Ethiopian Journal of Development Research Vol. 21, No. 1, April 1999

THE DIMENSIONS OF UNDERNUTRITION AND MALNUTRITION AND THEIR DEMOGRAPHIC CORRELATES IN THREE COMMUNITIES OF ARSI REGION IN ETHIOPIA

Hadgu Bariagaber*

ABSTRACT: *The study was undertaken in three communities which are located around Eteya town in Arsi Region, Ethiopia. The sampling strategy was based on a general purposive criterion of selection due to time and cost considerations as well as ease of enumeration and supervision. The overall sample size was fixed at three villages/communities with comparable number of private and co-operative households. It covered 701 households, consisting of 359 private and 342 co-operative farming households respectively with 3676 persons and 641 pre-school children.*
The main objectives of the study were two-fold and they were to:

1. *estimate the level of undernutrition of the households and malnutrition of the pre-school children in the three study communities; and*
2. *investigate the influence of some selected demographic variables on the nutritional status of the households as well as the pre-school children.*

The results of the study indicated that the level of undernutrition of the communities was found to be ranging from about 54 percent for the cooperative households to about 63 percent for the private farming households and the size of the malnourished pre-school children in the two farming sectors ranged from about 43 percent facing underweight to 67 percent experiencing stunting, with notable differentials among male and female-headed households. The variations in the nutritional status among male and female-headed households were explained by their demographic composition and economic activities in which the female-headed households were characterized by small family size and engaged in both agricultural and non-agricultural activities such as

* Faculty of Social Sciences, Population and Sustainable Development, University of Botswana.

- access to adequate shelter has been very limited with inadequate housing facilities and growing trends of homelessness in the urban areas of the country; and

- social welfare services and security are lacking for families, women, children, and the youth, especially for the disadvantaged social groups such as the elderly people, persons of disability, orphans and abandoned children.

Results of the recent nutrition survey of the CSA showed that about 64 percent of the pre-school children in Ethiopia were found to be chronically malnourished and 48 percent underweight with the Regional prevalence of stunting which ranges from 49 percent in South Omo to 75 percent in South Gondar with a modal value of 40-50 percent underweight (Tesfaye and Debebe, 1992:24-25).

Furthermore, as rightly stated by Nebiat (1990:62), societies in developing countries are always facing high prevalence of nutritional deficiency conditions, which is mostly explained in terms of food energy deficiency (i.e., Undernutrition) due to the background variables of scientific and technological underdevelopment. This state of affairs has been so overwhelming to prevent the attainment of national food self-sufficiency.

The root causes and problems of undernutrition and malnutrition are multifaceted: inadequate food supply, poor health conditions, ignorance about nutrition, limited purchasing power, demographic factors and lack of proper management. The non-demographic influences of nutritional deficiency were further studied by Nebiat (1989:521), who stated that the quantitative and qualitative food consumed by the individual or family are directly influenced by the availability of food, food habits as

determined by the educational and socio-cultural orientations, by the intra-family food distribution and by food processing and preparation methods. According to Nebiat, the key factors affecting food availability are the levels of production, adequacy of distribution system, the population size and the economic capability of people to purchase food.

Until quite recently, the demographic influence of nutritional status of a population had been investigated at macro-level and the consideration of population size was used as denominator and food supply as numerator to compute per capita calorie intake and requirements. But, the macro-level consideration conceals a lot of internal variations associated with age/sex structure of the population, anthropometric measurements and other variations within the population segments and resources distribution.

Although it has been recognized that the determinants of nutritional status have been social, economic and demographic factors (Peter L.Pelet 1986:4-5), much research activities and resources were used to be geared towards health and economic perspectives of determinants of the nutritional status of the population. However, the determinants could broadly be identified at two levels; namely, basic/initial and immediate determinants of undernutrition and malnutrition.

The basic determinants can be explained largely by economic perspectives in which crop production (yields), wealth distribution (proxy to income), crop pricing and acquisition policies, rural investment programmes, technological levels, literacy status and access to other resources are considered major determinants (independent variables) explaining the level of food consumption which is the dependent variable.

The present study is, therefore, motivated by the need to investigate the influence of demographic variables on nutritional status-i.e. undernutrition and malnutrition when food reaches the households.

