CHAPTER V

FOOD INSECURITY AND FACTOR AFFECTING FOOD INSECURITY

In the study area depending on based on the ethnicity and resource endowments, households were engaged in different types of agricultural activities. Therefore, different sources were identified from which households were getting food items. The identification of those sources is particularly important for the policy makers in order to reduce the incidence of food insecurity in the future.

5.1 Food sources

According to the farmers' opinion, 49 percent households have sufficient food from their own production. But, 39 percent of households depended on their own production as well as from the market. Six percent of the households were totally dependent on the market for their food and another six percent of households were found depending on their own production and from relatives. Basically, during the discussion, respondents' answer was based on cereals rather than considering the whole food items. But, while looking at the caste level, 89 percent of total respondent from *Brahmin*s were getting sufficient food by their own production and 11 percent were found depending on the own production and from the market. In case of *Chhetri*, 50 percent of the surveyed households were fulfilling their food demand by their own production and another 50 percent households were getting food from their own production and from the market. Additionally, in case of *Sudra*, 30 percent of households were fulfilling the demand of food from own production and 52 percent of households were dependent on their own production and market, but whereas 18 percent of households' food was totally from the market. So these households were affected by the market forces such as price, supply etc. In case of *Tharu*, 41 percent of surveyed households under this category were fulfilling their food demand by their own production and another 41 percent of households were depend on own

production and market and 18 percent of households were getting food from the own production and from relatives (Table 5.1).

Table 5.1 Different sources of food (cereals) under different caste/ethnic group.

Caste/ethnic group	Food sources				Total
	Own production	Own production and market	Totally from market	Own production and relatives	
Brahmin	17 (89.5)	2 (10.5)	-	-	19 (100)
Chhetri	8 (50.0)	8 (50.0)	-	-	16 (100)
Sudra	8 (29.6)	14 (51.9)	5 (18.5)	-	27 (100)
Tharu	11 (40.7)	11(40.7)	-	5 (18.6)	27 (100)
Total	44 (49.4)	35 (39.2)	5 (5.7)	5 (5.7)	89 (100)

Note: Figure in parenthesis indicates the percentage of the each caste category.

Source; Survey, 2004

But, while generalizing all food items, the respondents were asked whether they were fulfilling their household demand by their own production or not. On an average, 42 percent of households under *Brahmin* were still relying in the food market and 58 percent of surveyed households were found more or less sufficient from their own production. The percentages of relying on market were found higher in case of *Chhetri* than *Brahmin*. But, in case of *Sudra*s 81 percent of the total household under this category answered that they were buying food items from the market. Similarly, in case of *Tharu* also about 78 percent of the total surveyed household were found to buy food from the market and only about 22 percent were having own production and did not buy food items from the market (Figure 5.1).

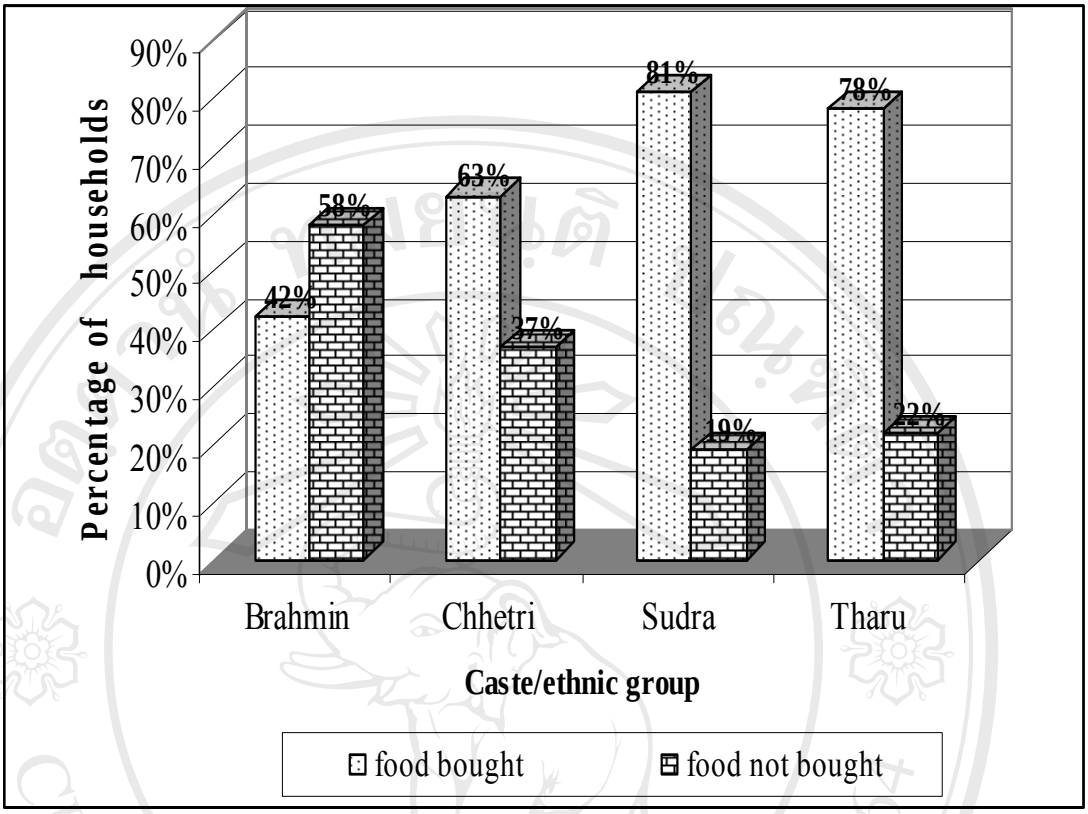


Figure 5.1 Number of households that bought foods from the market by caste/ethnic group.

