hungry because there was not enough food?
9. In the past 4 weeks, how often did you or any household member go a whole day and night without eating anything because there was not enough food?

By asking respondents to report their subjective assessment for each Nepali calendar month, we amended the conventional monthly HFIAS protocol to develop understanding of monthly scenarios of food (in)security over the previous 12 months. We recognize that asking food security-related questions for the last 1 year on a monthly basis has limitations because respondents may not remember and report correctly. However, in this case, the subjective observations were categorized and remain comparative across households and clusters. HFIAS responses were converted onto a 0 to 3 scale, where for example, for Question 1: "0" refers to "no food deficiency," 1 = "rare deficiency" (lacking one or two meals in a month), 2 = "occasional deficiency" (deficiency of three to 10 meals in a month), and 3 = "regular deficiency" (insufficiency for more than 10 meals in a month). The total HFIAS score for a particular household for any month ranges from "0" ("no" responses in all of the nine questions) to "27" ("regular" responses to all questions). The fieldwork was conducted during the sowing or planting or preharvest season of primary crops within ecological zones. Hence, the survey was conducted during April–May in Lumle, May–June in Upper-Mustang, and August–September in Meghauli. By developing the method in such a manner, we analyse whether a subjective self-assessment across a year could assist food security assessment when it is not possible to conduct fieldwork each month.

[3]To generate monthly data for the previous year, the names of the 12 Nepali months were used during the interviews for each question instead of reading "in the past 4 weeks."

To understand relationships between households and food security, correlation coefficient analysis was applied to the HFIAS and key household characteristics. Regression analysis was used to assess food security according to the five household livelihood capitals indexed from a range of variables. For example, the human capital index is obtained from variable values for labour force (age index + skill and education index + health index)/3, using an Actual-minimum/Maximum-minimum method. This study also draws in part from Sen's (1981) theory of food entitlement, so the resources that households command to achieve food security are discussed initially, followed by an analysis of food security in relation to availability and access, and the annualized and monthly HFIAS findings.

4 | RESULTS

4.1 | Available resources for food

The primary determinants of household food security in the Kaligandaki Basin are either directly or indirectly related to local farming systems. A farming system contains many elements within the study clusters (Åse et al., 2010), including the labour force and occupations; economic status of households in relation to quantity and quality of farmland, irrigation, and cropping intensity; livestock and monetary assets; and food items produced, exchanged, or gathered from local forests. In general, the typical practice of food consumption in Nepal is two main meals a day, and households in the study area are no exception. There is a tradition of evaluating households as "having better economic status" if a household can afford two full meals daily throughout the year (*dui chhak khana pugne*). The proportion of such better-off households was low within the study clusters.

4.1.1 | Labour force and occupation

Demographic characteristics vary across the studied households (Table 2). The studied populations are engaged in a wide range of occupations (Figure 2), although cropping and animal husbandry is adopted by most households. The highest proportion of respondents engaged in agro-livestock activities in Upper-Mustang (45.2%), compared with Meghauli (37%) and Lumle (31.7%). The proportion engaged in paid labour is also highest in Upper-Mustang (12.2%), followed by Lumle (9%) and Meghauli (7%). The larger tourism industries in Lumle and Upper-Mustang have probably resulted in more respondents being engaged in business or entrepreneurship (8.2% each). International labour outmigrants are highest in Lumle (10.6%), followed by Meghauli (8.8%) and Upper-Mustang (5.9%).

Many young people, including those below 15 years of age, are studying and helping with household chores and farming activities. Furthermore, there is no formal retirement age in rural Nepal, so people over 60 must continue to work if their physical ability permits (Subedi & Pandey, 2002; Subedi, Subedi, Dawadi, & Pandey, 2007a). Migration also provides income that can increase access to marketed food and reduce pressure on local resources. Of the total, only 12% of the adult population of Lumle and 10.1% of Meghauli and 7.1% in Upper-Mustang had international labour outmigrants, who were mostly male. More households are exploiting seasonal migration to neighbouring market centres and cities, again with men dominating.