OBJECTIVES AND RATIONALE OF THE STUDY

The general objective of the study was to investigate the influence of demographic factors on household food availability and nutritional status after food reaches the households of the study communities. The main objectives of the study were to investigate the demographic factors as immediate determinants of the nutritional status of the households, focusing on the undernutrition and malnutrition of households and pre-school children (i.e. determine the extent of under nutrition and malnutrition) and to determine the demographic correlates considering demographic factors as independent variables and the nutritional status (normal or deficient) as dependent variable.

The rationale and motivation of undertaking the study were three folds:

i. in Ethiopia, there had been limited investigation on the interrelationship between demographic factors and nutritional status;
ii. there had been impressions and official statements that the study Region (i.e Arssi), especially the district of the study communities (around Eteya Town) were assumed to be food surplus producing areas without investigating the demographic structure of the areas; and
iii. the dangers of undernutrition and malnutrition could lead to high and therefore serious morbidity and mortality rate.

SAMPLING ISSUES, DATA SOURCES AND IMITATIONS

An ideal methodological approach for impact/influence assessment studies, like the one under consideration, calls for four main criteria of sample selection:

- Experimental/control design (i.e., dividing subjects into those under certain development programme and those outside the programme to investigate any relative change overtime in the former as compared with the latter);
- Longitudinal time frame (i.e., repetitive survey to control variations);
- A large randomly selected number of observations (households, individuals etc); and
- Cross-sectional in dimensions (coverage).

However, a general purposive criterion of selection was adopted due to cost and time considerations and ease of enumeration and supervision. Consequently, the overall sample size was fixed at three villages (communities) with comparable size of private farming households and cooperative farming households.

The first sampling stage was the selection of one out of the 22 districts of Arsi Region, for the selected district was believed to have had normal demographic conditions (absence of war, drought, famine etc), normal food production process (as one of the supposedly surplus producing areas in the Region) and had relatively higher number of cooperative

women tended to over-weigh consumption so that aid would be provided in similar amount. Others thought that if the household food consumption were reported low, then the government or NGO's would assume that the community was poor to be supplied with food aid.

Since the food consumption survey was conducted in four repetitive rounds, there was sufficient time for repeated campaigns, explaining the objectives of the survey that it had nothing to do with aid or subsidies. Thus, it is felt that the averaged data was useable for the analysis..

APPROACHES FOR DETERMINING THE NUTRITIONAL STATUS OF THE COMMUNITIES

Quantitative Approach for Estimating Undernutrition

The quantitative approach of assessing the nutritional status of the households pertains to the estimation of undernutrition. The unit of actual food consumption in rural Ethiopia is the household/family which pools and prepares its food resources for collective consumption by the members of the household. The flour to be consumed daily by each surveyed household was weighed in kg and converted into calorie-equivalence using appropriate conversion factor of grain to calorie.

The calorific food requirement, which was estimated at individual level controlled for age, sex and body-size (weight), was aggregated at household levels to be consistent with the food consumption arrangements. The two components (i.e., food requirement and intake levels) were compared and the nutritional status of each household was determined.

The calorie requirements of healthy persons vary generally with respect to age, sex, body-size and level of activities. Within a given age/sex structure, there are certain vulnerable groups such as the youth, children, pregnant women and lactating mothers. These segments of the population need extra nutritional intake to compensate for their extra requirements for growth, development of fetus, placenta and associated maternal tissues of pregnant women and for producing milk in the case of lactating mothers (FAO, 1987:71). However, there are two complications which hinder the preparation of such estimates (FAO/WHO/UNU, 1985: 71, 78, 85 -89 FAO. 1973: 9,19, 35-36):

- apart from the normal collectively prepared and served household food, there had not been the tradition and the means for special additional food arrangements for the vulnerable groups of the population in the study areas; and

- recent studies show that there have been some difficulties and controversial issues in calculating the extra food energy needs during pregnancy and lactational periods.

However, for the completeness of the study of the population and food balance at community levels, the FAO/WHO/UNU (1985) recommended an average daily intake allowance of 240 and 500 calories per pregnant woman and lactating mothers respectively and these values were considered in the model whenever the surveyed household happened to have such vulnerable groups.