Source: Survey, 2004

While looking at the composition of calories under the different caste/ethnic group, cereal that is produced in their own farm land has contributed significantly on total diet. The percentage of calories supplied through cereal 80 percent in case of *Brahmin*, 71 percent, in case of *Chhetri* and 69 percent in case of *Tharu*. However, in case of *Sudra* it is about 52 percent (Table 5.2). In general, calorie supplied from livestock source was found very low. In case of *Brahmin* 13 percent of the total calories was supplied from the livestock products. But, in case of *Chhetri* it was only nine percent and for *Sudra* and *Tharu* three and two percent respectively. But conversely, the total calories contribution from the wild source was found higher in case of *Tharu* and *Sudra* than that of *Brahmin* and *Chhetri* (Table 5.2). Obviously, once calories were not supplied from other sources households have to purchase it. In total calorie composition, calories from the food items that were purchased from the

market has contributed the highest percentage in case of *Sudra* then followed by *Tharu* and then *Chherti* and then *Brahmin* (Table 5.2). Since, the *Sudra*s do not have sufficient land to produce the food to meet the demand of their households, therefore left over calories were bought from the market from their off-farm income which is contributing significantly in their total income.

Table 5.2 Average percentage of calories contribution from different sources of food.

Caste/ethnic group	Food bought	Wild	Own production		Others*
			Livestock	Cereal	
Brahmin	4.7	0.1	13.4	80.2	1.6
Chhetri	19.4	0.3	9.0	70.9	0.4
Sudra	43.4	0.5	3.4	52.3	0.4
Tharu	28.7	0.4	1.6	69.0	0.3

Note: * From own production of vegetable, fruit and from the gift.

Source: Survey, 2004

5.2 Food availability and food security

Besides, an earlier analysis showed that *Brahmin* and *Chhetri* were found to have relatively more access to the resources. Therefore, obviously it is likely to be that *Brahmin*, and to lesser degree *Chhetri*, households are less food insecure than that of *Tharu* and *Sudra*. This can be further substantiated by using the threshold level of 2,250 (as defined by NPC, 1983 cited by Shakya and Singh) calories per adult equivalent per day; only the *Brahmin* and *Chhetri* have crossed that threshold level; whereas *Tharu* and *Sudra* could not do so.

While looking at the heterogeneity of the average distribution of the calories per adult equivalent; *Brahmin* has the highest average (2626.6 calories) than all other groups. But standard deviation was also higher in the case of *Brahmin*. For *Chhetri* the mean value was found 2,251 calories per adult equivalent. In case of *Sudra* and *Tharu* the mean value was found 1,537 and 2,204 calories per adult equivalent respectively (Table 5.3).

Table 5.3 Average calories per adult equivalent per day under different caste/ ethnic group.

caste/ ethnic group	Mean	N	Std. Deviation	Minimum	Maximum
Brahmin	2626.6	19	1848.1	1211	6925
Chhetri	2251.4	16	653.6	1446	3923
Sudra	1537.2	27	466.7	1086	2479
Tharu	2204.3	27	1234.0	1052	6333
Total	2100.5	89	1204.3	1052	6925

Source: Survey, 2004

Statistically, by comparing mean of *Brahmin* and *Chhetri* there was no significant difference but while comparing mean of average calories per adult equivalent between and *Brahmin* and *Sudra* it was highly significant at 1% level of significance. Additionally, there was no significant difference between the means of *Brahmin* and *Tharu*. Similarly, there was highly significant difference (less than 1%) between the mean of calories per adult equivalent of *Chhetri* with *Sudra* and there was no statistical significant difference between the mean calories of *Chhetri* and *Tharu*. Similarly, while comparing the mean of calories between *Sudra* and *Tharu;* it was found that there was a significant difference (less than 1%) between the mean calories per adult per day.

Alternatively, when food situation was analyzed by the number of months of food insufficiency based on the responses of interviews; outcome was also somewhat consistent with the result calculated using calories. During the interviews, food insufficiency was defined as the inability to have access locally set standard-meal (meal comprises rice, pulse and vegetable or meat in place of pulse or bread in place of rice) for daily consumption. This criterion was used to categorize the household's of food insufficiency status. If this set food was deficient then the household was considered to be food insufficient. This set of meal was based on the consumption habit of sampled area. By setting this criterion, the average month of insufficiency for

Brahmin and *Chhetri* was found to be 0.6 month and 1.9 month respectively. Similarly, months of food insufficiency for *Sudra* and *Tharu* was found 6.7 and 4.7 months respectively (Figure 5.2).

