



Food Safety Awareness, Food Policies, and Gender: A Review and an Empirical Examination from Nepal

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Abstract

Hunger and malnutrition are critical challenges for developing countries. Access to sufficient safe and nutritious food is the key factor in addressing food security, health, and nutritional goals. Food safety and security are vital components of sustainable food systems. However, in developing countries like Nepal, food safety issues have received limited attention within the food systems. This study aims to review the relationship between food safety and food security, sustainable food systems, awareness, and food policies in Nepal, while also discussing the potential roles of women in these areas. Furthermore, the empirical examination presents our findings based on primary survey data from 604 consumer households in five major metropolitan areas of Nepal, Particularly focusing on gender differences in food safety awareness and purchase of fresh produce. Our overall findings suggest that the basic food safety practices and the enforcement of regulations have been overlooked in Nepal. Moreover, the study also underscores the potential roles women could play in enhancing awareness of safer fresh produce systems and safer food consumption. However, the findings also indicate that women in Nepal have lower awareness of food safety compared to men, emphasizing the need to improve education and awareness among women. To fully harness the potential of women as effective initiators, implementers, and promoters of enhancing food safety and sustainable food systems, awareness and training programs on food safety should prioritize the participation of women. It is crucial to encourage their involvement in food-related activities, leadership and management, and entrepreneurship.

Keywords: Safer Food, Fresh Produce, Vegetables and Fruits, Nepal, Metropolitan Households, Women Roles, Gender, Food Safety, Awareness, Consumption, Developing Country

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1. Introduction

Several risk factors for ill health are associated with food and diets (Webb et al., 2018). Access to sufficient, safe and nutritious food is critical for addressing food security, health, and nutritional goals. Unsafe food can create a vicious cycle of disease and malnutrition among children, the elderly, and vulnerable populations. A safer food supply is an instrumental factor in supporting food and nutritional security and sustainable development. The consumption of food plays a direct role in human health and well-being. Food security was traditionally defined as the availability of food that can meet the daily caloric needs of a given population in developing countries. However, by the 1996 World Food Summit, the definition has expanded to “*people having physical and economic access to safe and nutritious food to meet their dietary needs for an active and healthy life*” (WHO, 2019). This internalizes the essence of food safety for food security as well as broadens food security links to food rights and food sovereignty. Food safety encompasses the aspects of handling, preparation, storage, and consumption of food preventing contamination throughout the process and food chains, and reducing foodborne illnesses. Apparently, the inherent linkages between food safety, food security, and nutrition are integral.

Foodborne illness can occur because of our inability to detect risks and hazards in the food that we consume. For the assurance of safer food, we need assurance that the food will not cause harm to consumers when it is prepared and eaten according to its intended use (FAO / WHO, 2014). It is also a way to preserve the quality of food. Unsafe food means that the food might have been exposed to dirt, and germs and most of them have infections caused by bacteria, viruses, and parasites that we cannot detect with our naked eyes. Other than that, harmful toxins and chemicals are also the main reason for foodborne illnesses when food is contaminated (CDC, 2020).

In developing countries like Nepal, food safety issues have received limited attention in the food systems, typically when hunger is the primary constraint to guaranteeing food security. However, Nepal has slowly dropped its score on the Global Hunger Index (19.1) from a serious to moderate level (<https://www.globalhungerindex.org/>). There is still much work to be done in the broader avenue of addressing food insecurity and ensuring a safer food supply and consumption in Nepal. The efforts on food safety in Nepal are emerging but are at the initial stages. These efforts so far are mainly on identifying the issues and challenges and documenting or drafting some policies and acts (for detail, see our review in a subsection under 3.1) In this stage, along with policy designs, Nepal should work on the premise of speeding the awareness, educational, and dissemination efforts on the importance of food safety to consumers, entrepreneurs, and communities. This probably needs to find the best key initiator

and dissemination on multiple levels: households, communities, and private and public sectors to enhance the understanding of the need for and importance of safer food.

From a gender perspective, women play a central role in the food system and are integral components in the cultivation of food crops, food production, food consumption and related activities (Visser & Wangu, 2021; Njuki et al., 2021). According to the United Nations, women make up at least 43 percent of the agricultural workforce in developing countries – and as much as 70 percent in some countries. Therefore, women could be instrumental in the fight against malnutrition and in making food systems more sustainable. However, gender roles and women’s contributions are often not consistently recognized (Njuki et al., 2021). This study aims to address this gap in Nepal by providing a comprehensive discussion and recommendations.

The objective of this study is twofold. Firstly, we review the existing literature related to food safety, food security, and gender roles in food systems focusing in developing country perspectives and Nepalese context. We present our findings based on a comprehensive review into different subsections. Additionally, we conducted empirical examination utilizing primary survey of data from consumer households in Nepal. Specifically, our focus is on food safety awareness regarding fresh produce and gender differences. We examined the awareness level of food safety in fresh produce shopping and consumption, analyzing responses from a primary survey conducted in five major metropolitan areas of Nepal.

