East African Journal of Sciences (2019) Volume 13 (1) 81-88

Prevalence of Protein-energy Malnutrition in Children under Five Years of Age Admitted to Pediatric Wards at Asella Referral and Teaching Hospital, Arsi Zone, Oromiya, Ethiopia

Beshir Shaku Beriso

Department of Statistics, Haramaya University, P. O. Box 138 Dire Dawa, Ethiopia

Abstract: Malnutrition is a serious problem in Ethiopia as a result of which there is a high rate of mortality of children under the age of five years. The main objective of this paper is, therefore, to identify the prevalence of protein energy malnutrition and determine factors contributing to it for children under the age of five years that were admitted to Asella Referral and Teaching Hospital in Arsi administrative zone, central Ethiopia. Data were collected from 367 sample households selected randomly from a total of 6554 respondents. The data were analyzed using descriptive statistics and binary logistic regression model. The results revealed that 12%, 46% and 14% children were underweight, stunted and wasted, respectively. This implied that there is less severe problem form of protein energy malnutrition status. It was also found that sex of children, educational level of parents, distance of work place of caregiver from home, age of children, age of caregiver, marital status, family size, and family income were predictors of protein energy malnutrition. In addition, educational level of parents and economy of parents were important components for ensuring good nutritional of children. Therefore, improving parents' economy and literacy of the community (especially female literacy) is instrumental in minimizing protein energy malnutrition for under five-year children. Moreover, it is advisable if nutritional status of children be assessed periodically to monitor the situation and to take appropriate measures for combating and preventing malnutrition in children.

Keywords: Binary Logistic Regression; Nutritional Status; Protein Energy Malnutrition.

1. Introduction

Protein-energy malnutrition is manifested primarily by inadequate dietary intakes of protein and energy, either because the dietary intakes of these two nutrients are less than required for normal growth or because the needs for growth are greater than can be supplied by what otherwise would be adequate intakes (Kliegman, 2011). The term protein energy malnutrition includes a wide spectrum of malnutrition primarily affecting children in developing countries (infants, preschool). The severe clinical forms are marasmus, kwashiorkor and mixed feature called marasmic-kwash. The milder forms like stunting (chronic form), wasting (acute form) of malnutrition are highly rampant in developing countries (Kariuki *et al*., 2002).

Globally, protein energy malnutrition continues to be a major health burden in developing countries and the most important factor for illnesses and diseases especially among young children. The WHO estimates that about 60% of all disease occurring among children aged less than five years in developing countries, could be attributed to malnutrition (Faruque *et al*., 2008; Mullero, 2005). The improvements of nutrition, therefore, is the main prerequisites for the reduction of high infant and under five mortality rate, the assurance of physical arouse, social and mental development of children as well as academic achievements (Gernaat, 2008). Sub-Saharan Africa bears the brunt of protein energy malnutrition in the world. On average the protein energy malnutrition associated mortality in sub Saharan Africa is between 25% and 35% (Medhyg, 2004; Rutherford and Mahan, 2005).

Protein energy malnutrition is mostly common and kwashiorkor is prevalent in children under five years of age whereas marasmus is common in children less than 12 month of age (Kariuki *et al*., 2002). Under nutrition is a serious public health problem facing children worldwide particularly developing countries and the causes are multi factorial. The data from WHO showed that about 6% of all deaths occurring among children aged less than five years in developing countries could be attributed to under nutrition. In addition to this, WHO estimated that 226 million children are stunted, 67 million are wasted and 183 million are under weight (Tadesse, 2005; Yamane and Daman, 2006).