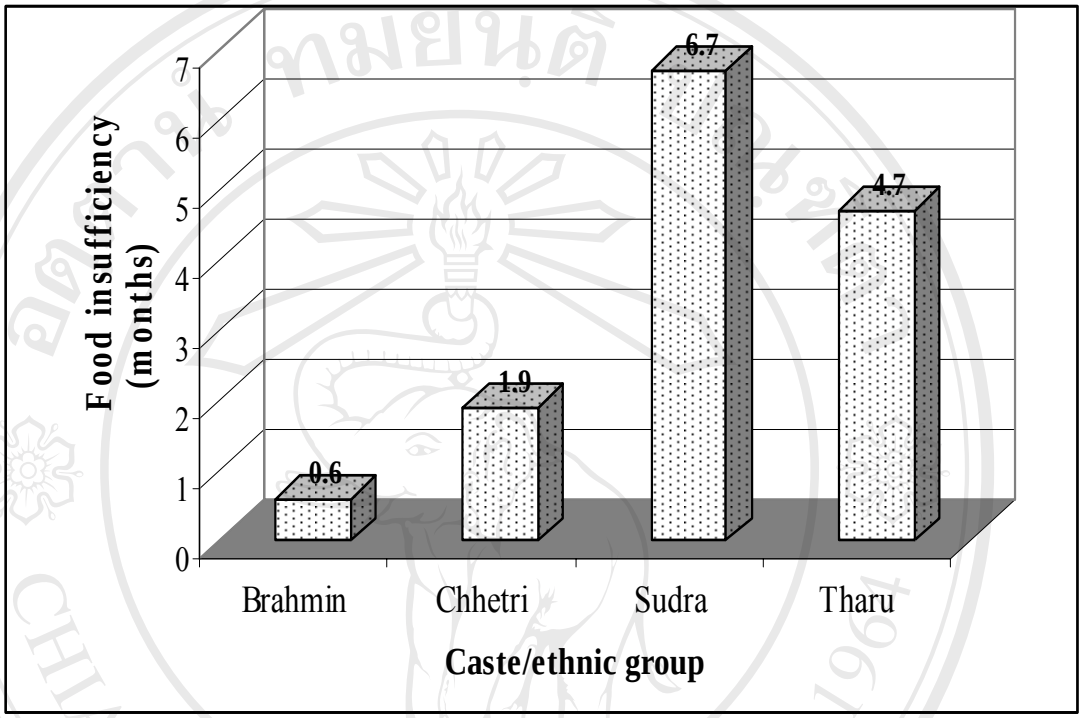


Figure 5.2 Average months of food insufficiency among the different caste/ethnic group.

Source: Survey, 2004

Out of 19 households of *Brahmin*, 89 percent households have sufficient food for whole year and only 11 percent households have food insufficient for 6 months. Similarly, out of 16 *Chhetri* households 56 percent households have sufficient food for whole year, whereas 31 percent food insufficiency for three months and 13 percent households have food insufficient for six or more than six months. But, for *Sudra* only seven percent households have sufficient food for whole year; whereas 15 percent households do not have sufficient food for 3 months, 52 percent of households do not have insufficient food for six to nine months and 26 percent of households do not have sufficient food for 11 months. For *Tharu* 30 percent of households have sufficient food for whole year whereas 22 percent do not have sufficient food for three months (Table 5.4).

Table 5.4 Situation of food insufficiency in different caste/ethnic groups.

Caste/ethnic group	Food insufficiency (months)						Total
	<3	3	6	9	11	12	
Brahmin	17(89.4)	-	2 (10.6)	-	-	-	19 (100)
Chhetri	9 (56.2)	5 (31.2)	1 (6.3)	1 (6.3)	-	-	16 (100)
Sudra	2 (7.4)	4 (14.8)	11 (40.8)	3 (11.1)	7(25.9)	-	27 (100)
Tharu	8 (29.7)	6 (22.2)	4 (14.8)	7 (25.9)	1 (3.7)	1 (3.7)	27 (100)
Total	36 (40.4)	15 (16.9)	18 (20.2)	11 (12.4)	8 (9.0)	1 (1.1)	89 (100)

Note: Figure in the parenthesis indicates the percentage of the caste category.

Source: Survey, 2004

From the survey on an average, *Brahmin* and *Chhetri* were having more than 10 months sufficient in paddy and wheat. But, households under *Tharu* has just more than seven and a half month sufficient in paddy and wheat whereas *Sudra* has less than five months self sufficient in paddy and wheat. Maize was usually consumed as roasted and stalks were used to feed the cattle. In oil seed crop, mostly rape seed was grown for the cooking oil for home consumption. On an average, *Chhetri*s were able to fulfill the demand of oil for about 2.3 months whereas *Sudra*s and *Tharu* could fulfill their cooking oil demand for around one and half months by their own production. But, for *Brahmin*s the average sufficiency was just about 0.79 month. Leafy vegetables were grown less in the sampled area. The sufficiency of leafy vegetable was found higher in case of *Brahmin*, but it was merely about for 1.16 month whereas for *Chhetri* it was about 1.06 months. But for *Tharu* and *Sudra* the average sufficiency of leafy vegetable was about 14 and 7 days by their own production. Potato was extensively used as vegetables, therefore the average months of sufficiency was about just more than four months. But while looking at the individual caste/ ethnic group; *Chhetri*s were producing enough to meet the demand for approximately six months whereas *Tharu*s were producing potato for about nearly about 5 months. But, *Brahmin*s have sufficient potato for nearly about 4 months whereas *Sudra*s have nearly about 3 months from their own production (Table 5.5).

Table 5.5 Average months of food sufficiency of some food items by own production.

Caste/ethnic group		Paddy	Wheat	Maize	Pulse	Oilseed	Leafy vegetable	Potato
Brahmin	Mean	11.37	11.37	0.32	1.63	0.79	1.16	3.89
	S.D.	1.89	1.89	0.74	3.38	1.96	0.50	1.88
Chhetri	Mean	10.13	10.25	0.88	2.63	2.31	1.06	5.75
	S.D.	2.419	2.91	3.00	4.88	4.37	0.25	3.95
Sudra	Mean	4.81	4.63	0.15	0.44	1.59	0.22	2.78
	S.D.	3.48	3.09	0.53	2.30	2.85	0.57	3.21
Tharu	Mean	7.59	6.52	0.15	1.78	1.48	0.48	4.93
	S.D.	3.92	5.01	0.53	3.86	3.50	2.31	3.30
Total	Mean	7.92	7.57	0.31	1.48	1.50	0.26	4.17
	S.D.	4.10	4.50	1.37	3.58	3.19	1.32	3.30