2. Methodology

For the first objective, we comprehensively reviewed the previous literature related to food safety, food security, and gender roles in food systems in developing country perspectives. Previous journal articles, information on formal websites, reports, google scholar, and Web of Science searches are the main sources for our review. We have presented review findings under different sub-headings in the result and discussion section. For the second objective, we used empirical survey data generated from a research project implemented¹ in Nepal to understand the baseline and drivers of food safety among consumers and producers of fresh produce systems, in collaboration with academic institutions, NGOs, and local government agencies. Based on the sample survey data of consumer households in five metropolitan areas of Nepal, we

¹ The major partner for field activities of the project in Nepal are Agriculture and Forestry University, Nepal, and a national-level NGO, Sahavagi in Nepal; more information on the project: <https://rb.gy/mhsoj>

have assessed the roles of men and women members of the household in food safety-related practices. Additionally, we examined gender roles in fresh produce shopping and purchase, food preparation, and food decisions. We also investigated the level of awareness and understanding of different dimensions of food safety.

We administered stratified random sampling with randomly selected *wards*, and then *Toles*² within the selected metropolitan area. We devised a sample frame in each metropolitan area in collaboration with local government authorities and officials and administered in-person interviews based on a structured questionnaire using survey enumerators. Prior to conducting the survey, the project team constructed a detailed sampling and selection strategy protocol for this field survey. First, from each metropolitan area, 4 *wards* were randomly selected by picking a random number between 1 and the number of total *wards*, without replacement. Second, 3 to 4 *Toles* from each selected *ward* were randomly selected following the same random procedure. The project team ensured the representation of 12 random *Toles* from 4 random *wards* in each metropolitan area. Next, the project team prepared a comprehensive household list of 12 selected *Toles* of each metropolitan area in collaboration with local government authorities and officials. The number of households in the compiled list varied by location but it averaged around 1,000 households per metropolitan area. We randomly selected an average of 120 random households from each metropolitan's sample frame to represent the intended research questions of the project. Then the project team proceeded to conduct in-person interviews with randomly selected households from June to August of 2022. From in-person interviews conducted among households, altogether from 60 *Toles* of 20 *wards* in 5 metropolitan areas, we obtained 604 complete responses representing each metropolitan area. In-person interviews were conducted with one adult representative member of the household. The survey maintains questions to collect information from both the respondent and the household head if the primary respondent is not the household head.

Prior to survey administration and sampling, the data collection procedure and survey instrument (questionnaire) were approved by the Institutional Review Board (IRB) of the lead institution of the project as well as the Nepal partner institution responsible for data collection. Survey interviews were conducted by trained enumerators under monitoring and feedback in the field directly by the project's co-Principal Investigator (Co-PI) from a partner institution in Nepal. Figure 1 shows the

2 *Toles* represent the clusters or neighborhoods within the wards of a municipality. Ward is the smallest unit of local government within a metropolitan area or municipality. In constructing sample frames, the project directly collaborated with members/officials of "Tole Sudhar Samitee" that exist in metropolitan areas as the community's unified body to communicate with local government regarding local field-level needs and development.

consumer survey locations representing five large metropolitan areas in Nepal, namely Kathmandu Valley³ metropolitan area (Kathmandu, Lalitpur, and Bhaktapur districts), Bharatpur metropolitan area (Chitwan district), Butwal metropolitan area (Rupandehi district), Pokhara metropolitan area (Kaski district), and Hetauda metropolitan area (Makawanpur district). We maintained survey questionnaires electronically and recorded responses using Qualtrics⁴ software.

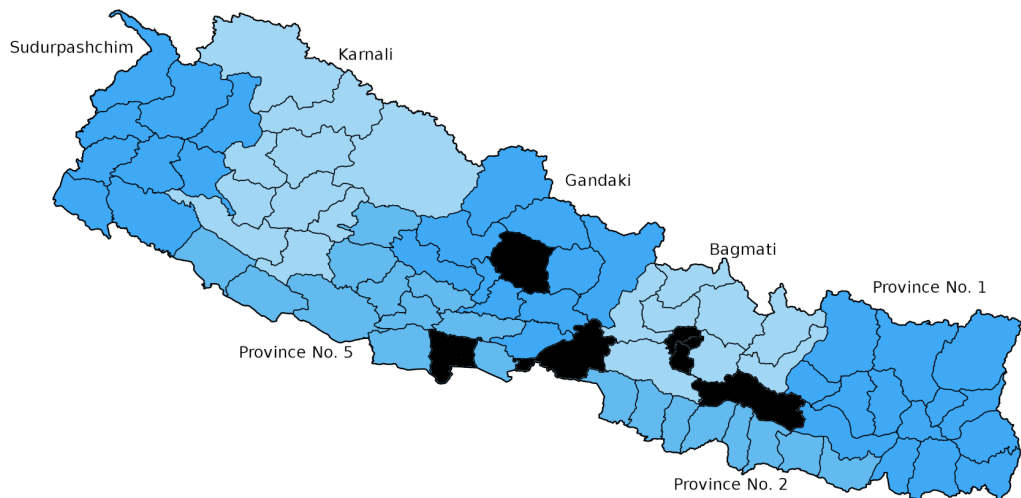


Figure 1: Figure showing the metropolitan area districts used in the consumer household survey (indicated by black dark shades)