Table 1: Fitted Equations of BMR by sex and functional age groups

Functional Age Group	Fitted Equations	Correlation Coefficients	Deviation
Males:			
BMR (0-2)	60.9w-54	0.97	53
BMR (3-9)	22.7w+495	0.87	62
BMR (10-17)	17.5w+651	0.90	100
BMR (18-29)	15.3w+679	0.65	151
BMR (30-59)	11.6w+879	0.60	164
BMR (65+)	11.5w+487	0.79	148
Females:			
BMR (0-2)	61.0w-51	0.97	61
BMR (3-9)	22.5w+499	0.85	63
BMR (10-17)	12.2w+746	0.75	117
BMR (18-29)	14.7w+496	0.72	121
BMR (30-59)	8.7w+829	0.70	108
BMR (60+)	10.5w+596	0.74	108

Note: The correlation coefficients in the above Table refer to the degree of closeness of BMR's within each functional age group. For example, the correlation of BMR values if individuals within the age group 0-2 for both sex is 0.97.

Source : FAO/ WHO /UNU : Energy and Protein Requirement Technical Report , series 724, WHO , Geneva , 1985, p 71.

An alternative model of multipliers, as presented in Table 2, col. 5, which attempts to minimize the variations was recommended for developing countries (W.P.T. James et al 1990: 23-30, 32). Based on this recommendation, Table - 2 is established and elaborated using the primary data on age, sex, and body weight. Similar calculations were done at household level to derive average per capita energy requirements in calories. Thus, the average per capita daily food consumption level in calories and the daily per capita requirements of each household were established and the nutritional status determined case by case.

Table 2: Derivation of Model Energy Requirements using the Empirical Data of the Study Communities

Age	Population		Average weight in kg		Average Per capita BMR		Multipliers for BMR		Per capita calories per day	
(1)	(2)		(3)		(4)		(5)		(6)	
	M	F	M	F	M	F	M	F	M	F
0	55	78	6.36	6.44	333	342	2.08	2.05	693	702
1	71	69	8.77	8.30	480	455	1.97	2.06	947	938
2	63	74	10.30	10.05	573	562	1.87	1.82	1071	1025
3	79	53	12.43	11.80	777	765	1.58	1.47	1231	1121
4	48	51	13.52	13.11	802	794	1.60	1.52	1284	1206
5	94	46	16.41	15.69	868	852	1.74	1.62	1510	1381
6	79	64	18.03	16.87	904	879	1.76	1.59	1587	1400
7	81	78	19.87	19.52	946	938	1.74	1.58	1649	1484
8	86	81	21.12	22.68	974	1009	1.67	1.55	1626	1565
9	64	66	25.04	24.50	1063	1050	1.70	1.45	1803	1519
10	70	68	26.53	26.45	1115	1065	1.76	1.65	1962	1764
11	45	48	29.37	30.14	1165	1114	1.72	1.62	2004	1805
12	73	61	31.06	32.45	1195	1142	1.69	1.60	2020	1827
13	40	45	32.98	36.22	1228	1188	1.67	1.58	2051	1877
14	42	64	38.21	39.85	1320	1232	1.66	1.57	2191	1934
15	57	44	41.29	43.88	1374	1281	1.62	1.54	2226	1947
16	43	43	43.70	44.38	1416	1287	1.60	1.52	2266	1956
17	29	24	49.09	47.03	1510	1320	1.60	1.52	2416	2006
18-29	196	323	55.71	51.90	1551	1259	1.82	1.67	2786	2103
20-39	360	403	58.07	49.61	1553	1261	1.82	1.67	2826	2106
60+	124	94	55.78	46.16	1240	1081	1.51	1.56	1872	1686
Total	1799	1877	35.61	34.84	1161	1059	1.70	1.60	1974	1694

Different levels of critical points of undernutrition have been defined and recommended in relation to BMR and multipliers (Mats. H. Lorsted No.11: 3 -7; FAO/WHO/UNU 1985; W.P.T. James 1990; UN University, 1989) and the relevant ones for the purpose of this study are indicated as follows :

holdings was estimated to be 48 years as against 43 years for the co-operative households and the fertility level as measured by children born at the end of the childbearing ages for the private holding households was reported to range between 6.1 for female-headed and 6.4 for male-headed households in the private sector as against 4.8 for female-headed and 5.7 for male-headed households in the co-operative sector.