Note: S. D. = Standard Deviation

Source: Survey, 2004

Similarly, while looking at vegetable self sufficiency (other than potato and leafy vegetable), *Brahmin* has 3.89 months sufficient while *Chhetris* have sufficient for 2.69 months. For *Sudra* and *Tharu*, it was self sufficient for about 0.78 month and 3.15 months respectively. Mango and banana were the major fruit crops in the study area. *Brahmin* households have enough mango production from their own orchard for about 1.52 month for consumption; whereas *Tharu* have sufficient for about near for about one month and rest of other groups have sufficient for less than one month. Surprisingly, in case of banana, *Sudra* and *Chhetri* have sufficient production for slightly more than four and a half month. *Brahmin* and *Tharu* have sufficiency for nearly for about two months. Besides, these two fruits, *Brahmin* has 1.68 months sufficiency on other fruits such guava, jackfruits, lime. Rests of the other groups have less than one month sufficiency. While looking at the livestock products such milk, egg and meat, household under *Brahmin*s were found producing more milk than other caste/ethnic group. *Chhetri*s were better in meat production to meet the demand of their household. *Tharu*s have better sufficiency in case of egg than that of other caste/ethnic groups (Table 5.6).

Table 5.6 Average months of food sufficiency of some food items by own production.

Caste/ethnic group		Vegetable *	Mango	Banana	Other fruits	Milk	Egg	Meat
Brahmin	Mean	3.89	1.52	1.79	1.68	10.58	0.11	0.26
	S.D.	1.48	0.47	2.39	1.33	3.00	0.31	0.45
Chhetri	Mean	2.69	0.81	4.69	0.75	8.25	0.94	3.56
	S.D.	2.41	1.16	5.87	1.29	5.31	2.97	5.24
Sudra	Mean	0.78	0.48	4.70	0.15	1.74	0.22	2.78
	S.D.	1.31	0.93	4.92	0.53	3.55	0.80	3.87
Tharu	Mean	3.15	1.04	1.96	0.89	1.00	1.44	1.48
	S.D.	2.29	1.22	3.84	1.18	3.22	3.29	3.30
Total	Mean	2.49	1.10	3.21	0.81	4.52	0.69	1.97
	S.D.	2.22	1.19	4.52	1.19	5.47	2.28	3.69

Note: S. D. = Standard Deviation

* Other vegetables excluded leafy vegetables

Source: Survey, 2004

By using the threshold limit 2,250 kilocalories as defined by the National Planning Commission (1983), 27 households were found as food secure households out of 89 households based on the calories calculation. While doing so, seven households of *Brahmin* were found food sufficient, which makes about 37 percent of the total households in this category; whereas 44 percent of households under *Chhetri* castes were food sufficient out of 16 households. Similarly, in *Sudra* only 15 percent of total sampled households under this category were food sufficient, whereas in the case of *Tharu* it was 33 percent (Table 5.7).

Table 5.7 Number of food secure households under each caste/ethnic group.

Caste/ethnic group	Number of food secure HHs*	Percentage to total HHs under each caste/ethnic group	Number of food insecure HHs*	Percentage to total HHs under each caste/ethnic group
Brahmin	7	36.8	12	63.2
Chhetri	7	43.8	9	56.2
Sudra	4	14.8	23	85.2
Tharu	9	33.3	18	66.7
Total	27	30.3	62	69.7

Note: * Households were compared with the threshold limit of 2,250 kilocalories per caput.

Source: Survey, 2004

The percentage of food secure households under the *Tharu* ethnic group was higher than that of what was expected. So, this warrants further investigation. For that food secure households was further analyzed against the land ownership because earlier analysis has shown that under the *Tharu* category most households were under mixed ownership. It was found that out of nine food secure households under *Tharu* category seven households were under mixed ownership (i.e own farm and under sharecropping). For the time being these households were found food secure but any time in the future they could be evicted from the land and would fall into the food insecure condition. Similarly, in case of *Chhetri* also out of seven food secured households three households were under mixed ownership. But, in case of *Brahmin* only two households out of seven food secure households, were under mixed ownership (Table 5.8).

Table 5.8 Food secure households and their land ownership.

Calorie range	Caste/ethnic	Types of land ownership		Don't do agriculture	Total
		Fully ownership	Mixed Ownership*		
2250 - <2500	Brahmin	1			1
	Chhetri	1			1
	Sudra	3		1	4
	Tharu		1		1
Sub total		5	1	1	7
2500-3000	Brahmin	1	1		2
	Chhetri	1	3		4
	Tharu		2		2
Sub total		2	6		8
>3000	Brahmin	3	1		4
	Chhetri	2			2
	Tharu	2	4		6
Sub total		7	5		12
Total		14	12	1	27

Note: * Under mixed ownership households have own land as well as produce crop under sharecropping.

Source: Survey, 2004

But while taking threshold limit of 2,140 kilocalories average calories, which is set for *Tarai* by the National Planning commission (1983, cited by Shakya and Singh, 2000), the number of food secure households under *Tharu* and *Sudra* remained the same as it was before while taking the threshold of 2,250 calories, which is the national average (UNDP, 2001). But, in case of *Brahmin* one household whereas in case of *Chhetri* two households were successful to cross that threshold limit (Table 5.9).

Table 5.9 Number of food secure households under each caste/ethnic group.

Caste/ethnic group	Number of food secure households*	Percentage of total HHs under each caste/ethnic group	Number of food insecure households*	Percentage of total HHs under each caste/ethnic group
Brahmin	8	42.1	11	57.9
Chhetri	9	56.3	7	43.7
Sudra	4	14.8	23	85.2
Tharu	9	33.3	18	66.7
Total	30		59	

Note: * Households were compared with the threshold limit of 2,140 kilocalories per caput, which is calculated for *Tarai*.