3. Results and Discussion

3.1 Food Safety, Sustainable Food Systems, Gender Roles, and Nepal: A Review

3.1.1 Food Safety and Food Security for Sustainable Food Systems

Food safety and security are complementing elements in sustainable food systems. The tools and strategies used to achieve food security must align with food safety and public health as well as sustainability. It is necessary to maintain and ensure food safety in the food supply meeting the hunger reduction goals. However, maintaining food safety and quality assurance can result in some reduction in quantity in the

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- 3 We included Kathmandu valley representing larger metropolitan area concept in this study because of the proximity and close commercial, market, and location ties of three districts within this (the Valley captures metropolitan areas of Kathmandu, Lalitpur, and Bhaktapur districts). Moreover, it is not uncommon to refer “Kathmandu Valley” for common larger metro area in studies and communication.
- 4 Qualtrics (<https://www.qualtrics.com/>) is one of the leading platforms in electronic and offline survey questionnaire design and response data collection

short run. However, one should internalize the implications and consequences of food not being safe and its connection to food security. Food is not wholesome if it is not safe—this brings us to the notion of “there is no food security without food safety” (FAO, 2019a), or “food safety is food security” (UNSCN, 2019) in maintaining sustainable food systems.

A sustainable food system should provide food security and deliver nutrition for all in such a way that the economic, social, and environmental bases are not compromised for future generations (FAO, SFS, 2022). United Nations Sustainable Development Goals (SDGs) aim for sustainable food systems. The SDGs, adopted in 2015, call for constructive changes and positive transformations in food and agricultural systems to end hunger, achieve food security, and improve nutrition by 2030. These require the combination of interconnected actions at the local, national, regional, and global levels.

The Food and Agriculture Organization of the United Nations (FAO/UN) estimates in its report – *The State of Food Security and Nutrition in the World 2019* - that 820 million people in the world were still hungry in 2018 (FAO, 2019b). The situation highlights the emphasized needs and importance of the hunger eradication agenda of the United Nations’ SDGs. This requires proper approaches to improve the current food systems (El Bilali et al., 2019; Panait et al., 2020). The FAO estimates an average of 600 million cases of foodborne illnesses annually (FAO, 2019a; FAO, 2019b, FAO, 2020) and 420,000 deaths associated with contaminated food (FAO, 2019a). Food safety is an integral part of the SDGs (FAO, 2019a; FAO, 2019b). Particularly, addressing SDG goal 2 of ending hunger with secured food and nutrition in sustainable agricultural systems is only achievable when available food is safe for consumption. Unsafe food represents a global threat to both human health and economies and obstructs the goals of sustainable food systems. However, research in food safety as a part of sustainable food systems has been just emerging in developing countries.

3.1.2 A review of historical development and current policies and efforts on food safety in Nepal

The institutional initiative on regulating food safety in Nepal began after the establishment of the Department of Food in 1961. However, regulation of food safety in Nepal began in 1966 by enforcing the Food Act (Pant, 2007). This is followed by the Food Regulation of 1970 and the formulation of the Food Safety Policy in 2019. Traditionally, food safety regulations were based on inspecting and analyzing end products (FAO, 2009; Singh, 2005). Current efforts are aimed to replace traditional approaches by ensuring total quality management and ‘farm to fork’ holistic approaches, which focus on all levels of production, processing, transportation, and trading (Singh, 2005). Additionally, the attention to the requirement for international

markets and provisions and thus the initiation of government's regulations on food safety started after Nepal's WTO (World Trade Organization) membership, especially on sanitary and phytosanitary (SPS) requirements (Pant, 2007).

Nepal's five-year periodic plan started to give importance to the agriculture sector in 1956. However, efforts to adopt policies related to food insecurity started mainly from the Agricultural Perspective Plan of 1995 to 2015 (APP, 1995-2015). Likewise, the tenth periodic plan (2002-2007), the first three-year interim plan (2007-2010), and the second three-year interim plan (2010-2013) supported and introduced a long-term vision for food security. The Food and Nutrition Security Plan (FNSP), 2013 supported the government's initiatives in quality and nutritious food.

In the context of Nepal's commitment to zero hunger challenge initiatives introduced by the Rio+20 conference on sustainable development to end hunger, food insecurity, and malnutrition by 2025, Nepal should equally emphasize food safety measures (FAO, 2015). However, the initiatives in Nepal towards food chains have focused less on the quality of the produce. Besides, the Nepal government's long-term Agricultural Development Strategy (2013-2023), and Multi-sector Nutrition Plan (2013-2022) have not emphasized well on the food safety regulations. However, the third three-year interim plan (2013-2016), National Food Safety Policy (2019), and the recent 15th five-year periodic plan have importantly discussed the consideration of food quality and food safety-related issues (MOALD, 2019; NPC, 2019).