Malnutrition in children under five years is a devastating and costly public health problem associated with high morbidity and mortality in the developing world. Malnutrition impairs growth and development in children, delays recovery from disease and injury, predisposes to infections and also reduces wellbeing (Abdulkarem and Jasim, 2009). Globally, 148 million under-fives in developing regions are underweight for their age (Kamau *et al*., 2002). In children under five years of age, just over 2 million deaths are directly attributed to stunting, severe wasting, and restricted intrauterine growth, and about 1 million to vitamin A and zinc deficiencies. And again about one-third an estimated 178 million children under age five living in developing countries have stunted growth. In line with

*Corresponding Author. E-mail: beshirshk2@gmail.com

ISSN 1993-8195 (Online), ISSN 1992-0407(Print)

this, stunted growth is the most important risk factor for illness and death with hundreds of millions of pregnant woman and children are particularly affected by nutritional status (Lisa *et al*., 2011; WHO, 2004). Malnutrition continues to be a major health problem through developing world particularly in southern Asia and sub Saharan Africa (WHO, 2004). Most studies show that children under the age of five are the worst affected by malnutrition in developing countries. This is because of children of this age require a lot of nutrients not only to grow but also to build immunity against disease (Anwar *et al*., 2010).

Protein energy malnutrition affects every fourth child worldwide, 150 million (26.7%) are underweight while 182 million (32.5%) are stunted. Geographically more than 70% of protein energy malnutrition children live in Asia, 26% in Africa and 4% in Latin America and Caribbean. Their flight will have begun even before birth with a malnourished mother (Israt Rayhan and Sekander, 2006; Sununtar, 2005).

In Ethiopia child malnutrition is an enormous challenge since as the country had a 10.4 % under-five mortality rate in 2009, of which the majority was linked to severe and mild to moderate malnutrition (MoFED, 2002; UNICEF, 2010). According to Ethiopian Demographic and Health Survey in 2016 reports, the stunting (chronic malnutrition) and underweight (chronic and acute malnutrition) in children less than five years of age were 47% and 38%, respectively (CSA, 2012). In addition to this, in Ethiopia child malnutrition rate is one of the most serious public health problems and the highest in the world (Margaret and Yaguett, 1976; Zewditu *et al*., 2001). Although, the prevalence of child malnutrition in Ethiopia shows that, 51%, 47% and 11% of under five-year children are stunted, underweight and wasted respectively and protein energy malnutrition is the major cause of child mortality and is responsible for 85% of under-five mortality (Deriak and Jellife, 1999; Gugsa, 2000).

While the problem of malnutrition in Ethiopia is relatively well documented, its specific determinants are not well understood. To reduce malnutrition one must understand causes of child malnutrition and factors affecting them significantly impairs growth and development in children, delays recovery from disease and injury, predisposes to infections and also reduces wellbeing in particular and economic growth of countries like Ethiopia in general. Most previous studies conducted on prevalence and factors of malnutrition status of under five children in different countries used descriptive statistics and chi-square test of association. However, applying descriptive statistics is only used to summarize the information in short form and chi-square test also used to identify the association between the dependent variable and independent variables. However, the current study used descriptive statistics to identify demographic characteristics, socio-economic characteristics, perception of respondents on nutritional status of under five children, and binary logistic regression model to determine factors affecting protein energy malnutrition of under five year children in selected area. The main objectives of this study were, therefore, to assess the prevalence of protein energy malnutrition and the factors associated thereof for under five-year children at Asella Referral and Teaching Hospital.

2. Data and Methodology

2.1. Source of Data

The 2016/17 assessment of the prevalence of protein energy malnutrition on under five-year children admitted to pediatric wards survey of Asella Referral and Teaching Hospital was used in this study. The data were collected to provide basic information on the protein energy malnutrition status of under five-year children admitted to pediatrics wards in the Hospital. The survey was conducted by the Asella Referral and Teaching Hospital in 2016-2017. For the purpose of sample selection, simple random sampling technique was adopted to select a representative sample. Finally, after cleaning the data based on relevant variables, this study selected a total of 367 out of 6554 respondents.