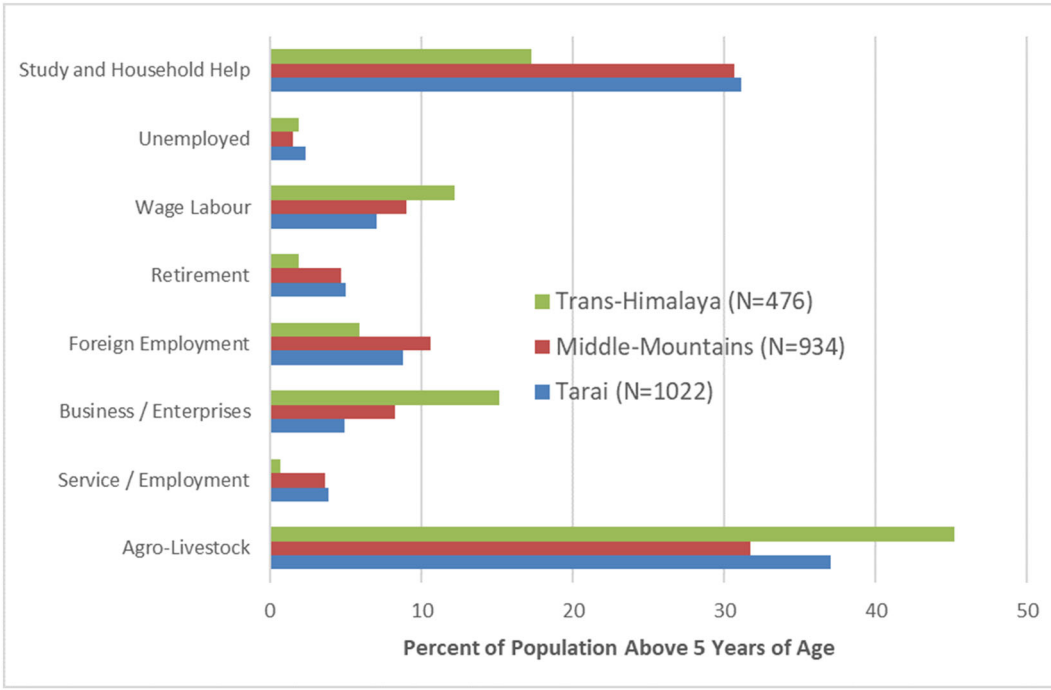

FIGURE 2 Occupational status of population by type of occupation in Meghauli, Lumle, and Upper-Mustang, Nepal (Source: Field Survey, 2013)

4.1.2 | Land and forest resources

Although arable land is a vital resource for food security in Nepal, growing population densities increase land use pressures. Due to the targeting of rural households, the proportion of total farmland in the study area is higher (97.8%) than the average value of 70.6% for Nepal (CBS, 2013), with fairly comparable proportions across the study clusters. Over 56% of Upper-Mustang households, 55.3% in Lumle and 46.4% in Meghauli have marginal holdings of less than 0.5 ha, remarkably less than the stated minimum arable land requirements for food self-sufficiency in Nepal (FAO & GoN, 2016). The proportions of small holders (0.5–2.0 ha) follow the opposite trend, with 50.3% in Meghauli, 41.8% in Lumle, and 40.9% in Upper-Mustang. Although mean landholding is 0.73 ha, the standard deviations of 0.68 ha in Upper-Mustang, 0.58 ha in Meghauli, and 0.56 ha in Lumle suggest important inequalities in land ownership in the Kaligandaki Basin. The cropping intensities across the basin are also highly variable. Actual cropping intensity in Meghauli is 264.4%, or close to three crops per year, followed by Lumle (183.8%), and Upper-Mustang (138.1%). Crops in Upper-Mustang are mostly irrigated, whereas just over half are in Meghauli and only 3% in Lumle.

The forest supplies a sizable portion of food for rural farming households in Nepal (Adhikari, Ojha, & Bhattarai, 2016; Subedi & Pandey, 2002; Uprety et al., 2012). However, respondents did not reveal high levels of forest exploitation, with only a few households in Meghauli and Lumle collecting some green vegetables, wild fruits, roots, and shoots. In Upper-Mustang, the harsh climatic conditions limit nature-based food collection. There are multiple reasons why food gathering is limited, with the erosion of traditional knowledge and forest policies constraining access (Adhikari et al., 2016).

4.1.3 | Livestock and monetary assets

Livestock such as cattle, buffaloes, goats, sheep, and poultry are an integral part of households' livelihoods; however, respondents noted that herd sizes are decreasing. On average, less than one cow, oxen, or buffalo and less than two goats are raised per household in Meghauli and Lumle. Trans-Himalayan households hold on average three or more cows, over 15 goats, and some horses and/or mules. These results are skewed by inequities in ownership, with one household having 250 goats in the Trans-Himalaya and two poultry farms in Meghauli dominating results. Livestock are important for dairy and meat products for domestic consumption; manure for fertilizer; and cash from transport, draught power, and sales in Nepal (Davies, Guenther, Leavy, Mitchell, & Tanner, 2008; Subedi & Pandey, 2002). Households in Upper-Mustang mostly keep cattle, mountain goats, sheep, yaks/*Jhocpos*,[4] horses, and mules. Households in Meghauli have the largest number of poultry, followed by male buffaloes for draught power, whereas households in Lumle keep buffaloes for milk and oxen for draught power. Poultry, goats, and sheep are major sources of cash income[5] in the study areas, and numbers of goats and/or sheep in particular can increase the economic status of a household.[6] However, because livestock are not insured, this form of wealth is not risk free (Dhakal, Bigsby, & Cullen, 2011).