The Constitution of Nepal (2015) has enshrined the right to food as a fundamental right for its citizens. Even after the endorsement of regulations like the consumer protection act by the government of Nepal, fresh produce like vegetables and fruits available in the market are unsafe (Prasain, 2020). Adequate implementation of new policies, regulations, and approaches are questionable with the lack of strict monitoring and feedback mechanism. Moreover, there have been repeated incidences of sickness outbreaks from food consumption at formal parties, social events, festivals, and restaurants (Aryal, 2022). Major issues in food safety in Nepal are microbiological and chemical hazards and surveillance of foodborne diseases which are associated with contaminated water with *E. coli* and other pathogens (Koirala & Tamrakar, 2010). Nepal's structural and institutional reforms and initiatives for self-reliance on agricultural produce, and consumer awareness of food hygiene demand for a change in the existing food safety policy. Further, the changing international food safety context also realizes the need for food safety policy reform.

On one hand, organizations involved in the food supply chains lack efforts to establish and implement food safety and quality assurance in Nepal. On the other hand,

government authorities have limitations in monitoring, control, and support mechanisms in implementing food safety assurance in food supply chains (Khanal, 2021). Moreover, food safety policy should also address the awareness needs of consumers on food hygiene and nutrition and appropriate inspection systems from farm to consumers. The new food safety regulations should capture the essence of the Plant Protection Act 1972, the Black Marketing Act 1975, the Competition Act 2007, the Consumer Protection Act 1997 and the Essential Commodities Act 1961 and similar to have provisions for protecting consumers from unhealthy and unsafe foods.

Women's knowledge and preference related to the selection and preparation of food are critical for household-level food safety. This importance of gender roles should be streamlined in agriculture and nutrition programs that address food safety and health risks. The Food Act (GoN, 1967) and the Consumer Protection Act (GoN, 1998) aim for food safety and consumers' rights. However, the Food Act has no specific provision to maintain gender-balanced or gender-inclusive voices or responses. The Consumer Protection Act has provisions for two women representatives nominated for the Consumer Council.

Recently, the House of Representatives of Nepal has endorsed the proposal to consider the bill to revise the Food Purity and Quality Act (Ghimire, 2023). The new Act should address the ambiguities of the role and responsibilities of the three tiers of government for the effective implementation of food safety regulations and should envision addressing the current gaps as mentioned above. Nepal is making efforts on food safety as an emerging need with new safety standards through the amendment of existing policies (Prasain, 2023).

3.1.3 The gender-based decision in the households of developing countries and Nepal

A plethora of literature focused on developing countries supports that women generally play an active role in many aspects of family and households, particularly meeting the family's basic needs for food, water, and fuel; women are also heavily occupied in crucial tasks but often unpaid and under-recognized (World Bank, 2015; Safilios-Rotschild, 1980; Accati, 1983; Safilios-Rotschild, 1983; Waring, 1997).

Women and men support each other at home and community levels in the aspects of household management and different activities involving food and agriculture. However, women have distinctly more significant roles than men in ensuring nutrition, food safety and quality (Gender and Development Plan of Action (fao.org), accessed 2022). In Nepal, women are primarily responsible for preparing and processing food for their households and spend considerable time in marketing activities related to food. Thus women can have vital roles to ensure food safety (Gender and Development Plan of Action (fao.org), accessed 2022).

KC (2021), in his study, reported that women are an integral part of the household activities such as cleaning, washing, preparation of meals, and marketing in Nepal. They have a major role in the food, nutrition, water, hygiene and consumption decision of families and children. Also, women and girls are primarily responsible for water-related work in Nepal (KC, 2021).

Gender roles, reflected in the tasks and responsibilities, is generally referred to how males and females decide, think, and feel according to norms and traditions and sometimes meet expectations and identities associated with being male or female in a certain society (for example, see: GESI, Nepal 2017; ASDP- GESI Strategy, 2021, FAO, 2011).

3.1.4 Potential Roles of Women in sustainable food systems in Nepal

Women are active participants in food systems as they are represented in every step and stage with a significantly important proportion as farmers, producers, workers, processors, distributors, researchers, vendors, food meal planners and makers, as well as consumers. Still, their contributions are often not consistently recognized. Women could be instrumental in the fight against hunger and malnutrition and an efficient contributor to productive and sustainable food systems. Following points discussed in I to III summarize and highlight our review findings in regard to the role of women in sustainable food systems in Nepal.

- a. **Food safety:** Women can play a crucial role in mitigating malnutrition, specifically because they are involved in crop and food production activities and primary decisions on the preparation of food for their families. World Food Conference in 1974, in its resolution VIII, recommended and highlighted “food supporting activities” as important contributors to meeting hunger and nutrition. Women’s important roles in childcare and child feeding, and their primary involvement in food preparation for the family, maintaining general cleanliness of stored foods, and marketing of food portray the potential roles women can play directly in maintaining food safety.
- b. **Agricultural production and food security:** FAO (2011) reports that significantly higher percentages of women in Nepal are employed in the agricultural sector than men. Active participation of female labor in agriculture has increased from 36 percent in 1981 to 66.5 percent in 2016 and 57.5 percent in 2018 (CBS, 2014, 2016, 2019)—a higher involvement of females in agriculture than male counterparts. Furthermore, due to the migration of men to urban areas, women are taking on greater responsibilities and tasks in rural areas (FAO, 2010). Rajkarnikar (2020) reported a remarkable foreign labor migration of men from Nepal which has changed the decision-making roles of females. Remarkable male-dominated labor