Furthermore, there existed differentials with respect to mortality condition between the two sectors. The infant mortality rates ranged between 106 per 1000 live-births for the co-operative and about 191 per 1000 live-births for the private farming households with crude death rates of about 18.3 per 1000 for the private and 9.1 per 1000 for the co-operative households. Among the private holding households, the crude death rate was reported to be 26.1 for male-headed households and 10.8 for female-headed households in the private as against 8.7 for male-headed and 9.4 for female - headed household in the co-operative sector.

The relative variations in the levels of mortality between the private and co-operative farming households could largely be explained by the differentials in their educational and nutritional status which appeared to be in favour of the co-operative farming households.

Certain non-demographic factors could have also contributed to the relative differentials in the levels of undernutrition among the private and co-operative households. For example, it was noted that the then Marxist Government of Ethiopia was more biased towards co-operativization for the purpose of favorable access to fertilizers, giving services and credit facilities, carrying out land allocation and rendering supports than towards private holding households.

Another interesting feature of Table 3 is the relatively less incidence of undernutrition in the female-headed households than in the households of their male counterparts. This could be explained by the fact that most of the female-headed households in both sectors were noted to supplement their regular income from being engaged in non-farming activities such as petty-trading, preparation of local drinks for sale etc. on Saturdays and Sundays and other day-offs/holidays.

Table 3: The size of Undernourished and Nutritionally Normal Households of the Communities by Type of Farming Sector and Sex of Household Heads

Sector	Normal	Mild	Severe	Total	All
Private:					
Male-headed households	32.1	57.6	10.3	67.9	100.0(234)
Female-headed households	47.2	48.8	4.0	52.8	100.0(125)
Sub-Total	37.3	54.6	8.1	62.7	100.0(359)
Co-operative:					
Male-headed households	40.8	50.5	8.7	59.2	100.0(287)
Female-headed households	70.9	25.5	3.6	29.1	100.0(55)
Sub-Total	45.6	46.5	7.9	54.4	100.0(342)
Both Sectors:					
Male-headed households	36.9	53.7	9.4	63.1	100.0(521)
Female-headed households	54.4	41.7	3.9	45.6	100.0(180)
Total	41.4	50.6	8.0	58.6	100.0(701)

Notes: 1. figures in parenthesis are total households in the communities.
2. Mild undernutrition is defined between 1.4 x BMR and 1.3 x BMR, where as the severe one is defined by less than 1.3 x BMR.
3. Total = Mild +Severe.

The Extent of Malnutrition in the Communities

The nutritional status of the pre-school children in the communities is summarized in Tables 4 and 5. Table 4 shows the degree of malnutrition with respect to weight-for-age (underweight) indicator, whereas Table 5 exhibits the status with respect to height-for-age (stunting).

As shown in Table 4, although there are marginal differences between male and female children and between the two sectors, about 43 percent of the pre-school children in the communities were reported to have been malnourished. This indicates that there had been acute or recent as well as long-existing malnutrition among the pre-school children.

Table 4: Proportion of Normal and Malnourished Pre-school children with Respect Weight-for-age by sex and Sector

Sector	Normal	Underweight	Total
Private			
male children	56.2	43.8	100.0(144)
female children	57.5	42.5	100.0(146)
Sub Total	56.9	43.1	100.0(290)
Co-operative			
male children	58.7	41.3	100.0(172)
female children	54.7	45.3	100.0(179)
Sub Total	56.7	43.3	100.0(351)
Both:			
male children	57.9	42.4	100.0(316)
female children	56.0	44.0	100.0(325)
Total	56.8	42.4	100.0(641)

Note: The reference value is median minus two standard deviations.

Unlike in the weight-for-age, the prevalence of chronic malnutrition as measured by height-for-age (stunting) appears to be very serious in both sectors for both sexes, reaching about 67 percent. However, Table 5 indicates that there appears to exist a relatively more long-endured and chronic malnutrition among the male sex than among their female counterparts. This may partly be explained by the fact that male children tend to be more active (playing, running etc) and could have spent more energy than their female counterparts.

