RESEARCH ARTICLE

Comparative Study of Agricultural Production Diversity and Household Diet Diversity in Kailali and Syangja Districts

Pangeni Sanju[1], Jaishi Mahesh[1], Khanal Santosh[2]

[1]Department of Agriculture Extension, Institute of Agriculture and Animal Science, Lamjung Campus, Lamjung, Nepal, [2]Department of Agriculture Extension, Institute of Agriculture and Animal Science, Gauradaha Campus, Jhapa, Nepal

ABSTRACT

This study was conducted to find out agricultural production diversity and household diet diversity in farming households and examine their statistical relationship. Data on production, consumption, and socioeconomic factors were collected from the cross-sectional survey using the semi-structured questionnaire in 2018, in which 120 respondents (60 from Kailali district and 60 from Syangja district) were interviewed. Agricultural production diversity was defined from species count for each household, and household diet diversity was obtained from dietary diversity score (DDS) using 12 food groups by the FAO in preceding 24 h recall period. Data analysis in the SPSS showed that the average species count of each household was 11.79 with average crop and livestock count of 7.95 and 3.88, respectively. Average DDS was 7.7 with minimum value 4 and maximum value 10. Agricultural production diversity and household diet diversity were positively correlated (0.249, at 0.01 level). Household diet diversity was positively correlated with size of landholding and size of kitchen garden. The consumption behavior shows that 100% of household have consumed cereals, 75% have consumed milk products, 52% have consumed fruits, and only 21% of the respondents have consumed meat and egg in the last 24 h recall period. Percentage of household consuming milk and milk products were higher in Syangja, whereas households consuming meat, egg, and fish were higher in Kailali. Wheat items were major alternative staple food in Kailali, whereas maize, millet, and wheat items were common alternative staple foods in Syangja. This study suggests that diversified agricultural production system is a promising strategy to provide diversified diet and ultimately improve food and nutrition security of farming households.

Key words: Agricultural production diversity, household diet diversity, Sociodemographic

INTRODUCTION

Nepal is a South Asian agrarian country where more than 66% of the Nepalese population are directly engaged in agriculture, and agriculture sector contributes to 27% of national gross domestic production.[1] With this background, agriculture has the potential to affect food system of Nepalese people as a major source of food and income. In Nepal, majority of farming families reside in rural areas and depends on subsistence farming for food; hence, agricultural production in farm is reflected in their diet in plates.[2] Diverse nutrition is obtained through diverse food system, and in turn, diverse food system is possible from diversified production system. Studies in the past in different countries, including Nepal, have found a positive and significant relationship between agricultural

---

Address for correspondence:
Pangeni Sanju
E-mail: pangenisanju222@gmail.com

production diversity and diet diversity.[3-5] Moreover, agricultural production diversity have seen as a promising strategy.[6,7] Agricultural innovations such as introduction of improved food crop species in farm through breeding such as biofortification have the potential to improve nutrition and health of the consumer.[8]

In Nepal, national household food security is only 48.2%, whereas, in rural areas, the percentage is only about 38.8%,[9] and only 40% of farming households are fully food secure (agricultural census 2012). The prevalence of undernourishment is 8.1%, child malnutrition is another serious issue where stunting is 37.1%, wasting is 11.3%, and underweight is 30.1%.[10-12] About 17% women of reproductive age have chronic energy deficiency.[9] In such critical situation of malnutrition study of variables determining dietary diversity assist to design a holistic as well as realistic approach to address the malnutrition and food security problems.[5] Moreover, in other ways, household food consumption, diet quality, and diversity are the one among four dimensions of food security; hence, the study of intra-household food consumption is an important step toward improving food and nutrition security.[13]

METHODS AND METHODOLOGY

The study was conducted in Kailai district geographically situated at latitude 28°22'–29°05' North and longitude 80°30'–81°18' East and Syangja district situated at latitude 28°4'60 North and longitude 83°52'0 East of Nepal in 2018 through the cross-sectional survey design using the face-to-face interview technique. Convenient sampling method was followed where a total of 120 households were interviewed each 60 from Kailali and Syangja districts by the semi-structured questionnaire. Primary information was obtained from field survey while desk study of publications, National Living Standard Survey reports, District Agriculture Development Office (DADO) and other national and international organizations, books, research papers, journals, articles, etc., were the source of secondary information. Agricultural production diversity was obtained from the crop and livestock count of each household, and dietary diversity score (DDS) was used to obtain household dietary diversity.[3,14] DDS was calculated from the sum of a total number of food groups consumed by the respondent household out of 12 in the last 24 h recall period according to the FAO guidelines.[15] Then, data were coded and analyzed using the Microsoft Excel and SPSS 16.0 model, descriptive analysis, The Chi-square test was conducted for the study and analysis of dependent and independent variables.