emigration in Nepal has contributed to increased land abandonment and a decrease in farming (Chaudhary et al., 2020). Additionally, the workload for farms and households has increased for females as farm and household responsibilities are transferred to female members (Pandey, 2021). This phenomenon, also referred to as the “feminization of agriculture” possesses challenges but also creates new opportunities for women in rural areas to lead and contribute. This increased involvement of females as agricultural labour, entrepreneur, or decision-maker in different stages of production and distribution highlights the role that women can play in maintaining safer food systems and contributing to the broader food security goals. However, scholars indicate that the proper documentation of women’s major functional roles and contributions to food production and food and nutritional security are underreported (Singh & Ram, 2014).

- c. Nutrition of family members: Women’s contribution is not only important for the total food supply to the household but also for dietary variation. Discussion and review suggest that women’s participation and increased involvement in food chain activities: i) enhances food availability and the type of food entering food chains, ii) enhances family’s nutrition as women are likely to give higher priority to the nutritional needs of their families than men, and iii) when women have higher access to the food and related cash, these resources are likely to be used for food consumption in the household and in enhancing nutrition for small children (ACC/SCN, 1989).

3.2 Food Safety Awareness on Fresh Produce Consumption: Gender-based Findings from a Primary Survey

In this section, we present and discuss our empirical findings on gender-related questions from the primary survey of 604 consumer households representing five major metropolitan areas of Nepal. Considering the food safety sensitivity and the focused agricultural commodities of the funding agency in Nepal, we specifically chose fresh produce consumption and purchase in this study. Fresh produce typically includes fresh vegetables and fruits. Fresh produce is sensitive to food safety as they are prone to both microbiological and chemical contamination.

Table 1: Descriptive demographic information of the respondent

Respondent characteristics	Frequency (number)	% sampled household
Gender: Male	285	47.19
Gender: Female	312	51.66
Gender: Other	2	0.33

Respondent characteristics	Frequency (number)	% sampled household
Respondent is the household head: yes	374	61.92
Respondent is the household head: no	230	38.08
Location of the respondent's household		
Kathmandu metro	122	20.36
Bharatpur metro	121	19.54
Butwal metro	121	20.03
Pokhara metro	120	19.70
Hetauda metro	120	19.87

Specifically, the salad vegetables and fruits that are typically consumed raw are more sensitive to food safety standpoint and microbiological contamination. With their higher sensitivity to quality deterioration, unsafe fresh produce can lead to higher foodborne illnesses. Food contamination is among the most common routes for transmission of *Salmonella spp.* and *Campylobacter spp.* (Jorgensen et al., 2002; Goncalves-Tenorio et al., 2018) and fresh produce is a principal source of foodborne illness outbreaks implicating toxin-producing *Escherichia coli*, *Salmonella*, *Listeria*, and human parasites (Callejon et al., 2015). Table 1 presents descriptive selected demographic information of the respondent in our sample. Among 604 complete survey responses, 52% were female respondents and 47% were male respondents representing consumer households sampled in nearly the same proportion from 5 metropolitan areas (around 120 households from each). Table 1 also shows that 62% of these respondents identified themselves as the head of the household.

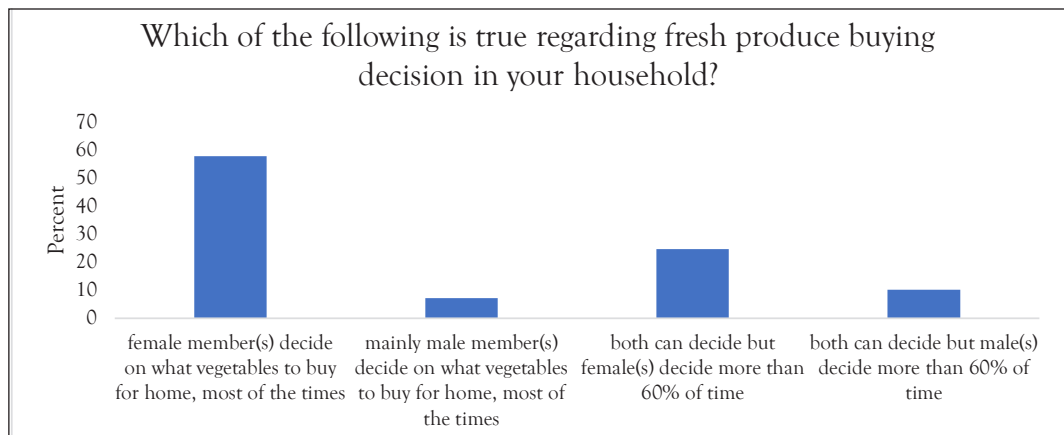


Figure 2: Fresh produce purchase and gender-based decisions among metropolitan households in Nepal, Source: primary survey, 2022