The stocks and flows of monetary assets are weak for most households, with very few (3.9%) investing financial resources in productive sectors. On the other hand, one third of households have borrowed money to support their livelihoods and were indebted at the time of the survey. Financial insecurity adds to the likelihood of food insecurity because the capacity to buffer against crop failures or other constraints are limited.

4.2 | Food (in)security

4.2.1 | Availability dimension of food security

Food must be available in sufficient quantity and quality for food security, which is determined by the resources available for local production or from other sources (sharing, food imports, and market integration; FAO, 2008). Most households in the Kaligandaki Basin are producer–consumers, so the term "availability" is used narrowly here and refers to levels of self-sufficiency of household food production. When households do purchase food, supplies are generally available, and constraints are largely associated with a household's financial resources, categorized under food access (see Section 4.2.2). Households were divided into five classes: no food deficiency, little, moderate, severe, and profound level of food deficiency (Table 3), derived from responses to the question: what share of your annual household food requirement was derived from your farm last year? The results indicate that most households in Meghauli (75.2%) produce sufficient food, followed by Upper-Mustang (39.4%) and Lumle (16.3%). The highest levels of food deficiency are found in Lumle where 12.8% of households experienced profound or 12.1% severe levels of food deficiency.

[4]*Jhocpo* is a crossbreed of cow and yak that is adapted to high altitudes.

[5]The local free range chicken meat costs more than NPR500 (US$6)/kg and the male goat (mutton) costs over US$7/kg, a milking buffalo costs about NPR60000 ($650), and a high breed milking cow worth about NPR80000 ($850).

[6]A household in the Trans-Himalaya owning over 250 mountain goats is equivalent to more than 3.75 million Nepali Rupees (US$37,500).

TABLE 3 Proportion of households with food availability by gender of household head across Meghauli, Lumle, and Upper-Mustang, Nepal (Source: Field Survey, 2013)

	Tarai			Middle-Mountain			Trans-Himalaya		
Level of deficiency	**Women**	**Men**	**Total**	**Women**	**Men**	**Total**	**Women**	**Men**	**Total**
No deficiency	76.6	74.5	75.2	12.5	17.8	16.3	21.1	46.8	39.4
Up to 25%	14.9	10.4	11.8	7.5	16.8	14.2	52.6	25.5	33.3
Up to 50%	4.3	7.5	6.5	42.5	45.5	44.7	15.8	17.0	16.7
Up to 75%	0.0	2.8	2.0	20.0	8.9	12.1	5.3	8.5	7.6
Over 75%	4.3	4.7	4.6	17.5	10.9	12.8	5.3	2.1	3.0

There is a small variation in the food security situation according to the gender of the household head. It is evident that female-headed households are more food insecure than male-headed households in terms of farm production, especially when household production forms a more important component of food security (Table 3).

4.2.2 | Access dimension of food security

Access to food refers to levels of food entitlement or resources essential for acquiring appropriate foods for a nutritious diet (Sen, 1989). The resources to acquire food can be conceptualized as alternative commodity bundles that a person or household can command by applying their totality of rights and opportunities within a society (Sen, 1984). The command over resources beyond farm assets is generally so poor for Kaligandaki households that it can be difficult to conceptually separate access from availability (USAID, 1992; see also Section 4.2.1), so the term access in this paper refers specifically to monetary resources, defined here as income available in relation to annual total expenditure (Table 4). The results indicate that Lumle households have the highest financial deficiencies, followed by Upper-Mustang and Meghauli. Larger minorities are spending a major share of their income to purchase food and thereby compromising their abilities to access other necessities or invest in productive activities, with 6.4% of households in Lumle followed by Meghauli (3.9%) and Upper-Mustang (3%) reporting deficiencies of up to 50% of their annual budget.

Although food access by gender of household head (Table 4) does not vary considerably, it is likely that the outmigration of men, and the associated remittances, help to supplement for lower local incomes for many female-headed households.