Source: Survey, 2004

5.3 Seasonality of food insecurity

Since, majority of people in Kailali district were found engaged in agriculture and very few people were in off-farm jobs. So, the season of harvesting and planting determine the expenditure and income pattern of the households. Consequently, the degree of food insufficiency varies according to the months in a year. In the sample area, it was found that expenditure was higher from around May to August because of admission cost of children in schools; children suffer from diseases like diarrhea, and skin diseases and livestock also suffers from diseases such as foot and mouth disease (FMD) and parasites. Besides, it is the time for planting of rice and harvesting time of wheat. Again the expenditure goes higher on September to December because of festivals *Dashain and Tihar* and it is planting time period for rape seed and wheat. There was less expenditure for *Tharu* because they do not usually celebrate festivals *Dashain* and *Tihar* but other costs will remain the same in all castes. For *Tharu*, on January/ February expenditure goes higher due to celebration *Maghi* festival (Table 5.10).

Table 5.10 Trends of expenditure, income, labor shortage, food shortage and diseases on plant and human being in the study area.

Activities	Apr/May	May/Jun	Jun/July	July/Aug	Aug/Sep	Sept/Oct	Oct/Nov	Nov/Dec	Dec/Jan	Jan/Feb	Feb/Mar	Mar/Apr
Events	School admission of children, Cucurbits planting (early)	Diseases (human) Paddy nursery, Maize planting (upland) Cucurbits	Paddy planting, Maize planting (upland) Cucurbits, Calving animal	Diseases Diarrhea in children, Paddy Planting, Calving animal	Paddy weeding, Nursery of winter vegetable	Dashain celebra-tion, Winter Vegeta-bles' nursery and transplanta tion	Tihar celebra-tion, winter vegetable harvesting (early), planting of winter crops	Paddy harvesting, wheat and planting, Vegeta-bles, Potato	Wheat planting Vegetables Off-seasons (cucurbits) nursery	Off-seasons (cucurbits), Beans, Maghi celebration (Tharu)	Okra, French bean, Asparagus bean, Potato harvesting	Harvesting of off season vegetables, Wheat harvesting
Expendi-tures	High	Medium	High	High	Medium	High	High	High	Medium	High (Tharu), medium	Medium	Medium
Income	High	Medium	Low	Low	Low	Medium	Medium	High	High	High	Medium	Medium
Labor shortage	Medium	Medium	High	High	Medium	No	High	High	Medium	High	No	Medium
Diseases (human)	Medium	Low	High	High	High	Low	Low	Low	Medium	High	No	No
Food shortage	No	Medium	High	High	High	Medium	Medium	No	No	No	No/Low	No/ low
Pest/ diseases	No/low	No/low	FMD livestock	FMD livestock	Insect in Rice	Insect in Rice	No/low	Late blight Potato& tomato	Late blight Potato& tomato	No/low	Insect veg. Wheat Rust	Insect veg. Fowl diseases

Source: Survey, 2004

In the case of income, April/ May and November to February was found to be a period of higher income due to rice and wheat and vegetable harvesting seasons. Income was found lower in the months June to September when it is the lean season for harvesting; but very few farmer harvested cucurbits at this time. But the expenditure was higher. In other months, the income was found to be at a medium level.

From May to August income remains low while expenditure and food shortage were higher. This ultimately has created the condition of temporary food insecurity for the households which barely meet their food requirement round the year (Figure 5.3). During these months food insecurity was found very conspicuous and severe in the most of the households; therefore these months were vulnerable even for the households which are above the threshold limit while calculating the calories on an annual basis.

