CHAPTER VII

FACTORS DETERMINING FOOD AVAILABILITY

This chapter deals the household food availability for consumption, its distribution pattern and the factors determining the food availability. At the end of the chapter problems related to food insecurity and households' food strategies to mitigate the food insecurity problems are discussed. Growing body of literature referring to food concern mostly on calorie based on the assumption that other needs are usually satisfied if calorie consumption is satisfactory (Maxwell and Frankenderger, 1992). Grounded on the same underlining concept, the present study has focused on per capita calorie availability expressed in-terms of adult equivalent unit of consumption, in order to analyze households' food security. Since food availability is the necessity condition for food security, a household food availability model was designed using least square linear regression in order to identify relative significance of different socioeconomic variables on net food availability for consumption. Inasmuch as, the data generated for this study were derived from cross-sectional household survey, the model presented does not deal temporal variation in food availability.

7.1 The aggregate food supply

As the production systems in the study area are subsistence in nature, the production decisions were found objectively consumption oriented. The systems are self-reliant with a scant use of external inputs, and the total household production goes both for consumption as well as further production investment in the form of seed, labor payment and livestock feed. Other than consumption, the farm produces generate cash for household daily requirement from the sales of grain, vegetables, livestock, fruits etc. The cash is further spent to buy food (particularly rice), consumer goods, agricultural inputs, and services. Therefore, the physical flow of household food supply model (Figure 7.1) starts from own farm agricultural production: a large share (40%) of the total farm production goes for the household consumption. The remaining part of the

production goes for seeds, labor payment, animal feed, sale, exchange, social obligation etc. The cash generated from the sale of on-farm produces together with off-farm revenue and remittance constitute the household total cash revenue. In the same manner, consumption from the own on-farm production and consumption from trading (purchase, wages received in kind, and barter) aggregate the total household consumption. The overall scenario of farm food flow indicates that other than own on-farm production, the market purchase, wage received in kind, exchange etc. are also important sources of food for consumption. However, total food supply from those sources account for less than 20 per cent on an average. Furthermore, the degree of dependency on each source of food supply differs from household to household basically determined by the household's resources endowment and consumption behavior.

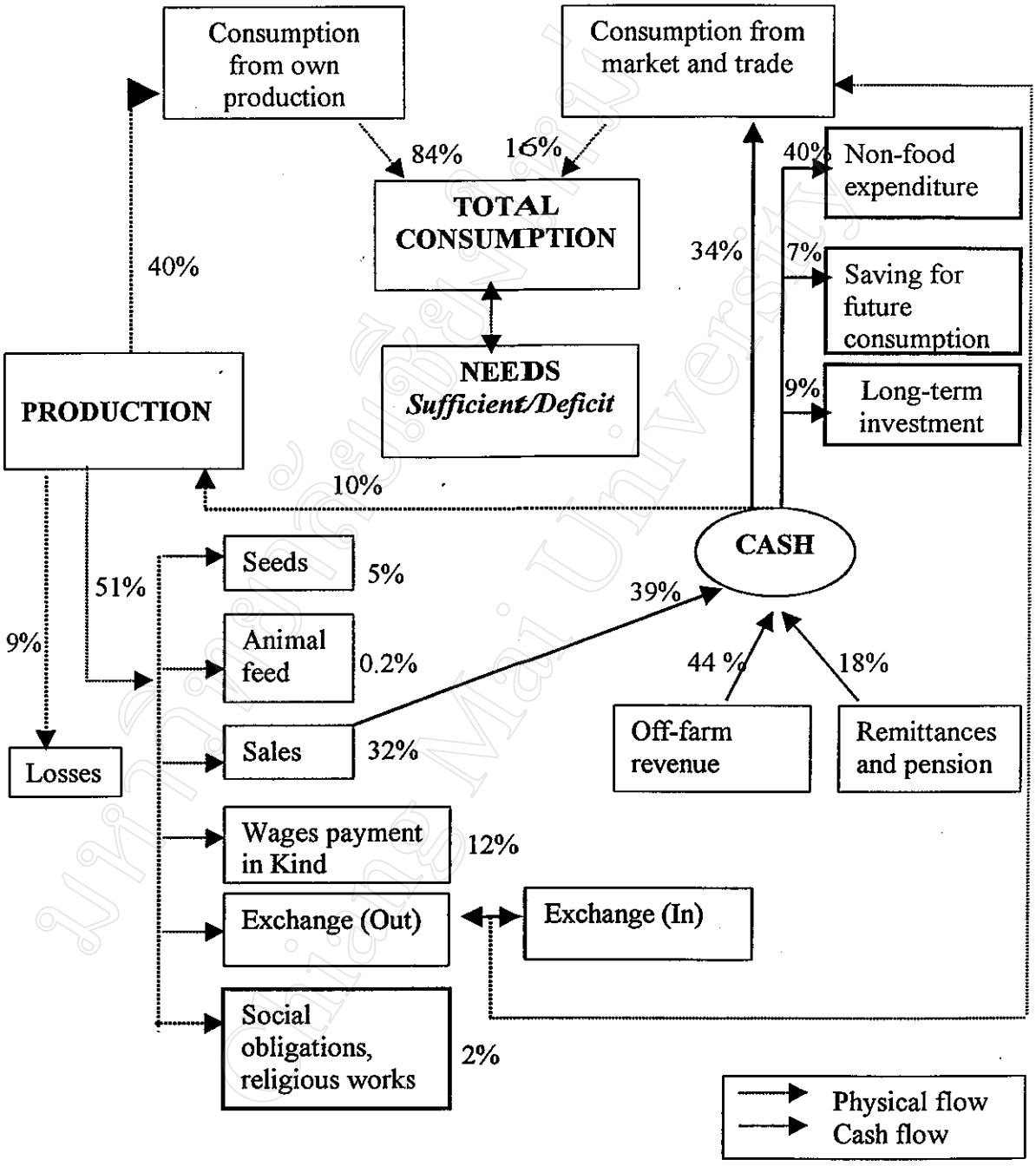

Figure 7.1 Physical and physical flow of household food supply
(Source: Survey data, 1998)