RESULTS AND DISCUSSION

Sociodemographic characteristics of respondents [Table 1]

Size of average landholding of the household was found to be similar. However, households in Kailali had a larger size of kitchen garden than in Syangja. Household having permanent residency was higher in Syangja than in Kailali as the study area, i.e., Attariya in Kailali is in the phase of rapid urbanization encouraging migration of people from hills to lower plain areas. Education level of female

Table 1: Sociodemographic characteristics of respondents

Characteristics	Kailali	Syangja
Gender (%)		
Men	25	65
Women	75	35
Average age (years)	39	48
Family size (No.)	6	5
Residency		
Permanent (%)	83	98
Migrated (%)	17	2
Size of landholding (Ha)	0.21	0.21
Size of kitchen garden (m²)	137	102
Number of the growing season in lowland	1.52	1.2
Structure of household		
Cemented (%)	82	48
Stoned (%)	18	45
Mudded (%)	0	7
Membership in cooperatives (%)	57	57
Membership in banks (%)	90	77
Monthly income (Rs.)	25–50 thousand	25–50 thousands
Distance to nearby market (km)	1.5	2.8
Household diet diversity (No.)	7.72	7.8

Source: Field survey, 2018

in farming household is critically low, wherein 36% of household women were illiterate, and in 36% households, they were capable of general read and write. Among the interviewed households, 31% of household were solely engaged in agriculture, 19% were engaged in job and business along with agriculture, and 13% were involved in job which clearly shows the importance of agriculture in the economy of household. Households having membership in any bank or cooperative had DDS of 8, whereas which were not member of any bank and cooperative had the value of 7. This positive link of bank and cooperative membership in household diet diversity is might be due to the contribution of cooperatives to improve social as well as economic status of farmers, thereby improving their purchasing power and agricultural cooperatives also provide education about food production, processing, and food habit thus better-ensuring household diet diversity and food security.[16]

Agricultural production diversity in household level

Table 2 shows the average species count of 11.79 with crop count of 7.95 and livestock count of 3.88. Average crop count and livestock count were higher in Syangja district with the lower value of standard deviation. The result signifies that both crop and livestock contribute for agricultural production diversity; however, diversified food crop production holds larger share to overall agricultural production diversity. Household diet diversity of Syangja was slightly higher than that of Kailali, suggesting that households in Syangja eat more diversified diet than in Kailali. As crop and livestock count per household is higher in Syangja, this also indicates the positive relation between production diversity and diet diversity.

Relation between agricultural production diversity and household diet diversity

Correlation analysis shows that agricultural production diversity and household diet diversity are positively correlated; however, the correlation is weak with a value of 0.249. This result is in line with the previous empirical findings in the

developing world.[3,14] There is a stronger positive correlation of household diet diversity with crop count than with livestock count in both study areas. This suggests that emphasis in crop diversification contributes more toward diversified diet. While comparing this relation between Kailali and Syangja districts, diet diversity is more strongly correlated with production diversity in Syangja (0.320) than in Kailali (0.213). In Kailali, this might have appeared as a result of other socioeconomic factors acting as moderators in this relationship. Size of land-holding, kitchen garden, and the

Table 2: Average crop count, livestock count, and species count of households

Variables	Kailali	Syangja	Total
Crop count	6.03 (3.299)	9.87 (2.375)	7.95 (3.449)
Livestock count	3.87 (7.345)	3.9 (7.182)	3.88 (7.233)
Species count	9.93 (8.948)	13.15 (7.983)	11.79 (8.647)

Source: Field survey 2018. Numbers signify the mean value of crop count, livestock count, and species count and numbers in parenthesis signify standard deviation

Table 3: Correlation between species count and diet diversity

Agricultural production diversity	Diet diversity score		
Pearson coefficient	Kailali	Syangja	Total
Crop count	0.198	0.332**	0.217*
Livestock count	0.170	0.242	0.193*
Species count	0.213	0.320*	0.249**
Total landholding (Ha)	0.233	0.493**	0.28**
Size of kitchen garden (m²)	0.093	0.481**	0.193*
No. of growing season in lowland	0.172	0.410**	0.234*