Table 5: Proportion of Normal and Malnourished Pre-school Children with Respect to Height-for-age (stunting) by Sex and Sector

Sector	Normal	Stunting	Total
Private			
Male children	31.3	68.7	100.0(144)
Female children	37.0	63.0	100.0(146)
Sub Total	34.1	65.9	100.0(290)
Co-operative			
Male children	30.2	69.3	100.0(316)
Female children	34.1	64.6	100.0(325)
Sub Total	32.2	67.8	100.0(351)
Both:			
Male children	30.7	69.3	100.0(316)
Female children	35.4	64.6	100.0(325)
Total	33.1	66.9	100.0(641)

Note: The reference value is median minus two standard deviations

Examination of the association between the nutritional status of the households and pre-school children was made by applying the **chi-square test** and it was noted that most of the malnourished pre-school children were from the undernourished households of the communities.

DEMOGRAPHIC INFLUENCE OF NUTRITIONAL STATUS: APPLICATION OF LOGISTIC REGRESSION MODEL

Demographic Correlates of Undernutrition

As presented in Table 6 , the demographic variables which are considered to be the predictors of the nutritional status with respect to undernutrition of the communities are nine. These variables were defined to be the independent variables which were assumed to explain the variation of the nutritional status among the households in the communities under study. On the other hand, the nutritional status, as a response/dependent variable, was defined by the following three alternatives:

Alternative A:
In this alternative, the dependent variable takes the value of energy intake (i.e, consumption level) of each household (i.e., continuous variable);

Alternative B:
The ratio of energy requirement to energy intake is considered to be the value of the dependent variable (i.e., fractional continuous variable), and

Alternative C:
Here, the dependent variable is defined by the critical values of undernutrition, i.e., when the dependent variable is a binary function in which the variable takes the values 0 or 1 in which 0 indicates normal nutritional status and 1 denotes the prevalence of undernutrition.

When Alternatives A and B are taken to define the dependent variable at a time and when multiple regression model is applied, the outcomes would indicate only the variations in the nutritional status among the households. For example, the outcome of the regression model, when the

dependent variable is Alternative A, shows that about 32 percent (i.e.,R^2) of the observed variations in energy intake among the households of the communities appear to account for the nine independent variables with a 5 percent level of significance, while Alternative B, as dependent variable, indicates about 23 percent variations at 5 percent level of significance.

Conceptually, the ratio of energy requirement to energy intake as dependent variable is more sound than the one defined by the amount of energy intake of each household. But the ratio still lacks the power to distinguish the well-nourished from the undernourished households because the ratio simply indicates that the energy requirement of a given household is either higher or lower than the energy intake of the same household. In this case, if the ratio is greater or less than unity, it does not necessarily mean that households with higher ratio would be better-nourished than those with a ratio less than unity.

Thus, a relatively more efficient alternative of the dependent variable of undernutrition and malnutrition is the one defined by the cut-off points established on the basis of the concept of BMR and the median minus two standard deviations for the assessment of households nutritional status and anthropometric variables for pre-school children. In this case, the dependent variable is a dichotomous/binary function (i.e., Alternative C).

Since the application of ordinary linear and multiple regression models is not efficient for a binary dependent variable (Roderick, Little, 1980 : 46-58 Maurice Kendall 1980 : 85 - 97), a more powerful model is sought. When interest is focused on the investigation of the influence of certain explanatory variables such as number of children in a household, household size etc. on dichotomous outcome (i.e., binary dependent

variable of nutritional status) one often applies a special type of regression called **Logistic Regression Model** (D.R.Cox, 1970:15-19, 22, 26, 27 Devid W. Hosmer etal, 1989:6-17 Douglas C. Montgomery etal, 1982:244-282); John Neter etal, 1985:357-367) .