7.2 Households distribution by the level of food availability

Once the per capita food availability in terms of Kilocalorie per AE per day was calculated from the disappearance equation (described in Chapter III p 33), the distribution pattern of sample households by the level of food availability was examined by plotting them into histogram (Figure 7.2). Among 135 sample households 10 per cent were found to be getting less than 1,500 Kcal per AE per day. A majority of households (55 per cent) were able to get 1,500 to 2,500 Kcal and a negligible number of households were found obtaining more than 4,500 Kcal per AE per day. In aggregate, more than two-third of the sample households were found getting less than subsistence calorie requirement of 2,500 Kcal/AE/day.

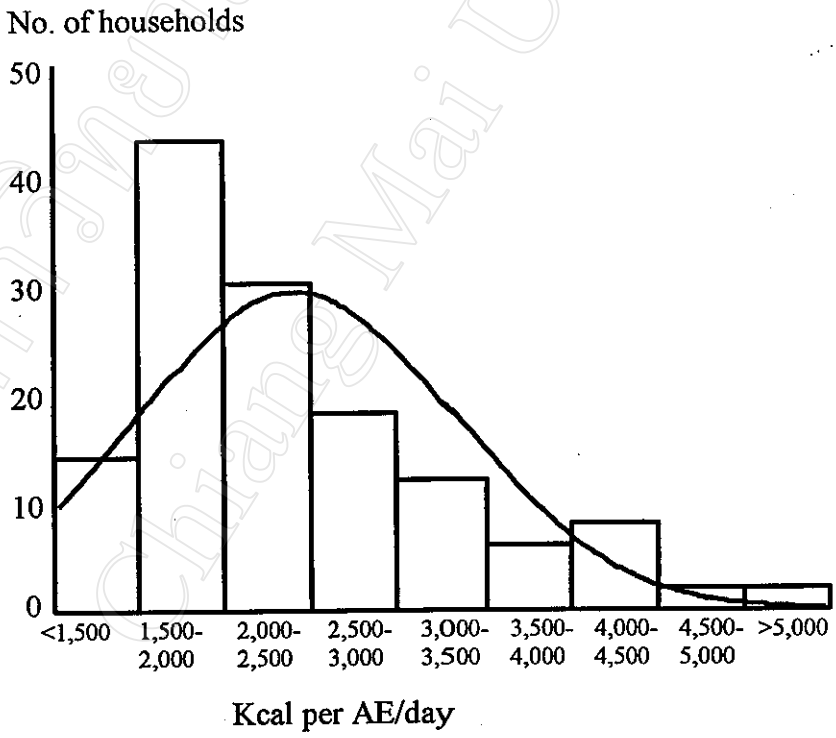

Figure 7.2 Distribution of sample households by calorie availability per AE per day (Source: Survey data, 1998)

7.3 Factors determining food availability for consumption

7.3.1 Specification of the model

This section presents an econometric model designed to analyze the relationship between the net calorie availability for consumption and some predetermined resource and demographic variables. The coefficient of each individual variable obtained from regression analysis was then used to interpret the relative contribution of each variable in the aggregate food availability expressed in terms of Kilocalories per AE per day. While designing the model, variables were defined with their expected results. The model was specified as:

$$KCAl\_AE = \alpha + \beta_1 LNDSZ\_AE + \beta_2 CASHREV\_AE + \beta_3 TADOPT + \beta_4 LSTUNIT\_AE + \beta_5 SHEAFM + \beta_6 ACTIVE + \beta_7 AGEHH + \delta_1 D_1 + \delta_2 D_2 + u \quad \text{----------} \quad (7.1)$$

Where KCAL _AE is net household food availability (Kilocalorie per AE per day calculated by disappearance equation)

α is constant term

β_1- β_7 are regression coefficient for explanatory variables

LNDSZ_AE is cultivated land size (hectare per AE).

CASHREV_AE is total cash revenue both from on-farm and off-farm (Rupees per AE)

TADOPT is technology adoption index

LSTUNIT_AE is livestock holding (livestock unit per AE)

SHEAFM is the proportion of economically active female household member to the total household size

ACTIVE is total number of economically active household member

AGEHH is age of the household head (years)

D_1 is literacy status of the household head

1 if household head can read and write

0 Otherwise

D_2 is ethnicity dummy

1 if *Bhramin/Chhetri* household

0 otherwise

δ_1 and δ_2 are coefficients for dummy variables

u is stochastic error term

7.3.2 Test for multicollinearity

Multicollinearity problem arises when some or all the explanatory variables are highly correlated reducing the precision of estimation. A simple way of checking multicollinearity is to check simple correlation coefficient among the explanatory variables (Sriboonchitta, 1983). Since there is no specific rule, correlation coefficients greater than 0.80 among the explanatory variables was used to indicate existence of severe multicollinearity, as a thumb rule (Studenmund, 1992). Furthermore, coefficient of determination (R^2) from the OLS regression was compared with correlation coefficient matrix of explanatory variables to decide whether the model has presence of severe multicollinearity. Inasmuch as none of the correlation coefficients were found more than R^2, it was considered that explanatory variables included in the model are free from the severe multicollinearity problem. With the exception of few variables most of the variables have below 0.30 simple correlation coefficients and none of the variables has correlation coefficient more than R^2 in the absolute value (Table 7.1).