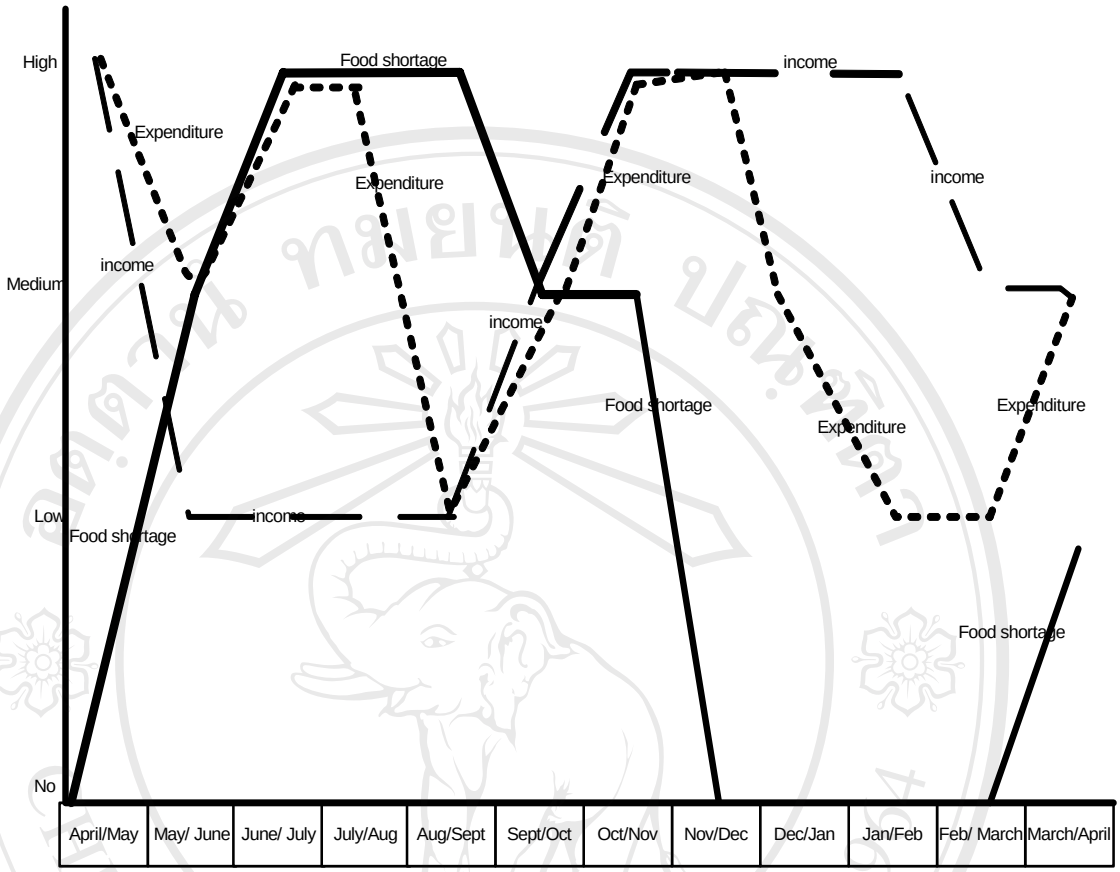
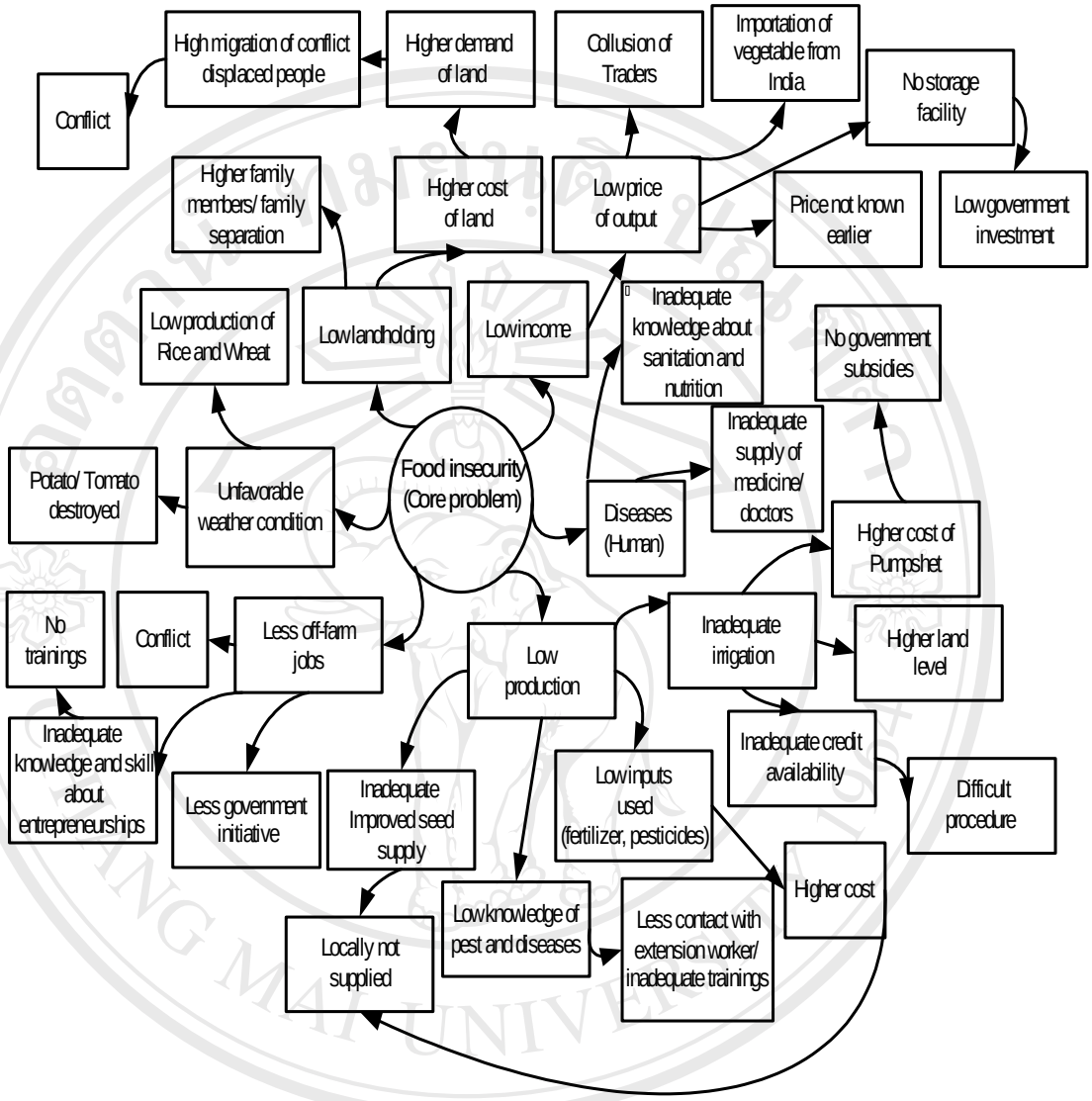


Figure 5.3 Seasonality of food insecurity.

Source: Survey, 2004

5.4 Factors affecting food insecurity

Basically, an earlier analysis has shown that the performance of agriculture determines the food secure or insecure situations of the households. The main common food items produced and consumed were rice, pulses, potato, tomato, meat (chicken, mutton, and fish), milk and milk products. But the consumption behavior was found different among the different castes and ethnic groups. Factors related with the production of these food items were the major determinants of the food insecurity status of particular households. More precisely, agriculture production, income (off-farm, non-farm and on –farm) and expenditure patterns had jointly determined the food security or insecurity status of a household in study area. But these factors were further determined by some other socio-economic factors, which might be direct or enabling factors only. All these factors are depicted on the "rich picture" (Figure 5.4).