The specific form of the logistic regression equation is as follows:

$$\Pi(x) = E(y/x) = \exp(b_o+b_1x_1 + \text{-----}) / (1+\exp(b_o+b_1x_1+b_2x_2 + \text{----})$$

Letting $Z = \exp(b_0+b_1x_1 + \text{------})$ and introducing the Logit/Probit transformation:

$$g(x) = \ln(\Pi(x) / (I-\Pi(x), \text{ we have}$$

$$\Pi(x) / I-\Pi(x) = lnZ/ (1+Z)/1- (Z/1+Z) = lnZ$$

$$\text{i.e., } g(x) = \ln Z = \ln(\exp(b_0+b_1x_1+ b_2x_2+\text{----})$$

$$= b_O + b_1 x_1 + \text{.....}$$

$$g(x) = b_O + b_1 x_1 + \text{.....}$$

By analogy, if P = Prob (number of children, household size, marital status etc.), then a simple way to represent the multiple regression model for logits P will be as follows:

$$\text{Logit } (P) = \log (P/1 - P) = a + b_1 x_1 + b_2 x_2 + \text{....}+ b_k x_k + E_i$$

Where P = Probability of undernutrition and malnutrition;

a = Constant term (i.e. marginal value or intercept term);

x_i = (When i = 1,2, ... k) = matrix of explanatory variables

b_i (when i = 1,2, 3....., k) = Vector of regression co-efficient and

E_i = Error term of the logit regression

The logit regression model is fitted using GLIM Computer Package Programme and the results are summarized in Table 6. This table presents the nine major independent variables with their corresponding

categorical variables. Interpretation of the summary results of Table 6 is focused on the magnitude of the adjusted "odds ratios" which are obtained by exponentiating the regression coefficients. These odds ratios indicate the magnitude of the likelihood of undernutrition with respect to its reference category.

The study considered the number of children less than 15 years of age in a household where households were stratified into four classes as those who had 0 to 1 child only; 2 to 3 children; 4 to 5 children and 6 children and more. In this case, those having had 0 or 1 child were the reference households to which the degree of undernutrition of other households was referred. The odds ratios are then interpreted to mean that households with 2 to 3 children were 1.42 times who were more likely to experience undernutrition than those with 0 or 1 child; those with 4 to 5 children were 2.55 times more likely to face undernutrition and those with 6 children and more were 4.59 times more likely to face undernutrition than those with 0 or 1 child. The odds ratios corresponding to the categorical variables of each major variable in the Table could be interpreted in similar way.

But the interpretation of the odds ratio corresponding to any negative regression co-efficient is the reverse. For example, the farming sector in which the regression co-efficient for co-operative household is negative (i.e.,-.3895) and the corresponding odds ratio is 1.48. In this case, the odds ratio is interpreted as meaning that the co-operative households would be 1.48 times less likely to experience undernutrition than those in the privately held households.

Table 6: Logistic Regression output of *Beta* Coefficients (adjusted),Standard Error, t-Values and Odds Ratios (adjusted) for Undernutrition

Categorical Variables (Independent variables)	Beta Coefficients	Standard Error	Computed t - values	Odds Ratios
HH Children:				
0 – 1 (R.C.)	.0000	-	-	1.00
2 – 3	.3473	.2910	1.1935*	1.12
4 – 5	.9376	.4167	2.2501	2.55
6+	1.5240	.6068	2.5115	4.59
HH Size:				
1 - 3 (R.C)	.0000	-	-	1.00
4 – 5	.5878	.3051	1.9266	1.50
6+	1.5030	.4077	3.6865	4.50
Marital Status:				
Dissolved	.0000	-	-	1.00
Married	.8190	.3291	2.4886	2.27
Religion:				
Christian (R.C.)	.0000	-	-	1.00
Moslem	.5567	.2094	2.6585	2.27
Ethnic Group:				
Amara (R.C.)	.0000	-	-	1.00
Oromo	.6724	.3591	1.8725	1.96
Age of Heads:				
15-34 (R.C.)	.0000		-	1.00
35-54	.1114	.2903	.3837*	1.12
55+	.2317	.2414	.9598*	1.26
Education:				
Primary 4 + (R.C.)	.0000		-	1.00
Primary 1 - 3	.0455	.3264	.1394*	1.05
None	.3812	.2798	1.3624	1.46
Wives:				
Female Heads(R.C.)	.0000		-	1.00
One wife only	.7418	.3039	2.4409	2.10
two and more wives	.4788	.4216	1.1357*	1.6141
Farming Sector:				
Private Holdings(R.C.)	.0000		-	1.00
Cooperatives	.3895	.2018	1.9301	1.40

Note: 1. R.C. = Reference Category

2. Figures with asterisks are not significant at 5 percent level and the rest are significant at 5 percent level.
3. HH Children = Children less than 15 years of age in each household.