Table 7.1 Correlation coefficients matrix of variables included in the model

	KCAL -AE	AGE HH	SHE AFM	LNDS Z_AE	TAD OPT	LSTUNI T_AE	ACTI VE	CASHR EV_AE	D1	D2
KCAL_AE	1.00									
AGEHH	0.24	1.00								
SHEAFM	0.15	0.18	1.00							
LNDSZ_AE	0.67	0.33	0.03	1.00						
TADOPT	0.42	0.19	0.13	0.45	1.00					
LSTUNIT_AE	0.52	0.21	0.07	0.48	0.35	1.00				
ACTIVE	-0.11	0.24	0.25	-0.00	0.12	0.02	1.00			
CASHREV_AE	0.33	0.07	0.11	0.30	0.48	0.26	-0.06	1.00		
D1	0.13	-0.29	-0.01	0.11	0.39	0.14	-0.02	0.39	1.00	
D2	-0.07	-0.03	0-.05	-0.24	-0.48	-0.32	-0.06	-0.31	-.036	1.00

(Source: Survey data, 1998)

7.3.3 Test for heteroscedasticity

Since all estimation technique assume that error term is homoscedastic within the equation. Therefore, existence of homoscedasticity has important implications for all the estimation techniques (Shriboonchitta, 1983). For the linear statistical model, where data are collected from different social stratum, there is likely to have existence of heteroscedasticity (ibid.). Under such condition the variance of disturbance term sometimes happens to be systematically related with one or some explanatory variables as value of error term is more likely to be small for smaller value of explanatory variable and vice versa (Judge *et al.*, 1982, Harvey, 1976).

Having no *a priori* evidence about the nature of heteroscedaticity, a postmortem examination of residual squared ($\hat{u}_i^2$) was done plotting them against the one explanatory variable to see if there is any systematic pattern. Although, $\hat{u}_i^2$ and u_i^2 are not the same, u_i^2 can be used as proxies for $\hat{u}_i^2$ (Gujarati, 1995). Ordinary Least Square (OLS) regression was first run and then $\hat{u}_i^2$ were plotted against land size variable (LNDSZ_AE). The results from scattered plot exhibited almost linear relationship between u_i^2 and LNDSZ_AE, suggesting the presence of heteroscedasticity in the data.

Further empirical test of heteroscedasticity was conformed by using Glesjer test. Therefore in order to correct the heteroscedasticity problem in the data and increase the efficiency of estimation Generalized Least Square (GLS) technique was employed by using LIMDEP software packages.

7.3.4 Selection of functional form

Inappropriate functional form of included variables in the model causes serious consequences leading to the misinterpretation of results. Therefore, it is of crucial importance to identify suitable functional form of the variables included in the model before designing the final model. Since food availability for consumption based on the overall household resource endowment and household demographic structure, it is assumed that food availability for consumption increases with increasing household resources. Therefore, there might have some proportionate relationship between food availability for consumption (dependent variable in the model) and resources variables (explanatory variable). In order to examine the relative change in food availability in response to unit change in the resource variables, both linear and semi-logarithmic (*log-lin* model) functional forms were examined, and the coefficient of determination (R^2) was taken as the criteria for selecting appropriate functional form of the model. As the dependent variable is transformed into natural log, R^2 of the semi-log functional form equation is not directly comparable, therefore, quasi-R^2 was calculated taking anti-log of the transformed variable ($\widehat{\ln KCAl\_AE}$) as suggested by Studenmund (1992).

$$Quasi\ \ R^2 = 1 - \frac{\sum[KCAL\_AE - anti - \log(\widehat{\ln KCAL\_AE})^2]}{\sum[KCAL\_AE - mean\ \ of\ \ KCAL\_AE]^2} \qquad (7.2)$$

$$= 1 - \frac{[4.6E+07]}{[1.1E+08]}$$

$$= 0.59$$

The quasi-R^2 obtained from the above equation (7.2) is higher than the adjusted R^2 (0.56) obtained from the linear equation implying that the semi-log equation provides a better overall fit than the linear one. Therefore, based on the overall fit of the equation, semi-log functional form was tentatively chosen. The final selection was, however, made using Box-Cox test. To use the Box-Cox test both transformed and non-transformed form of the dependent variables were deflated by their respective geometric means and then regressed with explanatory variables (Studenmund, 1992), and the functional form with lower residual sum of square (RSS) was then chosen. Since, the semi-log functional form resulted lower RSS i.e. 0.10 than that of linear functional form (RSS value of 9.22) the semi-log functional form was then finally selected. This semi-log model gives neither a constant slope nor a constant elasticity. If an explanatory variable changes by one unit, then change on dependent variable takes place by $\beta i.100$ per cent, holding other variables constant. The slope and elasticity are calculated by $\beta i.Yi$ and $\beta i.X_i$ respectively (ibid)

7.3.5 Descriptive statistics

The descriptive statistics viz. mean, standard deviation, coefficient of variation (CV), minimum and maximum value of each variables included in the model are presented in Table 7.2. The coefficient of variation, which reflects dispersion in the data set appeared to be greater than 25 per cent in all variables included in the model. Among the variables included in the model, the total cash revenue per AE found to be with higher variation.

Table 7.2 Descriptive statistics of the variables included in the model

Variables	Unit	Mean	Std. Dev.	CV %	Mini-mum	Maxi-mum
KCAl_AE	Kilocalorie	2,413.8	918.6	38	1,173.00	5,242.00
AGEHH	Years	47.77	11.82	25	20.00	77.00
SHEAFM	Ratio	0.38	0.16	42	0.10	0.83
LNDSZ_AE	Hectare	0.34	0.21	61	0.06	0.97
TADOPT	Percentage	32.64	22.29	68	4.5	87.50
LSTUNIT_AE	LSU per AE	0.86	0.44	51	0.04	2.3
ACTIVE	No./household	3.08	1.26	40	1.00	6.00
CASHREV_AE	NRs per AE	6,935.00	8,424.50	121	133.70	52,300.00

(Source: Survey, 1998)