Source: Field survey 2018. **and *denotes statistically significant at 0.01 level and 0.05 level, respectively

Table 4: Percentage of households growing different food crops in Kailali and Syangja

Food group	Kailali (%)	Syangja (%)
Cereals	100	100
Vegetables	100	100
Tubers (potato)	98	93
Fruits	47	58
Meat	27	23
Eggs	20	25
Fish	8	0
Legumes	90	88
Milk products	65	85
Fat	41	23
Sugar	88	98
Tea/Coffee	86	98

Source: Field survey 2018

number of the growing season in lowland which is a major cultivated land are positively correlated with household diet diversity which is due to their contribution in diversifying agricultural production of the household. In subsistence farms, where their participation in purchase of food items is limited, the diversity of own production is rather crucial for own consumption.[8]

Food groups eaten by households in last 24 h

Cereals, including rice, wheat, maize, and millet, are the major source of carbohydrate with 16% of protein and vegetables, including green leafy vegetables which contains a variety of vitamins and minerals were consumed by almost every respondent household in the last 24 h recall period [Tables 3,4]. Household that has consumed legumes, including lentil, peas, and grams are the good source of protein (20%) Vitamin B and iron were in higher percentage in both Kailali and Syangja. Consumption of cereals, vegetable, and legumes by the majority of household in both study areas is due to typical meal pack of Nepalese *Dal Bhat tarkari* that include rice, curry made from vegetables, and legume soup. More than 90% households in both study areas have consumed tubers mainly potato in their diet, which is rich in carbohydrate, proteins, and vitamins. Consumption of milk product by higher percentage of households in Syangja is due to the higher number of household rearing milch animals mainly buffalos in Syangja. The higher percentage

of households in Syangja have consumed fruits in the last 24 h. Fruits such as banana, guava, and citrus were commonly consumed fruits in Syangja, whereas mango and banana were common in Kailali. Such fruits are good source of vitamin and minerals as banana provides potassium and citrus provide Vitamin C to human body. Meats consist of 20% protein of high biological value, 20% fat and 60% water (www.britanica.com). However, only few households 27% in Kailali and 23% in Syangja have consumed meat in their recent diet. Fish is a good source of unsaturated fatty acids such as omega-3 fatty acids which highly beneficial for brain development. However, the study shows only 8% household in Kailali had consumed fish and not a single respondent household in Syangja had consumed fish in last 24 h. Milk is considered as complete food lacking only vitamin C zinc and iron. Milk and milk products are good source of protein, Vitamin A, B, D, calcium, and iron. Household consuming milk and milk products such as yogurt and mohi in their daily diet were higher in Syangja.

Food crops grown by households

From Figure 1, households growing rice, maize, millet, black gram, Colocasia, banana, and citrus are higher in Syangja, and households growing wheat, lentil, and mango are higher in Kailali. Cultivation of maize, millet, and Colocasia by farming families of Syangja is due to the culture of relay cropping of maize and millet in upland areas. And mix cropping
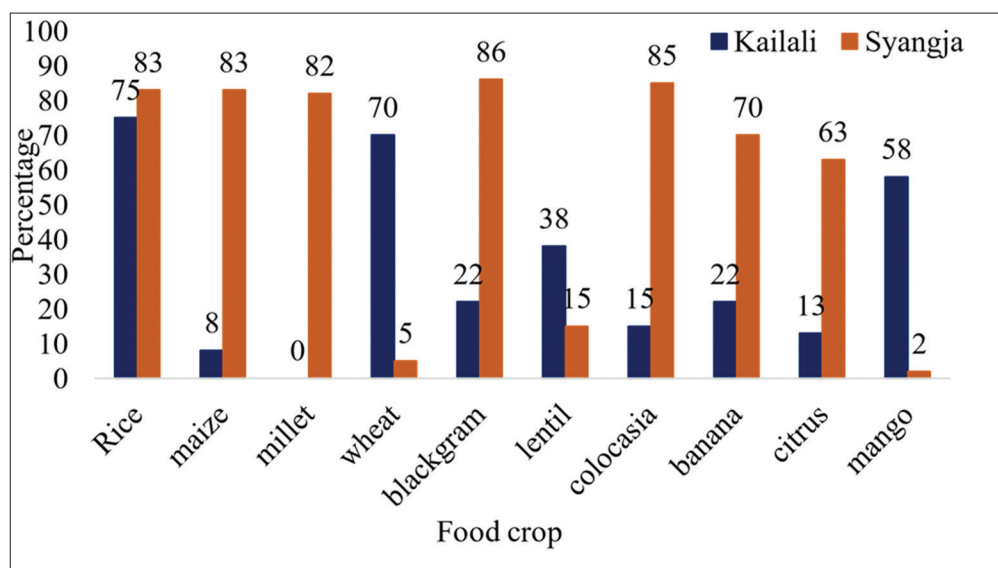