Note: Arrow represents "caused by"

Figure 5.4 Rich picture of food insecurity of the study area.

Since, most of the factors that were affecting were analyzed earlier except conflict. So here, analysis is focused how conflict actually affects agriculture. According to respondents, following problems were created by conflict that ultimately affect to agriculture in many different ways.

I. Most of the people were displaced from their villages or farmland to the cities. Therefore, in such circumstances displaced family left their land either on sharecropping or on partially/fully fallow condition.

II. Due to the first cause land on sharecropping increased. Less production and productivity has been realized due to low investment especially on inputs under sharecropping.

III. Due to security problem, people have restricted their movements that disrupted the fishing and collection of food items such as mushroom and leafy vegetable from forest and natural water bodies.

IV. Frequency and duration of field inspections are greatly reduced due to the insecurity.

V. Frequency and amount of purchase of inputs from the market has also been reduced.

VI. Frequency of visits to the agriculture/ livestock service center also reduced due to conflict.

VII. Adult male members were found migrated to the cities or outside the country for indefinite period.

5.5 Factor affecting food availability

Food availability is the one of the necessary enabling conditions for the food security. It should not be confused with food security but should properly be seen as only a part, albeit an important part of food security. In Nepalese condition, the minimum per capita daily calorie requirement was estimated at 2,250 at the national level. So, here in the study 2,250 kilocalories was taken as the threshold level from which households were categorized as food secure or insecure as per their calories availability.

Food unavailability at household level was found the most distressing factor that contributes to food insecurity especially when there is subsistence farming

predominant and off-farm jobs are at rudimentary. Therefore, it is very important to analyze the factors affecting food availability so that in future development efforts can be concentrated on those factors in order to reduce the incidence of the food insecurity at the household level. So for that purpose, a regression model was used to identify the significant contributing factors. In order to achieve that objective, the initial regression model (see equation 3) was proposed for the analysis of contributing factors on food availability.

By running model, the signs of number of variables were found contrary to the expectation, though R-square was high because of the many variables. High R-square, opposite sign of coefficient as per theory explained and few significant t-values indicate "classic" symptom of multicollineraity (Gujarti, 2003, p.359). Later, while looking at correlation matrix, dummy for *Brahmin* was found highly correlated with most of the variables like household head's year of education, loan amount, animal equivalent and distance to forest. Similarly, other variables like stock of capital and amount of loan and amount of loan to animal equivalent were also found highly correlated to each other that cause multicollinearity.

In order to avoid multicollinerity problem, all selected variables were changes into the ratios. Ratio variables, like ratio of irrigated land to cultivated land, ratio of cultivated land to per adult equivalent, ratio of female adult equivalent to total adult equivalent and ratio of expenditure on agriculture to cultivated land were constructed. By putting these variables new model was constructed. Still even in this model some independent variables were found correlated. Highly correlated variables were dropped from the model and then following model was constructed (see equation 4).

$$K_a = \beta_0 + \beta_1 D_{sudra} + \beta_2 X_{cultland\_aev} + \beta_3 X_{femeco\_toteco} + \beta_4 X_{aev} + \beta_5 X_{parcel} + \beta_6 X_{ratirri} + \beta_7 X_{aneqv} + \beta_8 X_{agexpend} + \varepsilon_i \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where,

Dummy variable for *Sudra* (D_{sudra}): Since, dummy of caste of *Brahmin* and *Chhetri* were correlated with other explanatory variables and were removed from the model. Besides, as earlier analysis has shown that average mean of calories per adult equivalent was not significant different among *Brahmin Chhetri* and *Tharu*; but this mean value was significant different with *Sudra*. Additionally, *Sudras* were having less access to resources which are required for the agriculture production. Therefore, *Sudra* was only taken in the dummy variable and its coefficient of this was expected to be negative.

Ratio of cultivated land to adult equivalent ($X_{cultland\_aev}$): It was expected that ratio of cultivated land to the adult equivalent has positive effect on the calorie per adult equivalent; since majority of households were found depends on agriculture. This ratio was obtained from by dividing the total cultivated area of the household by its adult equivalent.

Ratio of female economically active members to total economically active members (X_{femeco_toteco}): This ratio was calculated to see the effect of the female economically active member on the calorie per equivalent. The reason behind of using this variable was that females were contributing more on agriculture the expectation of sign cannot be determined because in one hand females are contribution in agriculture while in other hand they are less educated and less trained than male.

Adult equivalent (X_{aev}): It was expected that adult equivalent (AE) has negative effect on calorie per adult equivalent. As the family size increases the calories per caput was expected to be decreases.

Number of parcel (X_{parcel}): Since land fragmentation was an issue especially in the Tarai; therefore this variable was taken to see the effect on calories per adult equivalent. Prior expectation of sign of coefficient cannot be made.

Irrigated land holding ($X_{ratirri}$): This independent variable was calculated by dividing irrigated area to the total cultivated area. It was expected that households that possess higher irrigated area has positive effect to the calorie per adult equivalent.

Animal Equivalent unit (X_{aneqv}): Animal husbandry was found one the major component in the farming system of the study area. Animal were kept in the households for meat, egg and milk. Therefore, it was expected that animal equivalent unit should possess the positive sign on its coefficient.

Expenditure on agriculture ($X_{agexpend}$): Since the majority of households were agriculture based therefore, it was expected that higher the expenditure higher would be the calories per capita.

In order to find the best fit model for the food availability, four competitive models were prepared by using natural logarithm of the same set of variables following. Among four competitive models, semi-logarithm model gives (natural logarithm value of dependent variable) the best fit to describe the factors affecting food availability (Table 5.11). That's why this basis was used to construct natural logarithm based competitive models as follows.