Figure 2 shows the household-level decisions on fresh produce (what and where to buy) by gender, among metropolitan households in Nepal. Our results suggest that females in the household are primarily the decision makers on fresh produce: 58% of the sampled households indicated that females in the household decide on what vegetables to buy for the household, most of the time while only 7% indicated mainly male members decide on what vegetables to buy, most of the time. It is also interesting to see the response to the other two options to affirm the mix or extent of decision-making on this. Note that 25% of the sampled households indicated “both can decide but female(s) decide more than 60% of the time” while only 10% indicated “both can decide but male(s) decide more than 60% of the time.” Together, we see that female member of the household is dominantly the decision maker in fresh produce purchase decisions in 83% of the households in metropolitan areas. A male member of the household is the primary decision maker in fresh produce purchase only in 17% of the households.



Figure 3: Gender roles in fresh produce purchase from the market, Source: primary survey, 2022

Figure 3 shows the gender roles in fresh produce purchases from the market. This question is related to the actual purchase or buy activity from the market or marketplace. It intends to capture the selection and choice, which typically involves the buyer’s consideration or judgment based on a set of attributes of a commodity and/or market. Our result (figure 3) shows that female members are involved in purchasing fresh produce from the market for the vast majority of households. Female members are involved in fresh produce buying activity in 70 percent of the sampled

households while male members are involved in the same activity in 30 percent of sampled households.

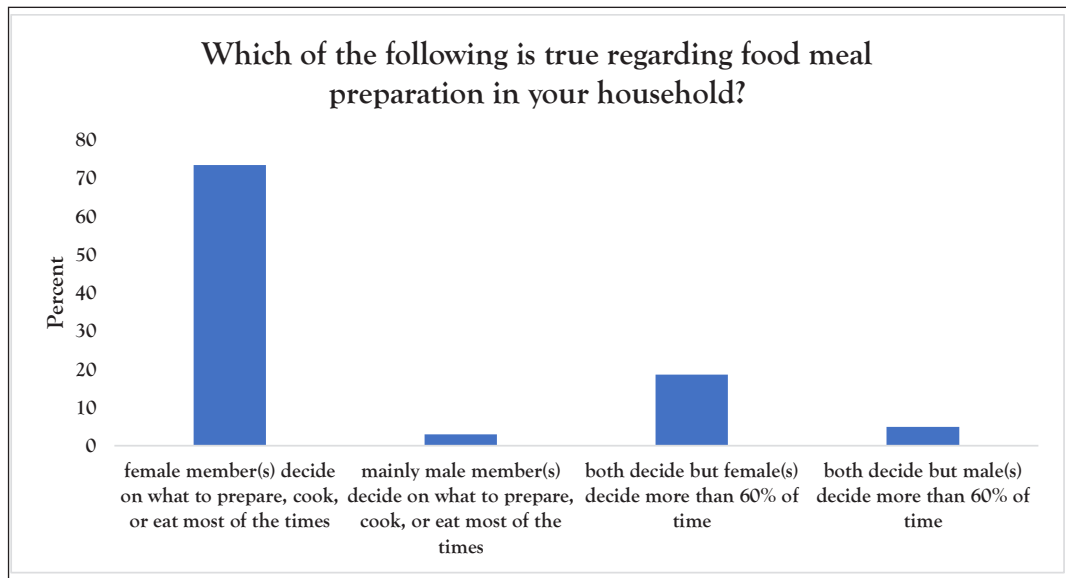


Figure 4: Food meal preparation decisions in the households and gender roles, Source: Primary Survey, 2022

Figure 4 shows the gender roles in food meal preparation, intending to capture the decision and access related to food meal preparation in the households. Our results show that a remarkably higher proportion of the sampled households, 73 percent, indicate that “female members decide on what to prepare, cook, or eat most of the time” and 19 percent indicate “both decide but female(s) decide more than 60% of the time.” This suggests that females have strong and dominant roles in decisions related to food meal choice, preparation, and cooking in households.

Clearly, the findings shown in Figures 2, 3, and 4 suggest that women are dominantly the decision maker in fresh produce purchase, shopping, and food meal preparation in households. This also indicates that the women’s choice decisions in the fresh produce market as well as their decisions in food meals, guided by awareness, could potentially drive the food safety and nutrition-related aspects in the household and communities. Next, we present our findings on awareness levels of different attributes and the differences by gender.