Figure 1: Percentage of households growing different food crops in Kailali and Syangja (Source: field survey 2018)

of legumes and Colocasia in maize field. The popularity of citrus and banana among households of Syangja is due to climatic suitability for such fruits similar reason fits for the popular occurrence of mango trees in home garden in Kailali.

Livestock production diversity

The number of household rearing buffalo is higher in Syangja that in Kailali this is because buffalo rearing was common among farming families and was preferred by farmers in Syangja. Data from nation report also show that the total population of buffalo is higher than cattle in Syangja district (CBS, 2011).

Alternative staple food consumed by household

Apart from rice respondents used to consume wheat bread, maize and millet products as their staple food. In Kailali, 49% of household used to eat wheat bread as a major alternative staple food [Figures 2 and 3]. In Syangja, 31.5% of household used to consume wheat bread, 4% consume maize products such as

Figure 2: Percentage of household-rearing livestock in Kailali and Syangja (Source: Field survey 2018)

Figure 3: Percentage of household consuming alternative staple food (Source: Field survey 2018)

maize pancake, maize pudding (*Aato*), and 15.5% used to consume millet products such as pancake and *Dhindo* and as alternative staple food. Households in Kailali have not consumed maize and millet products such as *Aato* and *Dhindo* as their staple food. Consumption of wheat bread as alternative staple food after rice in Kailali is due to wheat being next major staple food crop grown. Similarly because of maize-based farming system, maize and millet were grown in uplands areas in Syangja in the rainy season which were consumed as alternative staple foods.

Among the total studied household, 74% were involved in the production of both crop and livestock that signifies that diversified production system is common among smallholding farmers. Households of Brahmin and Chettri had DDS of 7, whereas Janajati and Dalit had only 6 DDS. Household having monthly income >10,000 had score of 8, whereas those having monthly income <10,000 had DDS of 7. Households having food availability for 12 months had DDS of 8, while those with food availability for <3 months had diet diversity of 7. This result is supported by findings of[17] where a study on smallholding farming household in West Kenya has found significant association of farm production score and DDS with ethnicity and wealth status. In Syangja 36% and in Kailali only 19% of household consume more than 75% of their diet from their own production. This suggests the influence of purchased food in household diet in Kailali where the study area is nearby urban city. In Syangja, study area was in remote area where households have limited access to market. Sibhatu *et al.*[14] in their study in Malawi had also suggested important role of production diversity in remote areas where farming is of subsistence type.
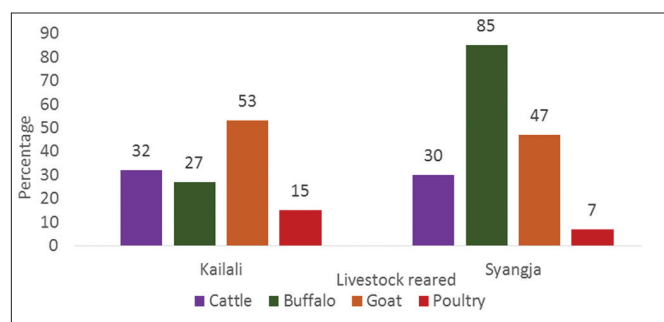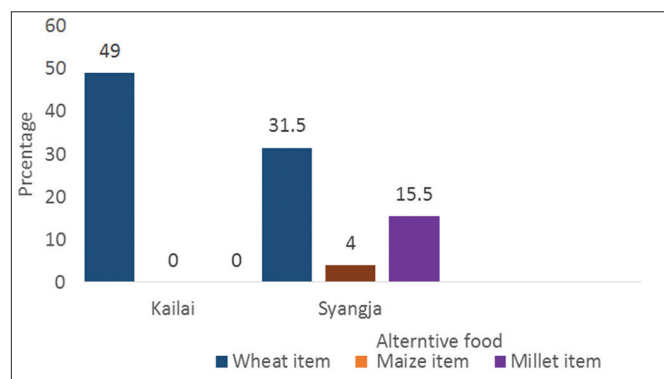
CONCLUSION