TABLE 4 Proportion of households with access to food by gender of household head across Meghauli, Lumle, and Upper-Mustang, Nepal (Source: Field Survey, 2013)

	Tarai			Middle-Mountain			Trans-Himalaya		
Level of deficiency	**Women**	**Men**	**Total**	**Women**	**Men**	**Total**	**Women**	**Men**	**Total**
No deficiency	78.7	82.1	81.0	82.5	73.3	75.9	47.4	59.6	56.1
Up to 25%	19.1	13.2	15.0	7.5	18.8	15.6	52.6	31.9	37.9
Up to 50%	2.1	4.7	3.9	7.5	5.9	6.4	0.0	4.3	3.0
Up to 75%	0.0	0.0	0.0	0.0	2.0	1.4	0.0	4.3	3.0
Over 75%	0.0	0.0	0.0	2.5	0.0	0.7	0.0	0.0	0.0

4.2.3 | Annualized HFIAS method of food security analysis

The utilization of food is defined by the security of the provision of essential nutrients from foods consumed (FAO, 2008). Particular sections of a population, such as children, adults generally, or those involved in manual labour, pregnant women, the elderly, or infirm require different levels of nutrition to ensure all physiological needs are met (FAO, 2006; USAID, 1992). Proper use, processing and storage techniques and the provision of clean water, sanitation, and health care are also important issues. Food stability on the other hand refers to availability, access, and utilization of food at all times without interruption (FAO, 2006). Sudden economic, social, or environmental shocks and cyclical events such as seasonal variations in food availability need to be avoided. Many food security assessments do not incorporate these two important concepts sufficiently, especially in Nepal where winters can be particularly harsh (see, e.g., CBS et al., 2013:3). Rather, food supply chains are often assumed to be consistent or that people will store and distribute food adequately in the household. As outlined in Section 3.3, we synthesize answers from the annualized HFIAS survey to use as indicators for food security in general. In other words, the HFIAS allows for the subjective assessment of the overall food security situation without analysing the different availability, access, utilization, and stability dimensions independently.

Based on total annualized HFIAS scores, households were categorized into four groups: no food deficiency, little food deficiency, moderate food deficiency, and severe food deficiency (Table 5). Over one third of households have experienced food insecurity to some level across the Kaligandaki Basin over the past year. The problem is more acute in the Middle-Mountains (Lumle) and Trans-Himalaya (Upper-Mustang) where half or more of households experienced some insecurity. HFIAS scores were also averaged for clusters. Lumle households experience a lack of food "moderately" (three to 10 meals) each month, because the mean HFIAS is 18 out of a possible 27 (indicating a very regular or severe deficiency). Mean food insecurity is "occasional" (lack of one or two meals a month) for the households of Upper-Mustang, whereas households in Meghauli are generally food secure (Figure 3). It is interesting to note that a slightly higher proportion of male-headed households (63.2%) than female-headed (57.8%) stated that they experience food insecurity, which is the opposite finding to levels of availability.

A notable proportion of households reported a moderate level of food insecurity according to the HFIAS, with higher proportions of female-headed households in Lumle and Upper-Mustang than in Meghauli (Table 5). There are also variations between and within ecological zones (Figure 3), with the highest levels of food insecurity in the Middle-Mountains.

TABLE 5 Proportion of households with level of food security in relation to a holistic measure of HFIAS by gender of household head across Meghauli, Lumle, and Upper-Mustang, Nepal (Source: Field Survey, 2013)

	Tarai			Middle-Mountain			Trans-Himalaya		
Level of deficiency	**Women**	**Men**	**Total**	**Women**	**Men**	**Total**	**Women**	**Men**	**Total**
No deficiency	85.1	82.1	83.0	50.0	48.5	48.9	57.9	46.8	50.0
A little (1–2 meals a month)	10.6	12.3	11.8	30.0	37.6	35.5	31.6	46.8	42.4
Moderate (3–10 meals a month)	4.3	5.7	5.2	17.5	11.9	13.5	10.5	6.4	7.6
Severe (more than 10 meals a month)	0.0	0.0	0.0	2.5	2.0	2.1	0.0	0.0	0.0

Note. HFIAS: Household Food Insecurity Access Scale.