7.4 Empirical results and discussions

From the test of heteroscedasticity as described earlier, it was understood that the assumption of homoscedastic variance in the model is no more valid. Therefore, the LIMDEP software package, which provides White's heteroscedasticity-corrected variance and standard error along with the Generalized Least Square (GLS) estimation (Green, 1985) was employed to estimate the regression coefficients. The outcomes of the regression analysis are presented in the Tables 7.3

Table 7.3. Results of Generalized Least Square (GLS) estimation

Dependent variable: ln(Kcal/AE/day)

Variables	Unstandardized coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T-ratio	Sig. level
Constant	6.956	0.110		63.017	0.000
AGEHH	0.003	0.002	0.089	1.284	0.202
SHEAFM	0.319	0.131	0.146	2.432	0.016
LNDSZ_AE	0.742	0.116	0.455	6.409	0.000
TADOPT	0.003	0.001	0.206	2.590	0.010
LSTUNIT_AE	0.209	0.55	0.259	3.791	0.000
ACTIVE	-0.045	0.018	-0.162	-2.550	0.012
CASHREV_AE	1.17E-06	0.000	0.028	0.402	0.68
D1	0.095	0.061	0.113	1.559	0.122
D2	0.188	0.048	0.266	3.887	0.000

F-statistics (9,125) = 20.11, Significance level of F-test = 0.000

Results from regression analysis presented in the above (Table 7.3) show that with the exception of number of economically active household member, the sign of variables included in the model are in consistent with the underlined expectations of the model. The key results form regression analysis suggest that access to land is by far the most important determinant of food availability in the study area. The central role of land holding in determining consumption availability of food might have largely resulted from the household economic structure, where a major share of food comes from own on-farm production. The standardized beta coefficients obtained by subtracting mean by observed value of each independent variables and dividing by its own standard deviation revealed that land holding with beta coefficient of 0.45, explains relatively higher variation in the food availability per AE per day. Tschirley and Weber (1994) in their study in rural Mozambique have also reported land holding as a principal determinant of income and food consumption. Empirically the present result suggests that keeping other variables constant, an increase in one unit (hectare per AE) of cultivated land holding increases the food consumption per AE per day by 74 per cent. In other way, one unit (hectare per AE) changed in cultivated land holding increases calorie availability (Kcal/AE/day) by 1,678

unit. Moreover, if we express the figure in more practical way using the local unit of land i.e. *ropani* (one *ropani* equivalent to 0.05 hectare), there will be 84 unit increase in calorie available for consumption per AE per day by increasing one *ropani* of cultivation land per AE.

The result empirically revealed that lack of cultivating land as the major constraint of household food security in the study area where farm production is almost entirely consumption oriented. Obviously, land fragmentation as a result of increased population size could be the major reason responsible for decreasing land availability in the study area. The key role of access to cultivating land on household food security might also be largely related to the poor infrastructure development resulting lack of alternative sources to household sustenance other than agriculture. This result, therefore, may differ under the condition of developed market accessibility with off-farm employment opportunities where dependency on land for sustenance is lower.

Livestock being a productive asset plays crucial role in determining agricultural production and productivity especially under the subsistence agricultural production systems. Importance of livestock as the major source of wealth and investment in the rural areas has been widely recognized. Livestock, therefore, has important contribution to household food security directly by providing animal food and indirectly through income generation and supporting crop production systems. Considering its overwhelming importance in agricultural production and consumption, livestock holding in term of LSU per AE was included in the model. The empirical evidence from regression analysis shows a positive and significant ($p<0.01$) effect of livestock holding on calorie availability per AE per day suggesting that with the increase of one unit livestock (LSU) per AE the food availability increases by 20 per cent, *ceteris paribus*. Moreover, the estimated beta coefficient (0.259) for this variable also revealed significant role of livestock to explain variability in the household food availability. This result corroborates with the findings of Castro *et al.* (1981) indicating livestock as a major

determinant of household food production and consumption. Food availability response to livestock holding is presented in Figure 7.3, which shows other variable remaining constant, if the present level of livestock holding is increased to the level of about 1.3 LSU per AE, the subsistence calorie requirement could be met.

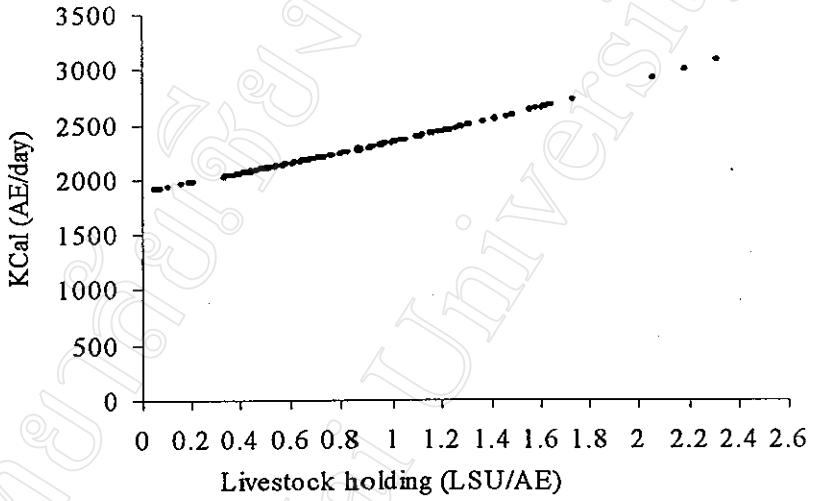

Figure 7.3 Food availability response to livestock holding

The number of economically active household member was presumably considered as one of the important household resources determining the level of on-farm food production and food acquisition from different sources and finally household food security. The number of economically active member, therefore, was included in the model to examine its effect on overall food availability, and was expected to have positive effect on household food security. Contrary to the expectation, the coefficient of economically active household member was found negatively significant (p<0.012). The result suggests that other things remaining the same, an addition of an adult member in the household reduces average energy availability for consumption (Kcal per AE per day) by 4.5 per cent. In other words, withdrawal of an economically adult member of the households adds 4.5 per cent up daily calorie availability for consumption to the rest, which suggests existence of surplus labor and increasing population pressure on limited

available resources and lack of off-farm employment opportunities. The problem has further manifested by the overwhelming percentage of unused available man-days during the winter, when there are no agricultural activities. Looking at the present population growth trend and the population structure, the above mentioned result indicates a serious threat on household food security, if population growth is not checked. Tschirley and Weber (1994) in their study have also reported declining calorie availability with the increasing adult household member in the rural Mozambique.