The findings with respect to religions and ethnic composition appear to be striking in which Moslem households who are also mostly from the Oromo ethnic group experienced 2.3 times more likely to be undernourished as compared with their Christian counterparts who are mostly from the Amhara ethnic group. This could be explained by the fact that most of the Oromo/ Moslem households resettled from the lowlands to the newly established villages during the villagization programme as private farming households and allocated relatively smaller per-capita land as compared with the land allocated to the co-operative households who were mostly Christians/ Amharas .

Demographic Correlates of Malnutrition

The Logistic Regression Model was also applied to investigate the Demographic Correlates of malnutrition. As presented in Appendices A and B, the dependent variables were weight-for-age (underweight) and height-for-age (stunting) and the results of the model are summarized in Appendices A and B respectively with their corresponding independent variables. The interpretation of the odds ratios are similar to Table 6.

When underweight is considered as a dependent variable, the prevalence of short term malnutrition appears to be significant for the following independent variables:

- when the age of the child is between 12-23 months with an odds ratios of 1.90 as compared with the reference category;
- when the child depends on breast-feeding alone during 12-23 and 24 months and over with odds ratios of 3.17 and 4.88 respectively;
- households of four members and above with an odds ratio of 1.92;

- when mothers' religion is Moslem with an odds ratio of 2.23; and

- when the child does not live with his/her mother (i.e., either mothers live elsewhere or dead) with an odds ratio of 2.49.

With respect to stunting, the most significant correlates appear to be the following independent variables:

- mothers of dissolved marriages with an odds ratio of 2.71 as compared with those having intact marriages;

- Moslem mothers with an odds ratio of 1.39; and

- children from polygamous households with odds ratios of 2.75 and when both parents alive with an odds ratio of 2.32.

In light of the results in Appendices A and B, an attempt was made to investigate a model that best fits by forward selection and backward elimination procedures and the results are summarized in Table 7.

As shown in Table 7, the final model manifests that parents' residence status (i.e., whether parents of the child were living at home, living elsewhere, dead or the child is from polygamous households); the weaning status of the child (whether the child is still breast-fed or not) and duration of breast-feeding (i.e., period when the child depends on his/her mother's milk without any solid supplement) appear to be the most important correlates of long term malnutrition.

With respect to stunting, mother's religion and duration of breast-feeding seem to manifest important correlation. This Table indicates that the higher the duration of dependency on breast-feeding alone, the more serious the magnitude of malnutrition tends to be. Furthermore, the

more the child depends on solid food alone, the higher the prevalence of malnutrition. Regarding religious affiliation, children of Moslem households appear to experience higher degree of malnutrition than their Christian counterparts.

This appears to be an interesting finding which is consistent with the findings in Table 6. The Moslem households who are also from the Oromo ethnic group appear to have faced relatively higher levels of undernutrition than their Christian counterparts. Naturally, children of the Moslem/ Oromo households are likely to be more malnourished than the children of their Christian counterparts. This could largely be explained by the differentials in land allocation and availability of milk for children among the two religions and ethnic groups. It was observed that the Christian households used to have more animals living in the same villages whereas the animal of the Moslem / Oromo households were left to stay in the lowland areas during the villagization programme.

APPENDIX - A

Logistic Regression Coefficients, Standard Errors, t-Statistic and Odds Ratios for Underweight as dependent variable

Variables	Regression Coefficient	Standard Error	t- statistic	Odds Ratios
Birth Order:				
4+ (R.C.)	.0000	-	-	1.00
1-3	.4031	.2457	1.6406	1.50
Siblings:				
0-4 (R.C.)	.0000	-	-	1.00
5+	.2368	.2471	.9583	1.27
Sex				
Male (R.C.)	.0000	-	-	1.00
Female	.1846	.1734	1.0646	1.20
Age of child:				
<12 (R.C.)	.0000	-	-	1.00
12-23	.6419	.6113	1.0501*	1.90
24-35	-.0482	.6341	-.0760	1.05
36+	-.3343	.6689	-.4998	1.40
Weaning Status:				
None (R.C.)	.0000	-	-	1.00
Partial	.1271	.3445	.3689	1.14
Fully	.0658	.4045	.1627	1.07
Duration of Breastfeeding:				
<12 (R.C.)		-		
12-23	.0000	-.5428	-	1.00
24+	1.1540	.5576	2.1260*	3.17
	1.5860		2.8443*	4.88
HH Children:				
0-1 (R.C.)	.0000	-	-	1.00
2-3	.0197	.4618	.0427	1.02
4+	.0108	.5140	.0210	1.01
HH Size:				
2-3 (R.C)	.0000	-	-	1.00
4+	.6513	.4295	1.5164*	1.92
Marital Status:				
Dissolved (R.C.)	.0000	-	-	1.00
Married	.0416	.4268	.0975	1.04