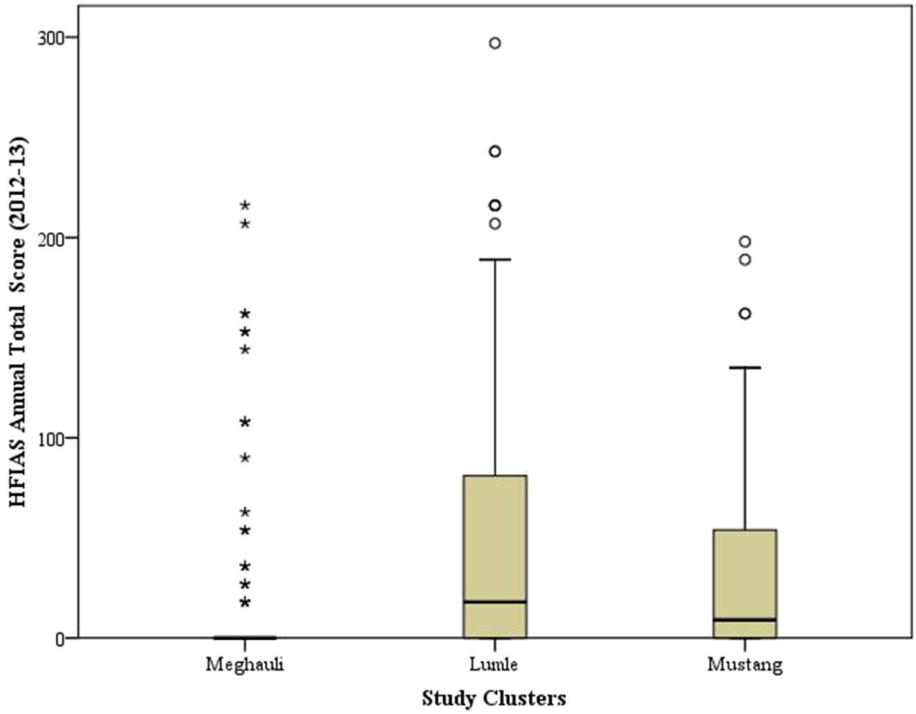

FIGURE 3 Annual total HFIAS score for households in 2012/13 in Meghauli (Tarai), Lumle (Middle-Mountains), and Upper-Mustang (Trans-Himalaya), Nepal

Food security in Nepal is also closely related to seasonal conditions. Most households are cultivator–consumers, so the months with better food security broadly coincide with the post-harvest months, whereas the shortages in food availability are mostly pronounced after sowing crops (Figure 4). The winter months of December and January in the Trans-Himalaya and the preharvest time of July through September in the Middle-Mountains are critical to food security.

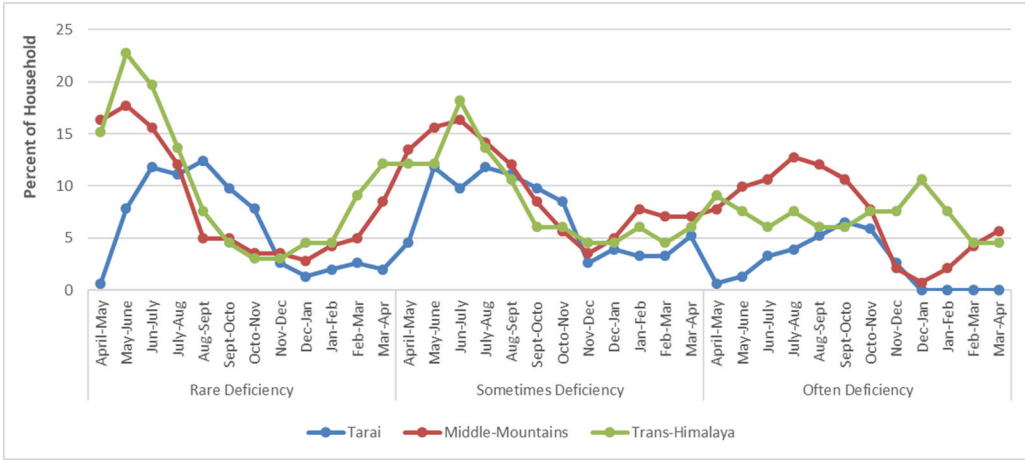

FIGURE 4 Monthly scenario of food insecurity in relation to HFIAS by level of insecurity and ecological zone in the Kaligandaki Basin, Nepal (Source: Field Survey, 2013)

4.2.4 | Socio-economic variables and food security relationship

The relationship of household size, ratio of economically dependent population, and arable land was compared with HFIAS food security (Table 6). Larger household size does not necessarily generate a food insecurity problem as indicated by the negative relationships between household size and the HFIAS scores in all study clusters. Consistent with work by Adhikari and Bhole (1999), dependency ratios, on the other hand, are positively correlated with the HFIAS findings, particularly in Lumle and Upper-Mustang, reflecting that a larger number of economic dependents tends to hinder household food security. However, as none of these relationships are statistically significant, it might also be that the population classified as economically dependent (below 15 years of age and above 60 years of age) are truly economically active to some extent.