The sample size was obtained using the following formula:

$$n = \frac{(Z_{\alpha/2})^2 P(1-P)}{d^2} \quad (1)$$

$$n_f = \frac{n}{\left(1+\frac{n}{N}\right)} \quad (2)$$

Where: d is some margin of error to tolerate in estimation; p is the proportion of protein energy malnutrition status (stunting under five year children); q is the proportion of non-stunting children; N is total number of children admitted in Hospital; n is sample of selected children using simple random sampling and n_f is the sample size calculated based on the total number of children admitted; Z is the value of standard normal distribution for a given level of significance (α). In fixing this sample sizes at $\alpha = 0.05$, $P = 0.40$ were used. The value of P was taken from Ethiopian Demographic and Health Survey in 2017 that the prevalence of stunting was 40%.

2.2. Methods of Data Analysis

The methods of data analysis used for this particular study were descriptive statistics for describing general characteristics of the respondents. The dependent variable is protein energy malnutrition status of children for binary logistic model, which is categorized as malnourished and not- malnourished.

The independent variables included in model are age of child, sex of child, number of siblings, age of caregivers, marital status of caregiver, religion, caregiver distance of work place from home, family income, educational status of parents and family size.

2.2.1. Logistic Regression Model

Logistic regression analysis extends the techniques of multiple regression analysis to research situations in which the dependent variable is categorical like malnourished/non-malnourished (present/absent). Logistic regression allows one to predict a discrete outcome, such as group membership, from a set of independent variables that may be continuous, discrete, dichotomous, or a mix of any of these. Generally, the dependent variable for this study is binary which is malnutrition status (malnourished/not-malnourished). Logistic regression is much more relaxed and flexible in its assumptions than multiple regression analysis. Unlike the multiple regression analysis, the logistic regression does not have the requirements of the dependent variables to be normally distributed, linearly related, nor equal variance with in each group. Logistic regression has a peculiar property of easiness to estimate logit differences for data collected both retrospectively and prospectively and this has contributed a lot to its importance in application areas (Tabachnik and Fidell, 2001).

There are two main uses of logistic regression: Firstly, to predict the group membership. Since logistic regression calculates the probability of success over the probability of failure, the results of the analysis are in the form of an odds ratio. Secondly, logistic regression also provides knowledge of the relationships and strengths among the dependent and independent variables.

The assumptions of logistic regression are: firstly, the dependent variable must be categorical, the groups must be mutually exclusive and exhaustive; a case can only be in one group and every case must be a member of one of the groups. Secondly, the independent variables need not be interval, nor normally distributed, nor linearly related, nor of equal variance within each group (Polit, 1996; Agresti, 1990).

The dependent variable in logistic regression is usually dichotomous, that is, the dependent variable can take the value "1" with probability of being malnourished/presence of PEM" π_i "or the value 0 with probability of being not- malnourished/absence of PEM" $1-\pi_i$ ". For example, binary (dichotomous), but logistic regression analysis does not model this outcome directly. Rather, logistic regression analysis is based on probabilities associated with the values of Y. We assume that Y is dichotomous, taking on values of 1 (that is, positive outcome, or success) and 0 (that is, negative outcome, or failure).

The probability proportion of $Y_i = 1$ is defined as $\pi_i = p(Y_i = 1/X_i)$ and $Y_i = 0$ is defined as $1-\pi_i = p(Y_i = 0)$. Because of the reasons discussed above, the logistic regression model was used in order to address the issues under objectives of this study effectively. The logistic model is defined as; let $Y_{n\times 1}$ be a dichotomous outcome random variable with categories 1 (malnourished) and 0 not-malnourished children. Suppose $X_{n\times(p+1)}$ denote the collection of $p-$predicator variables of $\mathbf{Y}$, where,

$$\begin{bmatrix} 1 & x_{11} & x_{12} & x_{13} & \cdots & x_{1p} \\ 1 & x_{21} & x_{22} & x_{23} & \cdots & x_{2p} \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ 1 & x_{n1} & x_{n2} & x_{n3} & \cdots & x_{np} \end{bmatrix}$$