From the results obtained from the study, it can be concluded that agricultural production diversity and household diet diversity are positively correlated; hence, diversification in production system leads to diversified diet. Consumption of food-containing animal protein such as meat, egg, and fish is more common in household of Kailali, and consumption of milk products and fruits is common in households of Syangja. In Syangja, larger percentage of household

consume their diet from own farm production while some portion of diet in Kailali is occupied with purchased food. In Kailali, household expends larger percentage of their income in food than in Syangja. This work has studied food consumed and food crops and livestock produced by farming households in certain places of Kailali and Syangja districts, although further studies in this topic emphasizing on nutritional issues and food habit of farming household in various places of country can be carried out to elaborate the relationship between agriculture food and nutrition.

ACKNOWLEDGMENT

REFERENCES

1. Statista, 2019, Nepal: Distribution of Gross Domestic Product (GDP) Across Economic Sectors from 2007 to 2017; Available from: https://www.statista.com/statistics/425750/nepal-gdp-distributionacross-economic-sectors. [Last accessed on 2016 Dec 02].
2. Shinichiro S, Keiko K, Yoshiko I, Mihoko Y, Kumiko Y, Sakiko K. Number of food items as an indicator of nutrient intake. Ecol Food Nutr 1994;32:197-206.
3. Jones AD, Shrinvas A, Bezner-Kerr R. Farm production diversity is associated with greater household dietary diversity in Malawi: Findings from nationally representative data. Food Policy 2014;46:1-12.
4. Mulmi P, Masters WA, Ghosh S, Namirembe G, Rajbhandary R, Manohar S. Household food production is positively associated with dietary diversity and intake of nutrient-dense foods for older preschool children in poorer families: Results from a nationally-representative survey in Nepal. PLoS One 2017;12:e186765.
5. Venkatesh P, Sangeetha V, Singh P. Relationship between food production and consumption diversity in India. Agric Econ Res Rev 2016;29:139-48.
6. Fanzo J, Hunter D, Borelli T, Mattei F, editors. Diversifying Food and Diets: Using Agricultural Diversity to Improve Nutrition and Health. London: Routledge; 2013.
7. Powell B, Thilsted SH, Ickowith A, Termote C, Sunderland T, Herforth A. Improving diets with wild and cultivated biodiversity from across the landscape. Food Secur 2015;7:535-54.
8. Hoddinott J. Agriculture, Health, and Nutrition: Toward Conceptualizing the Linkages. Washington DC: International Food Policy Research Institute; 2012.
9. National Demographic and Household Survey, Nepal; 2016. Available from: https://www.dhsprogram.com/pubs/pdf/fr336/fr336.pdf. [Last accessed 2015 Jan 20].
10. Food and Agriculture Organization. The State of Food Insecurity in the World 2015. Rome: Food and Agriculture Organization of the United Nations; 2015.
11. International Fund for Agricultural Development. The State of Food Insecurity in the World 2015. Rome: International Fund for Agricultural Development; 2015.
12. World Food Program. The State of Food Insecurity in the World 2015. Rome: World Food Program; 2015.
13. Food and Agriculture Organization. An Introduction to the Basic Concepts of Food Security. Rome: Food and Agriculture Organization; 2008. Available from: http://www.foodsec.org/docs/concepts_guide.pdf. [Last accessed on 2018 Mar 03].
14. Sibhatu KT, Krishna VV, Qaim M. Production diversity and dietary diversity in smallholder farm households. Proc Natl Acad Sci U S A 2015;112:10657-62.
15. Food and Agriculture Organization. Guidelines for Measuring Household and Individual Dietary Diversity. Rome: Food and Agriculture Organization of the United Nations; 2011.
16. Khatiwoda YR. Cooperatives, Economic Democracy and Human Security: Perspectives from Nepal: 1st National Cooperative Congress, March 27, 2014, Kathmandu, Nepal.
17. Ng'endo M, Bhagwat S, Keding GB. Influence of seasonal on-farm diversity on dietary diversity: A Case study of smallholder farming households in Western Kenya. Ecol Food Nutr 2016;55:403-27.