Religion:				
Christian (R.C.)	.0000	-	-	1.00
Moslem	.8017	.1968	4.0737*	2.23
Ethnic:				
Oromo (R.C.)	.0000	-	-	1.00
Amhara	.1965	.4500	.4367	1.22
Education:				
Primary 4+ (R.C.)	.0000	-	-	1.00
Primary 1-3	.0202	.4025	.0502	1.02
None	.2816	.3449	.8165	1.33
Age of mother				
20-29 (R.C.)	.0000	-	-	1.00
15-19	.1672	.3992	.4188	1.18
30+	.2791	.2301	1.2130	1.32
Parents' Status				
Mother present (R.C.)	.0000	-	-	1.00
Both present	.0227	.3672	.0618	1.02
Polygamous HH's	.0426	.4284	.0994	1.04
Mother Absent	.9128	.6455	1.4141*	2.49

Note: 1. R.C. = Reference Category
2. Figures with asterisks are significant at 5 percent level.

APPENDIX – B

Logistic Regression Coefficients, Standard Errors, t-Statistic and Odds Ratios for stunting as dependent variable

Variables	Regression Coefficient	Standard Error	t-statistic	Odds Ratio
Birth Order:				
4+ (R.C.)	.0000	-	-	1.00
1-3	.1894	.2417	.7836	1.21
Siblings:				
5+ (R.C.)	.0000	-	-	1.00
0-4	.0466	.2396	.1945	1.05
Sex:				
Female (R.C.)	.0000	-	-	1.00
Male	.2488	.1688	1.4757	1.28
Age of Child:				
<12 (R.C.)	.0000	-	-	1.00
12-23	.7483	.5485	1.3643	2.11
24-35	.3980	.5699	.6984	1.49
36+	.6931	.6038	1.1479	2.00
Weaning Status:				
None (R.C.)	.0000	-	-	1.00
Partial	.0653	.3264	.2001	1.07
Fully	.3041	.3916	.7766	1.36
Duration of breastfeeding:				
<12 (R.C.)				
12-23	.0000	-	-	1.00
24+	.5005	.4775	1.0482	1.65
	.4840	.4697	1.0304	1.62
HH Children:				
4+ (R.C.)	.0000	-	-	1.00
1-3	-.0688	.2277	-.3022	1.07
HH Size:				
4+ (R.C.)	.0000	-	-	1.00
1-3	-.1070	.4183	-.2558	1.11
Marital Status:				
Married (R.C.)	-.0000	-	-	1.00
Dissolved	.9973	.4301	2.3188*	2.71
Religion:				
Christian (R.C.)	.0000	-	-	1.00
Moslem	.3265	.1914	1.7059	1.29

Ethnic:				
Amhara (R.C.)	.0000	-	-	1.00
Oromo	.-0851	.4400	-.1934	1.09
Education:				
Primary 4+ (R.C.)	.0000	-	-	1.00
Primary 1-3	.4098	.3901	1.0505	1.51
None	.3687	.2813	1.3107	1.45
Age of Mother				
30+ (R.C.)	.0000	-	-	1.00
20-29	.0950	.2246	.4230	1.10
15-19	-.3256	.4452	-.7314	1.38
Parents' Residence Status:				
Mother present (R.C.)				
Both Present				
Polygamous HH's	.0000	-	-	1.00
Mother absent	.8435	.4322	1.9516*	2.32
	1.0130	.3753	2.6992*	2.75
	.7653	.6713	1.1397	2.15

Note: 1. R.C. = Reference Category
2. Figures in asterisks are significant at 5 percent level

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