1) The first model was built by using the original value of both dependent and independent variables (Model I – the linear model).
2) The second model was built by taking natural logarithm on dependent variable and leaving independent variables as its original value (Model II – the log linear model).
3) Third model was built with taking natural logarithm on both dependent and independent variables (Model III- the double log model).
4) The fourth model was built by taking natural logarithm on independent variables and leaving dependent variable as its original values (Model IV – linear log model).

These models were compared with following criteria as suggested by Gujarati (2003, p. 536).

- **R-square:** Higher the R-square, the better the model. But by simply increasing independent variables can increase the R-square even if those variables are not significant.
- **Adjusted R-square**: Higher the R-square, the better the model.
- **Akaike Information Criterion** (AIC): Lower the value of AIC the better the model.
- **Schwarz Information Criterion** (SIC): Lower the value of SIC the better the model.

Table 5.11 Model selection criteria of four competitive models.

Criteria	Model I*	Model II	Model III	Model IV**
R-square	0.648 (0.508)	0.569	0.496	0.515 (0.163)
Adjusted R-square	0.613 (0.502)	0.526	0.446	0.467 (0.152)
Akaike Information Criterion	16.257	1.093	1.249	16.577
Schwarz Information Criterion	16.507	1.343	1.499	16.827

Note: Figures in the parenthesis indicates the recalculated R-square and adjusted R-square using Gujarati formula (Gujarati, 2003).

Source: Regression analysis.

To compare any two models on the basis of coefficient of determination (whether adjusted or not), the sample size n and the form of the dependent variable must be the same; but the explanatory variables may take any form (Gujarati, 2003, p. 219). But, recalculation of R-square as suggested by Gujarati, then the resulted R-square can be compared across the models (Gujarati, 2003, p. 221). The best model

would have higher R-square and adjust R-square and owning the lowest Akaike Information Criterion and Schwarz Information Criterion. Best on the above mentioned criteria model II is the best among the four competitive models (Table 5.11). Therefore it is chosen was chosen for analysis.

Among all selected independent variables, the dummy variable for *Sudra* (the 0.05 level of significance), ratio of female economically active to total economic active members (at the 0.1 level of significance), adult equivalent (at the 0.000 level of significance), expenditure on agriculture (at the 0.05 level of significance) and animal equivalent units (at the 0.1 level of significance) were found significant affecting the level of food availability at the household level (Table 5.12). By looking at the estimated coefficients of each variable, the adult equivalent household members and were negatively related to the food availability contributed the highest. On the other hand, the animal equivalent units and expenditure on agriculture has a positive effect on the level of food availability. Among these independent variables, the adult equivalent was the most influential variable on the available calories values in the household followed by expenditure on agriculture (see the contribution coefficient in Table 5.12). This implies that if there is a change on those influential variables the calories values available per adult equivalent per day would substantially change. Interestingly, if the household were *Sudra*, the calories values would be 1.30 calories per adult equivalent per day (anti-natural logarithm of 0.261 or 474 calories per adult equivalent per annual) lower than household in the other caste/ethnic groups.

Surprisingly, the ratio of total cultivated land to adult equivalent and any other land variables were not significantly associated with the food availability of the household. It is definitely because majority of farmers in the study areas owned less cultivated land as compared to the household members. This indicates that increasing agricultural production of the households in the study area is rather limited.

Table 5.12 Estimated coefficients and their statistical values of factors affecting food availability at the household level in Kailali district, Nepal using the log-linear model (Model II).

Independent Variable	Unstandardized coefficient		Standardized coefficient (beta)	Significant level (Sig. p)
	Estimated coefficient (B)	Standard error		
Constant	7.923	0.207		0.000
Dummy variable for *Sudra*	-0.261	0.108	-0.208	0.017
Ratio of cultivated land to the adult equivalent	0.015	0.010	0.186	0.112
Ratio of economically active female members to total economically active members	-0.588	0.334	-0.137	0.081
Adult equivalent	-0.121	0.025	-0.437	0.000
Number of parcel	0.055	0.044	0.146	0.209
Ratio of irrigated land to total cultivated land	0.163	0.111	0.114	0.144
Animal equivalent unit	0.030	0.018	0.170	0.087
Expenditure on agriculture	1.09E-05	0.000	0.254	0.011

Source: Regression analysis.

Household members are considered as resource endowment of a household. Increasing number of household members would increase the level of household resource endowment, which in turn increases the productive capacity, production and food availability of the household. This might not be the case if the household has limited amount of other productive resources. Obviously, as adult equivalent increases smaller would be productive resources per head and thereby decreases the calories per adult equivalent. It is not; therefore, surprised to find the negative estimated coefficient of the adult equivalent variable in the household food availability model. This implies that the larger households in the study area were confronting with limited

physical productive resources. Increasing productivity by means of training program and skill development as well as providing other job opportunities are the immediate and appropriate measures to help these people. Alternatively, family planning aims at reducing household size would significantly reduce food insecurity situation in the study area in the long run.

The increasing number of animal equivalent and expenditure on agriculture were found positively contributed to food security of the household level. This is partly because people in the study area raises animal mainly for home consumption. On the other hand, increasing agricultural expenditures would directly increase crop and animal production in the household and thus made more food availability. The low accessibility to credit and less productive capacity of *Sudra*'s and *Tharu*'s households would possibly block them in the situation of food insecurity. Moreover, the increasing input prices due to the privatizing policy of the government would raise the agricultural expenditures without the change in the agricultural production. There is also a high possibility of decreasing farm production among the poor households due to this privatizing policy. Counteract measures are needed.