Women's role in household food security is considered crucial, and it is widely accepted that despite the daily household's chores, women activities are mostly revolved around the household welfare through production, processing and acquisition of food. Bajrachayra (1993) in her case study in the eastern mid hills of Nepal has also reported substantial involvement of women in agricultural production activities in spite of daily household chores. Due to complexities and time constraint, data on women's share in different economic and non-economic activities was not collected in this survey. Therefore, proportion of adult women to the total household size was used as a proxy variable and regressed against food availability in order to understand the relative contribution of women on overall household food security. The empirical result obtained from regression analysis showed a significant ($p<0.01$) and positive effect of economically active female household member on calorie availability per AE per day. This result implies that a unit increase in the proportion of economically active women member to the total household size increases the calorie availability per AE per day by 32 per cent, *ceteris paribus*. The above result suggests that despite the negative effect of number of economically active household member irrespective, there is positive role of women labor on overall household food availability (Kcal/AE/day), which could be due to higher involvement of women in household food production and acquisition. Kumar and Hotchkiss (1988) [as cited in Quisumbing (1996)] revealed that even under the resource pressure women's labor productivity in the hills of Nepal was positive in many crops. Additionally, during the course of the survey it was revealed that as compared

with their male counterparts, women agricultural labor from food insecure households in general prefer grain payment to cash payment for their wage payment which further support the above empirical results.

Even under the subsistence rural economy, it is customarily considered that access to cash as one of the most influencing factors of household food security since it determines the level of production and consumption investment. Considering the above underlying assumption, the total cash revenue per AE irrespective of sources was included in the model and was expected to have major contribution on overall food availability on consumption. Contrary to assumption, the regression results showed no statistically discernible effect of cash revenue on food availability although there is positive correlation. As the maximum share of food is acquired from own on-farm production, and larger section of cash revenue accrued among the food secure household from their own farm production, the effect of cash revenue on household food consumption availability was found to be non-significant. This result again corresponds to the results of Tschirley and Weber (1994) in rural Mozambique. However, as a means of acquiring productive resources, cash entitlement in the long run may play a crucial important role in household food security by increasing household access to productive resources like land and livestock. The weak influence of cash on food acquisition can further be interpreted as a result of lack of market for both agricultural products to sell and buy food products in the study area. Additionally, lack of off-farm employment opportunities has further impeded their purchasing capacity among the food insecure households. Lack of cash earning opportunity has, therefore, pushed the farm households towards self-reliance on their own on-farm production to ensure household food security.

Prominent variations in the choices of farm enterprises and consumption behavior were found among the different ethnic groups determined traditionally by the Hindu caste hierarchy. Therefore, ethnicity effect was presumably hypothesized to have positive influence on household food availability. An ethnicity dummy used in the model was,

therefore, found to be positively significant suggesting that *Brahmin/Chhetri* households are in better off situation in term of food acquisition than other ethnic groups in the study area. Conlin and Falk (1979), and Khare (1984) have also reported analogous results from their study in eastern hills of Nepal and northern India respectively.

It is obvious that adoption of modern varieties of cereal crops is important to enhance production, productivity, and finally overall household food supply, where a major share of household energy consumption is derived from cereals. Realizing the importance of improved cereals' varieties adoption on overall food supply, an adoption index was developed (Chapter III, p. 35.) considering the number of improved cereal crop varieties adopted/adapted by the individual sample household. The regression results showed significant effect of adoption index on food consumption availability. However, there was strong correlation (r=0.42) between land holding size and adoption index. This result can be further inferred that the most of crop varieties recommended by the research center are either in favor of large farm size holders or they are not in line with the needs of smaller farm households. As majority of households in the study area are small farm size holders, response of modern variety adoption on household food supply was found to be very small. Keeping other variables at their mean, food availability response to land holding and modern variety adoption is depicted in Figure 7.4.