Better farm productivity and higher cropping intensity in the Tarai helps to improve food security, as indicated by the significant negative correlation between the land resource index

TABLE 6 Correlation-coefficient and regression analysis of HFIAS with various household characteristics in Meghauli, Lumle, and Upper-Mustang, Nepal

	HFIAS Correlation-coefficient		
Household characteristics	**Meghauli**	**Lumle**	**Upper-Mustang**
Household size	−0.229*	−0.075	−0.260**
Household dependency ratio	−0.079	0.125	0.177
Household land resources (Standardized Indexed Value using {(Actual-Min)/(Max-Min)} method for household level and mean for clusters)	−0.210*	−0.162	−0.016
Share of remittance in livelihoods contribution	−0.243*	−0.178**	−0.220
Labour migration abroad	−0.066	−0.110	−0.52
Regression analysis (p values: less than 0.05 is significant at 95% and less than 0.1 is significant at 90% confidence levels)			
Human Capital Index@	0.999	0.660	0.011
Social Capital Index@	0.380	0.180	0.488
Natural Capital Index@	0.078	0.523	0.686
Financial Capital Index@	0.000	0.001	0.000
Physical Capital Index@	0.334	0.519	0.055
Fallow farmland	0.756	0.532	0.059
Household size	0.355	0.508	0.811
Dependency ratio	0.598	0.844	0.013

Note. "@" represents indices were calculated after converting the variables of these groups into index values using max-min method at first and followed by obtaining weighted mean of the components and particular livelihood capital index finally. For example, Human Capital Index = (Labour Force Index + Education and Skill Index + Health Index)/3. Further, Labour Force Index = (number of economically active population in a household − minimum number of economically active population in the cluster)/(maximum number of economically active population in the cluster − minimum number of economically active population in the cluster). HFIAS: Household Food Insecurity Access Scale.

*Correlation is significant at the 0.01 level. **Correlation is significant at the 0.05 level (two-tailed).

and the HFIAS data. In other places, the correlation is not as strong. Larger areas of fallow land and poor irrigation facilities in Lumle, and only a single growing season in Upper-Mustang may have led to the weak relationships between the variables elsewhere. It is possible to conclude that the size of landholdings may not be as important as the potential for cropping intensification for household food security. That finding may be tied to the fact that households who obtain a major share of their livelihood from remittances sent by family members from abroad are statistically significantly more likely to be food secure across all clusters. In addition, households having more members working abroad and for longer duration are more likely to be food secure.

The roles of different livelihood capitals and other household characteristics were investigated to analyse their relationship with food security. Only financial capital has a statistically significant role in improving food security at all sites. The role of natural capital in Meghauli (Tarai) is only marginally significant at a 90% confidence level ($p = 0.078$). However, access to natural resources does not contribute significantly to food security in the other two clusters even though they are also rural households, perhaps due to the marginal size of holdings and limited cropping intensity. Human ($p = 0.011$) and Physical capital ($p = 0.055$), as well as the household dependency ratio ($p = 0.013$), are partial drivers of food security in Upper-Mustang, perhaps reflecting the fact that health, skills, and physical labour are very important in the region, together with food aid and key infrastructure.

5 | DISCUSSION

The households of the Kaligandaki Basin acquire food from both self-production and the marketplace. To source food, natural resources such as land, agro-livestock, and forest products are supported by financial capital obtained through employment, small businesses, and remittances (see Section 4.1). The overall food security situation assessed using HFIAS demonstrates that almost a half of the households in Lumle and Upper-Mustang and about one fifth in Meghauli experience some food insecurity (Section 4.2.3). Many households in Lumle and Upper-Mustang are food deficient from farm production alone (Section 4.2.1). Limited growing seasons, small farm sizes, lack of irrigation, and farm-land abandonment (in Lumle) are major causes of poor availability (Table 3). The access dimension of food from the market largely supplements for those limitations for households, although food purchases generally require expenditures of a large share of household income, potentially compromising access to other necessities (Section 4.2.2).