Table 2: Level of perceived importance on food safety and other attributes in fresh produce by male and female primary buyers, metropolitan households (HHs) in Nepal

Attributes	Primary buyer of Fresh produce in the HH	Level of perceived importance (numbers indicate frequency, expressed as proportionate (%) of the total of that gender)				
	(Male: 180 HHs Female: 424 HHs)	not important (1)	slightly important (2)	moderately important (3)	important (4)	very important (5)
Low price	Primary buyer: Male	20.99	27.07	30.94	14.36	6.63
	Primary buyer: Female	19.01	24.41	28.64	19.01	8.92
Easy shopping access	Primary buyer: Male	7.73	14.92	25.97	32.04	19.34
	Primary buyer: Female	5.40	13.62	23.24	32.16	25.59
Organic product ⁵	Primary buyer: Male	1.65	7.69	7.14	13.74	69.78
	Primary buyer: Female	1.41	9.39	10.09	19.01	60.09
Graded and sorted	Primary buyer: Male	20.44	29.28	20.44	19.89	9.94
	Primary buyer: Female	22.82	33.88	19.76	15.76	7.76
Labelled for safely produced	Primary buyer: Male	20.99	16.57	10.50	20.99	30.94
	Primary buyer: Female	32.55	15.93	10.07	15.46	26.00
Labelled pesticide residual free	Primary buyer: Male	18.78	16.02	9.94	12.71	42.54
	Primary buyer: Female	31.22	15.73	8.45	9.62	34.98

Table 2 presents the level of importance expressed by the consumer households on the main attributes of fresh produce. We present frequency results in each attribute and the importance level differentiated by male primary buyer households and female primary buyer households. Note that, consistent with Figure 3, female primary buyer households are those that indicated that a female member of the household is the primary buyer/ shopper of the fresh produce for the household. In our sample, 424 households (70 percent of sampled households) indicated that a female member is a primary buyer in their household. The level of perceived

5 We did not specifically describe word or definition of organic during the survey interviews and let consumers interpret and respond as is by this term.

importance of the attribute is expressed on a scale of 1 to 5: from ‘not important’ (1) to ‘very important’ (5). The frequency count numbers presented in Table 1 are proportionate to the total number of responses of that gender. In that, this is weighted by the number of responses on each. We used six important attributes: ‘low price’, ‘easy shopping access’, ‘organic product’, ‘graded and sorted’, ‘labelled for safely produced’, and ‘labelled pesticide residual free’ and were asked to rate each on a scale of 1 to 5.

The proportionate numbers on different importance levels on ‘low price’ are comparable across male and female primary buyers. For example, 9% of female primary buyers considered low prices a very important factor while only 6% of male primary buyers considered low prices very important. On the other hand, a higher proportion of male primary buyers (70%) consider organic produce a very important factor, as compared to the proportion of female primary buyers (60%). However, easy shopping access is a very important factor for a considerably higher proportion of female primary buyers than it is for male primary buyers—26% of female primary buyers considered it ‘very important’ while only 19% of male primary buyers considered it ‘very important.’ Findings presented in Table 2 show that in the case of directly observable attributes like graded and sorted, both male and female primary buyers are consistent in considering it as a ‘slightly important factor. Around 34% of female primary buyers and 29% of male primary buyers considered it as a ‘slightly important factor. Finally, we considered two factors with direct implications for food safety: the indication of safely produced (labelled for safely produced) and the indication of chemical toxicity free (tested and labelled pesticide residual free). We found interesting results. In both cases, higher proportions of male primary buyers put these factors as ‘very important’ than their female counterparts. 31% of male primary buyers as compared to 26% of female primary buyers consider safely produced attributes as a very important factor. On another spectrum, 31% of female primary buyers considered safely produced attributes as ‘not important’ as compared to 21% of male primary buyers. The results on the attribute pesticide residual free have a similar and even higher extent of difference between male and female buyer proportions. Around 31% of female primary buyers consider pesticide residual free as a ‘not important’ attribute in fresh produce while only 19% of male primary buyers considered it as not important. On the other hand, the proportion of female and male primary buyers considering pesticide residual free attribute ‘very important’ is 35% *versus* 43% (Table 2).

Table 3: Food safety-related considerations on fresh produce purchase by male and female primary buyers in metropolitan households (HHs) of Nepal

Signs/ indicators	Primary buyers of Fresh produce in the HH	Extent (numbers indicate frequency expressed as proportionate (%) of the total of that gender)				
	(Male: 180 Female: 424)	Never	Rarely	Sometimes	Very often	Always
Mold growth	Primary buyer: Male	0.55	0.55	0.55	2.20	96.15
	Primary buyer: Female	0.00	0.47	0.00	3.53	96.00
Sign of pesticide residues	Primary buyer: Male	12.71	26.52	14.92	19.89	25.97
	Primary buyer: Female	15.73	30.05	15.73	17.14	21.36
Bug damage, rots	Primary buyer: Male	0.00	2.22	3.33	8.33	86.11
	Primary buyer: Female	0.47	1.88	1.88	6.59	89.18
Potential for microbial contamination	Primary buyer: Male	15.38	32.97	12.09	22.53	17.03
	Primary buyer: Female	18.27	34.19	11.24	20.61	15.69

Table 3 presents the results of how often male and female primary buyers look for important food safety-related factors when buying fresh produce. We included common signs and indicators such as mould growth, a sign of pesticide residues, bug damage and rots, and indicators that are potential for microbial contamination. We asked each respondent on the extent of frequency on a 5-level scale from ‘rarely’ to ‘always.’ Our findings suggest that most of the buyers (both male and female) consistently ‘always’ look for mould growth—around 96% of male primary buyers as well as female primary buyers. Higher proportions of male buyers look for whether there are signs of pesticide residuals than female buyers. Around 30% of female buyers, and 26% of male buyers, rarely look for signs of pesticide residuals. However, the highest proportions of both male and female buyers (89% and 86%, respectively) always look for bug damage and rots—which are directly observable factors in fresh produce. Finally, our results in Table 2 show that a seemingly subtle but highly important consideration for indicators of potential microbial contamination is often neglected by both male and female buyers as nearly 33 to 34% of both male and female buyers rarely look for this consideration.