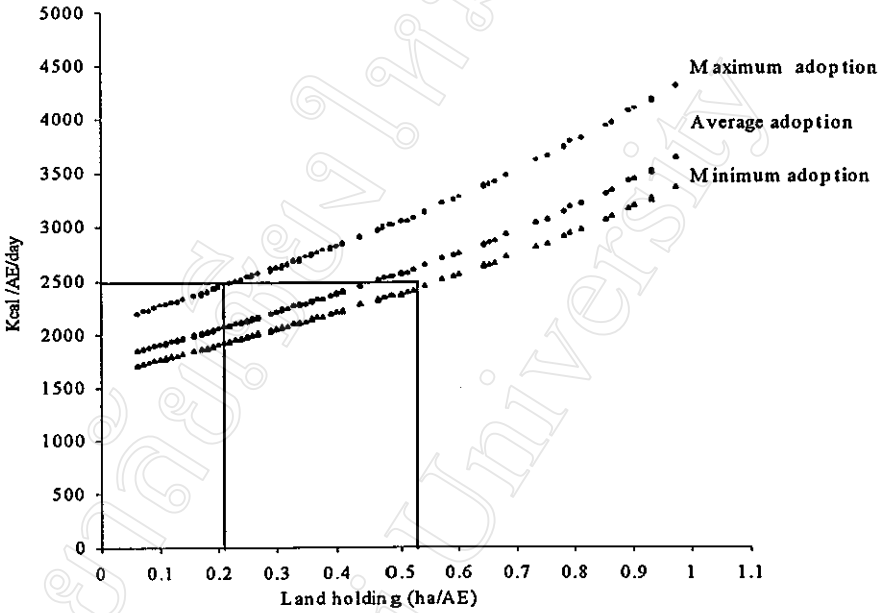

Figure 7.4 Food availability response to land and modern varieties adoption

Examining the response of food availability on land size and modern varieties adoption index, two scenarios emerges. First, even under the poor adoption scenario, if the present average land holding size (0.34 hectare per AE) is doubled, the subsistence calorie requirement i.e. 2,500 Kcal/AE/day could be met. The second scenario shows that under the present level of land holding, even if the modern variety adoption reached up to the full scale, the subsistence calorie requirement could hardly be met. Therefore, under the present situation, food security intervention through modern variety adoption may work well only under the large farm size condition. However, looking at the limited scope of increasing land availability, even if there is small response of modern variety adoption on aggregate food availability amongst the a small land size holder, increased modern variety adoption may be one way out to improve the food security situation at least for the short-run.

Educational status of household's head plays important role in the household resource management, technology adoption and even in the household food consumption behavior. Because of pervasive illiteracy in the rural hills of Nepal, educational status of household head measured in terms of years of schooling does not carry any pertinent meaning so far. Therefore, for the purpose of this study a dummy variable was used as whether or not a particular household's head can read and write. The empirical result from the regression analysis showed a positive effect of literacy on food availability, albeit, the extent of the effect was statistically non-significant, which might be due to the overwhelming prevalence of traditional production systems with low level of technological intervention.

Since this study was carried out in an interior rural area without road and market access, subsistence farming with the objective of ensuring household food requirement is the characteristic features of farming systems in the study area. The key results from statistical analysis indicate that calorie availability for consumption is highly correlated with access to cultivating land, and many farm households with smaller land holding was found to be unable to meet even the 80 per cent of calorie requirement. Livestock keeping, which could be one of the eminent strategies of ensuring food and cash security, found a major component of farming systems. The role of livestock on overall food supply has, therefore, found to be of great significance. Due to negligible market orientation both for selling and buying of agricultural produces cash transaction in the study area was found minimal which might have led self-reliance on food production and consumption. Having no alternative employment opportunities and pervasive underemployment with high dependency on agriculture have led pressure on available limited land resource for sheer survival. As regard to the ethnic variation in the household food availability that might have practically backed up by the cultural and rituals values determining the household consumption behavior and the choice of farming practices.

Since own on-farm production is the most quantitative component of food security among all the sample households, it forms the basis for food entitlement in terms of direct consumption of production. As the physical level of food supply determined by the total area of cultivation and per unit production, increasing productivity through technological intervention is important to enhance on-farm food security. Therefore, increased adoption of modern varieties together with inputs would be one way to boost up existing level of production and productivity thereby improving the food security situation at least amongst the large farm size holders.

7.5 Constraints to household food security

Understanding of the problems associated with food insecurity is important to design and implement food security interventions. This study has attempted to identify perceived problem, which are directly or indirectly responsible for hindering the household food security situation in the study area.

Problems identified through farmers' group and ranked by individual discussions were incorporated in the survey questionnaire and were assigned to rank by the individual interviewee. A simple three point scale: 1-3 was used to prioritize severity of the problem: 1 for least severe, 2 for moderately severe, and 3 for the most severe problem. The frequency of responses on each problem was then multiplied by the severity scale and aggregated to find out cumulative score. Based on the cumulative score the individual problem was ranked accordingly (Table 7.4)

Table 7.4 Household's perceptions on constraints to food security

Constraints	Severity level			Total score	Rank
	3 (Most)	2 (Medium)	1 (Least)		
	--------Number of responses----				
• Lack of irrigation	48	3	0	150	I
• Lack of employment opportunities	35	14	12	145	II
• Lack of suitable land	24	27	10	136	III
• Lack of market	17	24	12	116	IV
• Lack of inputs	20	25	5	115	V
• Diseases and pest	21	23	4	113	VI
• Lack of technical know-how	18	23	7	107	VII
• Land fragmentation	18	19	7	99	VIII
• Increased household size	16	5	19	77	IX
• Low wage rate	10	8	14	60	X
• Indebtedness	7	4	5	37	XI

(Source: Survey data, 1998)

From the results of problem ranking as mentioned earlier, lack of irrigation, lack of employment opportunity and lack of suitable land for cultivation came out to be the major problems associated with household food insecurity in the study area. Lack of irrigation, the most serious problem identified has resulted in declining agricultural production and productivity. As mentioned earlier, winter fallow was the prominent characteristic of the study area largely due to the problem of irrigation, which eventually rendered the cultivating land as an open access for grazing during the winter season. Lack of employment opportunity within and even outside the village, indeed, reduced their purchasing capacity to obtain required food and further investment for production.

This has further induced the situation of low production, low consumption and low investment, which has eventually intensified the problem of poverty and food insecurity.

Moreover, declining agricultural production and productivity is magnified by the lack of technological intervention and insufficient extension services. With the increasing demand for food due to increasing population to feed, the present level of production is not sufficient to meet the household food requirement. Therefore, many farm households are loosing their food self-sufficiency status. Obviously, lack of employment opportunities other than seasonal agricultural laboring with a minimum wage has further aggravated the situation among the poor households who are unable to sustain their living from their own farm production. Due to increasing hardship, during the late eighties, there was almost an established trend of permanent migration to *terai* from the study area. But the situation now has been changed due to increasing population pressure and heightened land price in *terai,* which compelled the poor households to eke out their living from the limited resources.

Since rural infrastructure is of central importance in enhancing production, consumption, distribution and trade, lack of transportation has been realized as one of the critical constraints impeding the agricultural production and productivity in the study area. Having no transportation and rural marketing structure, farm households are not able to sell their surplus agricultural produces, which further declines their access to cash and eventually leads to low investment and low production. Furthermore, lack of transportation and communication has put the farm households disadvantaged with poor access to inputs and information.