Despite the global food security discourse shifting away from a narrow focus on food supply, in Nepal, the "stability" dimension has only recently been considered in policy (FAO & GoN, 2016). That omission may be because the country has struggled to address important food security knowledge gaps. Kular et al. (2013) applied the HFIAS method and found moderate to severe levels of food insecurity in 8.6% of the studied households in Nepal. That conclusion is generally consistent with the Nepal Living Standard Survey 2010-2011, which found that 8% of households could not afford to eat one or more times a month (CBS-NLSS, 2012). Our findings from the Kaligandaki Basin suggest a more serious situation, with 15.6% of households revealing food insecurity in the Middle-Mountains, followed by Upper-Mustang, and Meghauli. On the other hand, the Nepal Demographic and Health Survey (MOHP et al., 2012) found that over 50% households in the Central Tarai are food insecure, which is inconsistent with our findings that only 11.8% of Meghauli households experienced an "occasional deficiency," followed by Lumle (35.5%) and Upper-Mustang (42.4%). The inconsistencies could be associated with

the fact that the Nepal Demographic and Health Survey asked only seven out of nine HFIAS questions and only gathered data for the previous month. There is a great seasonal variation in food security situation in rural households of Nepal, which is why, in contrast, this study generated annualized data from the analysis of household data from over 12 months.

Importantly, the household food security results vary according to the different indices across household and ecological zone, suggesting that the use of a single analytical method may be inadequate. In the Tarai, about a quarter of households reported deficiencies from self-production. However, only 19% had budget deficiencies and therefore food market access problems, and only 17% were identified as food insecure according to the HFIAS. In Lumle, 83.7% of households reported deficiencies in self-production. Although the majority of them access marketed food, a remainder of 24% of households experience budget deficiencies and a significant 51% of households reported some level of food insecurity on the HFIAS. In Upper-Mustang, a little over three fifths of households reported deficiencies in self-production, and 44% had budget deficiencies, with about half reporting some level of food deficiency. It is possible to conclude that although the indicators of food security measured here (availability, access and the HFIAS) led to similar results for households in the Tarai and, to a lesser extent, the Trans-Himalaya, the indices varied widely for respondents in the Middle-Mountains where neither availability nor access correlate strongly with households' subjective opinions of their own food security. That result may be due to various factors, some of which were raised in interviews that "rising food prices," "declining household food production," and "inequality in access to resources" are associated with exclusionary forces within the political and economic systems that may be experienced disproportionately in the Middle-Mountains (Pain et al., 2015).

It has been claimed that the liberal market economy adopted by Nepal in recent years has improved aggregate indicators of food security (Pyakuryal et al., 2010). Pandey et al. (2016) found a positive association between agricultural interventions and nutritional outcomes. However, other researchers argue that the liberal market has led to price increases since Nepal entered the World Trade Organization in 2004, driving an additional 4% of low-income people below the poverty line (Shrestha & Chaudhari, 2011). Here, Meghauli respondents in particular noted greater opportunities for crop intensification and off-farm employment that enable them to benefit from the new cash economy, even as they maintain traditional cropping practices (Table 6). Although that situation may be true for the Tarai, Lumle respondents expressed concern that increases in food prices and declines in local production have amplified the importance of cash income without corresponding in situ development opportunities. Where households depend on purchasing food (see Section 4.2.2), many are compromising on other necessities (see also CBS et al., 2013), whereas female-headed households may be benefitting from greater access due to financial capital from remittances.

The emerging food insecurity situation in the Middle-Mountains and the Trans-Himalaya is complex and further compounded by a decline in local investment in agriculture (associated with labour migration abroad and farmland abandonment), small farm sizes (almost all households own farm plots of less than 2 ha), lack of irrigation (lack of a water source, extreme weather events, and damage of irrigation infrastructure), and abandonment of farmland (see Section 4.2.4; Pandey, 2016). As poor rural households even in more marginal regions are made to become dependent on marketed food, they must also be assisted to develop sustainably (Dahal, Nyborg, Sitaula, & Bajracharya, 2009; Rutten, Shutes, & Meijerink, 2013). Khanal and Watanabe (2006) and Chidi (2017) both emphasize the importance of land abandonment in declining local agricultural economies. The causes of abandonment could be attributed to environmental variability, low returns, a shortage of labour due to outmigration, and/or the highly

unequal distribution of land, with a lack of secure tenancy (Gartaula, Niehof, & Visser, 2012; Pandey, 2016; Subedi, Subedi, Dawadi, & Pandey, 2007b). Importantly, only those Middle-Mountain households receiving remittances from abroad or from other cash-based businesses could afford to consistently access sufficient, high-quality food from the market (Table 6).