Overall, our results suggest that consumers have limited awareness about the needs and considerations of food safety in fresh produce, specifically on unobservable

potential microbial contamination risks. Additionally, females are relatively less aware of this than males and chemical/pesticide contamination risk is considered slightly more frequently in fresh produce decisions by Nepalese consumers than the microbial safety risk. The limited awareness and the associated limited regulations and monitoring can be considered probable reasons for higher food safety risks in Nepal. Outbreaks originating from the consumption of unsafe food and fresh produce have shown implications of higher degrees and magnitude for the public health risks in Nepal (Bhandari et al., 2019; Sharma, 2015; Prasain, 2020; Poudel, 2021).

4. Conclusion and Recommendation

In this paper, we present our findings derived from a comprehensive literature review and analysis of empirical data. The literature review encompasses three main aspects. First, we discuss the relationship between food safety and its inherent connection to addressing food security and promoting sustainable food systems, specifically focusing on developing countries and Nepal. Second, we examine the historical development and current perspectives on food safety and food security-related policies, highlighting the various efforts and challenges encountered in Nepal. Third, we delve into gender-related discussions, exploring the potential roles and importance of women in food systems, as well as their contributions to food safety and related aspects in Nepal. Using our empirical data based on the primary survey of consumer households and their decisions, we examined food safety awareness, gender roles, and gender differences in the choice of fresh produce attributes in consumption and purchase.

There have been efforts from Nepal's government and other stakeholders on food safety, even though food safety issues still need to be emphasized more as primary concerns in the food system. Our review findings on existing policies and mechanisms suggest that even existing policies and regulations in documents are lacking adequate implementation. These also face limitations in monitoring and feedback systems. We recommend that food system sustainability targets should be ensured with compatible food safety policy fitting it well with the current structural changes in Nepal's government system and maintaining feedback-based revisions from multiple stakeholders. Recently, the House of Representatives of Nepal endorsed the proposal to consider the bill to revise the Food Purity and Quality Act. The new Act should clarify the ambiguities of the role and responsibilities of the three tiers of government for the effective implementation of food safety regulations and should envision addressing the current gaps discussed.

Nepali food culture, food servings, food access and related activities hold women's roles as important risk managers in food consumption, preparation, and processing.

Thus investigating women's knowledge and preference related to the selection and preparation of food is critical for household-level food safety. This emphasizes the importance of gender-sensitive policies in the development of food safety interventions. Our review suggests that women play crucial roles in the food systems in Nepal. Our empirical findings support women's vital roles in fresh produce purchase, food meal preparation, and food-related decisions in households in Nepal. Further, feminization in Nepal's food production system also emphasizes women's vital role in augmenting food safety practices.

Moreover, our empirical findings also suggest that, in the current context, women are less aware than men of food safety-related issues and their importance in Nepal. Considering the roles women could play in food safety but their limited awareness, our study suggests the involvement of women in food safety and sustainable food programs. Therefore, awareness and training programs on food safety, which threaten public health, should emphasize women's participation.

Women's involvement should be emphasized and encouraged in food-related critical management, and decision-making activities, as well as in leadership and entrepreneurship. Formulation of food safety policy considering multiple stakeholders and gender sensitivity should encourage women to be effective implementers and promoters of food safety in sustainable food systems. Overall, in the interface of food safety, sustainable food systems, and women's roles, we recommend four important aspects: a) women's empowerment to emphasize the importance of food safety and roles they could play in food-related activities and decisions, b) awareness of food safety through training and outreach ensuring women participation, c) women-focused programs, enterprise development, leadership, and entrepreneurship in food systems, and d) gender-sensitive policy design, dynamic policy changes with changing government structure and multi-stakeholder feedbacks.

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Authors Contribution

Aditya R. Khanal: Khanal conceptualized and developed the idea and construct research goals, arranged resources and fundings; developed initial methodological framework and survey instruments, verified data, prepared plan and procedure for review process and method applications, prepared the first draft of the empirical analysis, and revised, edited, and finalized the manuscript in multiple levels and rounds.

Rita K. Gurung: Gurung applied the review procedure, assisted in formulation of overarching research goals of the study, undertook comprehensive literature review of main sections and initial draft write-up of the review section.

Ram Hari Timilsina: Timilsina contributed in outlining the research goals and aims, assisted in design of review methodology, assisted and supervised the data collection process and field level management in data collection, and contributed in revising the manuscript during multiple rounds.

Saroj Poudel: Poudel contributed in formulating overarching research goals, assisted in method and process designs, led the data collection process in the field, hired and supervised enumerators to collect data, and contributed in data compilation.

Conflict of Interest

The authors declared no conflict of interest.

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