Because of property inheritance tradition from fathers to sons, household's productive resources particularly the lands are divided into the small-scattered parcels loosing its economy of scale. Therefore, the poor households with small pieces of land generally are not interested to invest for small piece of land, which is insufficient to earn

their living. That could be one of the major reasons for majority of households responding lack of suitable cultivating land as one of the major constraints associated with food insecurity in the study area.

The changing relationship between agricultural producers and members of occupational groups of people: tailor, blacksmith and leather workers i.e. *Damai*, *Kami* and *Sharki* giving them the traditional caste level (Blaikie *et al.*, 1980) has intensified the food insecurity problem among those occupational groups of people. Traditionally there was client-patron type of relationship between those occupational caste of people and the agricultural producers in the rural hills, which involved kind payment fixed according to some discernible idea of likely annual demand for the services from each of the occupational groups (locally called *Bista* system). During the recent decade the demand for such services has declined sharply because of increasing availability of readymade goods like readymade clothes, agricultural tools, shoes etc. in the cheaper prices. Due to less demand of traditional skill of those occupational groups of people, the *Bista* system in the rural area has been observed fading away. Because of decreased demand for their occupational works, they are now obliged to change their traditional occupations to physical laboring and portering for which they are not accustomed with. This situation has virtually led them into the verge of poverty and food insecurity.

7.6 Households' food strategies

Households facing food deficit problem adopt self-insurance strategies to minimize the risk of food insecurity and reduce likelihood of stress on their household economy. Households' strategies to cope with food deficit problem vary based on the available opportunities and their resource base. Maxwell and Frankkenberger (1991) citing Chang Cham and Thomas *et al.* (1989) explained that households' strategies against food insecurity vary by region, community, social class, ethnic group, gender, age, and the season. Even the poor households with declining food entitlements do not

respond arbitrarily against the problem but try to develop systematic food security strategies according to their available resources and opportunities in order to minimize the risk of immediate food insecurity without compromising the long-term livelihood security. The understanding of household food strategies has therefore been recognized in order to develop food security monitoring systems (Davies, 1993). Furthermore, understanding of household's food strategies provides a basis for development intervention addressing the food insecurity problem.

As food security is inter-linked with the notion of livelihood security, there might have some degree of trade-off between the short-term coping strategies to acquire immediate food need and the long-term livelihood security. The poor food-insecure households are sometimes obliged to meet immediate food requirement at the expense of productive resources like land and livestock, which eventually erodes the long-term livelihood security. Davies (1993) has, therefore, clearly distinguished the short-term and long-term food strategies as the former responds to an immediate decline in access to food, and the latter in contrast, involves a permanent change in the ways in which food is acquired.

Considering the above notion of short-term (coping) and long-term (adaptation) strategies, a group exercise was done with the key informants in order to investigate the household's food strategies of the study area. The household's food strategies adopted in response to food deficit situation were found to be influenced by the severity of the problem, household resource endowment and the available opportunities. Household that faces one or two months food deficiency makes up the gap by selling agricultural produces and borrowing cereals or cash, it rarely faces acute shortage of resources. But the household members should always be prepared to face stress that could result from poor harvest or unforeseen demand for expenditures. Therefore, this type of household faces transitory type of food insecurity. In order to solve the problem in the long run, they try to increase the overall production by intensifying the production systems like

taking additional crops such as vegetables, rearing livestock, and renting-in land. They are, therefore, always looking for increasing production and income in order to secure their consumption. On the other hand, households facing substantial shortage in food each year are in much more precarious situations. This type of household faces acute food shortage every year and live in the situation of hand-to-mouth existence. The only way of living for them is to diversify their source of income. All adult members of those households do off-farm laboring just to sustain their living.

A range of short-term food strategies have been identified from the group discussion, which includes changes in consumption behavior (e.g. eating less preferred food, altering intra-household food distribution, reducing food intake and frequency), food and cash borrowing, livestock sale, sale of household assets, mortgaging or pledging of land, seasonal laboring etc. However, individual farm household adopts varieties of strategies based on its resource endowment and opportunities available. Initially farm household uses adaptative strategies (e.g. adjustment on crop and livestock, change in food habit, borrowing etc.), and as the problem intense there will be more commitment of selling domestic and productive resources. Changes in consumption behavior were found particularly related with the choice of food and frequency of meal. When there is less food available, the poor households reduce their frequency of meal from three to two or sometimes just one meal a day or consume inferior quality food. It was also mentioned that for some households during the most food deficit period the daily meal sometimes depend entirely on the mercy of neighbors. Moreover, many of the poor households with poor resource base are accustomed to living in a state of extreme food deficit situation throughout the year.

Farm household responds to the food shortage by using various distinguishing types of risk management strategies and the short-term coping behavior (Maxwell and Frankenberger, 1992). Initially they attempt to solve the problem by adjusting available resources like crop and livestock. As the problem intensifies over the time there will be

more commitment of domestic and productive resources in order to solve the immediate food problems, which eventually erodes the long-term production potentiality involving a trade-off between immediate problem solving strategies and long-term livelihood security. Maxwell (1995) has, therefore, used coping strategies as a food insecurity indicator as an alternative measure of food insecurity. As commitment to productive and domestic assets increases to solve the immediate food problem, there will be less chance of reversibility to the normal situation. Various strategies are often used together; they have been presented in the sequence of severity and in relation to the chance of reversibility and commitment to domestic resources.(Figure 7.5). Starting with adaptation strategies (e.g. resource adjustment) farm household try to meet the household food demand by selling liquid assets (e.g. small animals), and subsequently productive assets sales (e.g. farmland) as the problem pronounced. At the extreme situation farm household will be obliged to leave the place (out-migration) just to eke out its living.