Approaches to food security and agricultural development could be designed to meet the particular needs of different households in the three ecological zones. A transition from subsistence to purchased food may be relatively successful in the Tarai with all of its advantages, including agricultural mechanization, transportation, and opportunities for small-scale enterprises and urban employment. However, ongoing limitations in the Middle-Mountains and Trans-Himalaya suggest that agricultural policy could emphasize increasing local productivity of food and the utilization of agrobiodiversity and forest resources. Households in the upper parts of the Kaligandaki Basin are vulnerable to weather and topographic extremes, as well as social-political and techno-economic constraints such as poverty, small landholdings, and inadequate transportation (Macchi, 2011; Subedi et al., 2007a; Subedi & Pandey, 2002). Arguably, the focus on the market to overcome food insecurity has been overemphasized for many of these more marginalized rural communities since the 1960s, especially as traditional food items such as millet and buckwheat have been replaced and transport costs remain prohibitive for many respondents (Adhikari & Bhole, 1999; Bardsley & Thomas, 2005; Gaire, Beilin, & Miller, 2015).

The new Agriculture Development Strategy 2016-2035 (GoN/MoAD, 2016) still does not focus on critical issues of food security that reflect that complexity of household situations, such as lack of financial access; maintaining, repairing, and restoring hill agriculture; landlessness; and remittance dependence. Support for small scale investment into agricultural mechanization and irrigation appropriate for mountain environments remains an important intervention, as does improved transportation in the Middle-Mountains and Trans-Himalaya. To avoid ongoing, long-term stagnation in agricultural development and reduce the risk of external dependencies (Shively, Gars, & Sununtnasuk, 2011), food security policy could also focus on the greater empowerment of women to complement improvements in access, especially as the gender balance of agricultural labour changes in Nepal (Pandey et al., 2016).

6 | CONCLUSION

This research has identified highly variable food security situations across Nepali households and ecological regions of the Kaligandaki Basin. The small-scale producer–consumer households of the basin do not have adequate food availability through subsistence production alone, although majority of households have been able to supplement their food requirements from the market. While accessing marketed food, they often have to compromise other necessities such as investments in clothing, housing, education, and health. The holistic subjective analysis through the annualized HFIAS suggests that a notable proportion of households are food insecure, and that severity is highest in the Middle-Mountains, followed by Trans-Himalaya and the Tarai.

This study identified some limitations with the HFIAS method associated with a reliance on short-term subjective assessments, particularly when cultural issues may influence the understanding of the questions themselves and alter self-evaluations. Different households may "feel" food secure at different levels of nutrition. Because the respondents rarely indicated food insecurity in relation to a lack of "food variety," "preferred food items," or a "reduced amount of food intake," it seems that producer–consumers in rural Nepal generally feel food secure if they have anything to eat, which may hide underlying risks of malnutrition from an unbalanced diet.

On the other hand, even though the answers are accorded an equal weighting in HFIAS, not all the nine questions are of equal importance for indicating food insecurity. The conventional HFIAS also has a limited ability to describe seasonality of food availability and access, if data are only accessed for a single month. As these elements influence the HFIAS score, further research is required to establish baseline food security indicators for households. Nevertheless, by determining subjective evaluations of household food security over the last year on a monthly basis, we have shown that the method does allow for more sophisticated interpretations of individual household and regional experiences with food than is provided by availability and access data alone.

Ideally, it would be possible to develop robust research frameworks that incorporate multiple variables for each food security dimension, including clinical trials and sophisticated food supply chain analyses that allow for utilization and stability variables to be well-understood (FAO & GoN, 2016; Graef et al., 2015). Where those more comprehensive approaches are not possible however, we have shown that the application of the annualized HFIAS can support assessments of availability and access to provide a more robust approach to understanding the full food security situations across a range of socio-economic and agro-ecological contexts. By recognizing the findings obtained from HFIAS and the contextual differences across the households and ecological zones, new conversations could be initiated to generate reflexive policy that responds to the complexity of emerging food security situations in Nepal.

ACKNOWLEDGEMENTS

The data used in this paper were collected during the PhD research of the principal author. We would like to acknowledge The University of Adelaide, Australia, where the research work was based and funded; Pokhara University for providing the corresponding author with study leave. The gender component of analysis is also supported by Pokhara University Research Centre, Faculty Research Grant No: 03/2072/73; and Pawan Chitrakar, Kamal Singh Thapa, Dharma Raj Parajuli, and Deependra Pandit for their help during the fieldwork. We would also acknowledge the constructive feedback of anonymous reviewers of our manuscript and the editors of the journal.

ETHICAL COMPLIANCE

This paper entitled "An application of the Household Food Insecurity Access Scale to assess food security in rural communities of Nepal" is based on the data collected for the PhD project of the corresponding author. Respecting the National Statement on Ethical Conduct in Human Research and the Australian Code for the Responsible Conduct of Research, all ethical concerns have been followed. The ethical clearance for the work was obtained from the University of Adelaide, Australia, with Number: HP-2012-046.

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How to cite this article: Pandey R, Bardsley DK. 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