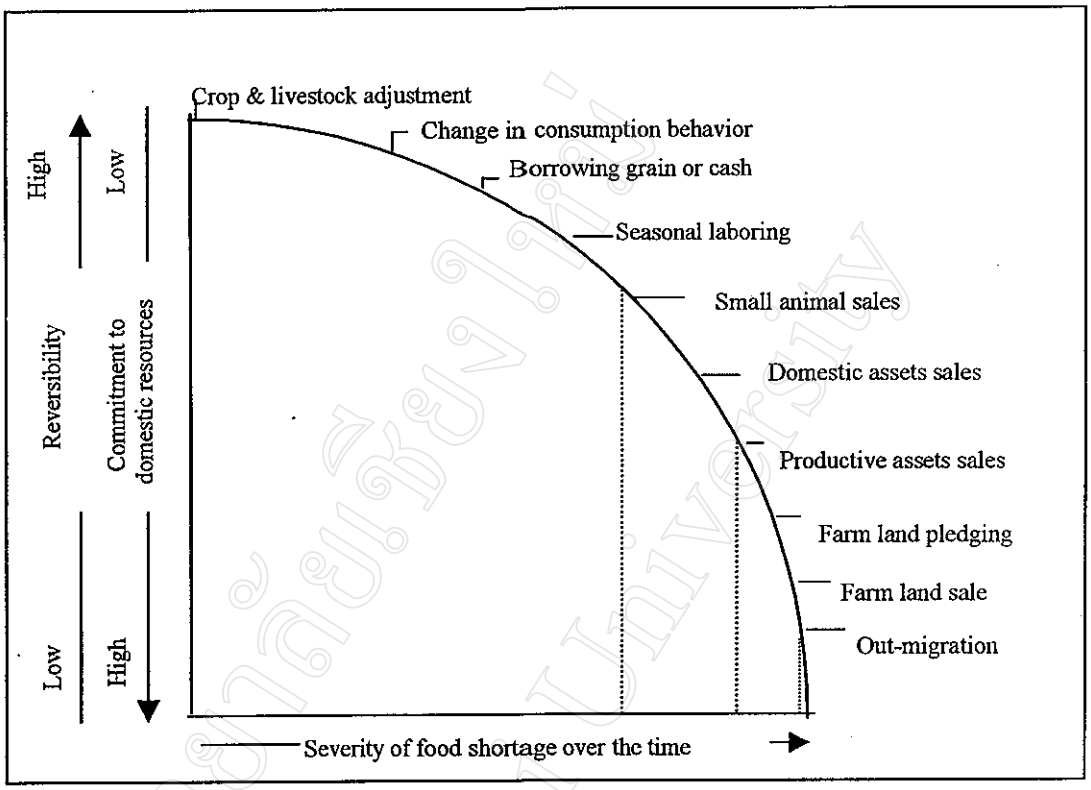

Figure 7.5 Households' responses to food shortage
(Adapted from Maxwell and Frankenberger, 1992)

Due to the unpredictable climatic condition and diverse topographic features, farm households in the study area have diversified their production systems exploiting different agroecological niche. Integration of crop, livestock, horticultural and agroforestry based integrated farming is an example that have been adapted by the farm households to minimize risk and uncertainty. Given the limited land resources, increased agricultural production through extensification is no more possible. Therefore, intensification of crop by intercropping different leguminous and non-leguminous crops particularly on the *Bari* land to increase aggregate production level per unit area of land is an obvious example of long-term strategies adopted by the farm households. In order to get sustainable growth in agriculture production through crop intensification emphasis has been given to the use of more local resources use with maximum resource recycling.

Terracing on sloppy land and compost making from forest bio-mass are important strategies to maintain soil fertility in order to enhance sustainable land use.

Renting-in land is found to be the one of the important strategies for increasing food production among the food deficit households. Farm households having no *Khet* land generally are found to be dependent on rented-in *Khet* land for rice production. Small farm animals such as goats, pigs and chickens are also managed as a safeguard against cash insecurity. Most of the food-insecure households earn cash form selling those animals to purchase food and other households necessities. Interestingly, these animals are widely viewed as a savings bank because they are considered life-saving assets during difficult times. Share rearing of livestock among the poor households was also mentioned as one of the important way out to cash deficit among the poor households. Various forms of animal share rearing are prevalent in the communities depending upon the relationship between rearers and owners. The different households' food strategies discussed above are summarized in Table 7.5.

Table 7.5 Household food strategies, objectives and responses

	Strategies	Objectives	Specific response
Short-term (Coping)	Purchase grain	-Protect consumption	-Use off-farm income - Sell assets -Borrow cash loan
	Receive grain		-Wages received in kind -Reciprocal obligation -Borrow grain -Exchange
	Modify consumption behavior	-Reduce consumption	-Reduced frequency of meal -Consume less preferred food -Reduced amount of food intake -Alternating intrahousehold food distribution
Long-term (adaptation)	- Crop diversification and intensification -Increase productive resources	- Increase production level - Minimize risk	-Use of different agroecological niche (vertical risk adjustment) -Multiple cropping - Choice of different crop with different maturing period (spatial risk adjustment) -Cultivate improved varieties -Renting-in land -Share rearing livestock
	Land improvement	-Increase soil fertility -Minimize risk -Increase production	-Irrigation -Terracing -Composting and manuring
	Diversify sources of off-farm cash income	-Increase purchasing power -Increase investment -Minimize risk	-Diversify off-farm works -Foreign employment

(Source: Group exercise, 1998)

Beyond household level, community level resource management strategies are another important aspect of food security strategies adapted in the study area. Increasing participation in community forest and community irrigation scheme can be recognized as the strong form of community solidarity. There are many forms of social relationship existed in the community, which can be regarded as established strategy to cope against food and cash insecurity. Labor and bullock exchange systems, which contribute significant labor requirement for agriculture has further magnified the strong social coexistence.