X is called regression matrix and without the loading column of 1's is termed as predictor data matrix. Then, the conditional probability that a child can be malnourished given the X set of independent variables is denoted by $p(Y_i = 1/X_i) = \pi_i$. The expression π_i has the form:

$$\pi_i = \frac{e^{\beta_o+\beta_1 X_1+\dots+\beta_p X_p}}{1+e^{\beta_o+\beta_1 X_1+\dots+\beta_p X_p}} = \frac{e^{X\beta'}}{1+e^{X\beta'}} \tag{3}$$

Where: π_i is the probability of child i being malnourished, Y_i is the observed nutritional status of i children's, $\beta \approx (p+1)\times 1$ is a vector of unknown coefficients. The model given in equation (3) is logistic regression model. The relationship between the independent and dependent variable is not a linear function in logistic regression; instead, the logit transformation of equation π_i yields the linear relationship between the independent and dependent variables. The logit transformation of π_i is given as follows:

$$\text{logit}\,[\pi_i] = \log\left[\frac{\pi_i}{1-\pi_i}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_p X_p \tag{4}$$

Where: Y_i is the dependent variable which is dichotomous taking the value of 1 if child is a malnourished or 0 otherwise. β_0 is the constant term, X_i is an independent variable, i=1,2,…,k; $\beta_1, \beta_{2,\dots}, \beta_p$ are the coefficients of independent variables.

The maximum likelihood and non-iterative weighted least squares are the two estimation methods used in fitting logistic regression model (Hosmer and Lemeshaw, 1989). When the assumption of normality

of the predictors does not hold, the non- iterative weighted least squares method is less efficient (Maddala, 1997).
In contrast, the maximum likelihood estimation method is appropriate for estimating the logistic model parameters due to its less restrictive nature of the underlying assumptions (Hosmer and Lemeshaw, 1989). Hence, in this study the maximum likelihood estimation technique is applied to estimate parameters of the model. Consider the logistic model $\pi_i = \frac{e^{X\beta'}}{1+e^{X\beta'}}$. Since observed values of Y say, $Y_i's\ (i=1,2,...,n)$ are independently distributed as Bernoulli with parameter π_i, the maximum likelihood function of Y is given by:

$$L(\beta(Y)=\prod_{i=1}^{n} P\left(Y_i \middle| X_{i1}, X_{i2} \dots X_{ip}\right)=\prod_{i=1}^{n}\left[\frac{e^{X_i\beta'}}{1+e^{X_i\beta'}}\right]^{Y_i}\left[\frac{1}{1+e^{X_i\beta'}}\right]^{1-Y_i} \quad (5)$$

Where: $\beta' = (\beta_1, \beta_2, ..., \beta_p)$
The objective of stating likelihood function is to get an estimator $\hat{\beta} = (\hat{\beta}_0,\ \hat{\beta}_1 ..., \hat{\beta}_p)$ of β which maximizes the likelihood function expressed in equation (5). Since the likelihood equations are non-linear in the parameters, the Newton-Raphson iterative maximum likelihood estimation method that expresses $\hat{\beta}$ at the $(u+1)^{th}$ cycle of the iteration is expressed as $\hat{\beta}_{u+1} = \hat{\beta}_u \left(X'\hat{V}_u X\right)^{-1} X R_u$, where $u = 0,1,2,...$ and $\hat{V}$ is a diagonal matrix,

$$\hat{V} = diag\left[\hat{\pi}_i(1-\hat{\pi}_i)\right] = Cov(Y) \quad (6)$$

with its diagonal elements $X_i = 1$. Finally, $\hat{\beta}$ is the resultant maximum likelihood estimator of β with residual $R = Y - \hat{Y}$. Newton's method usually converges to the maximum of the log-likelihood in just a few iteration unless the data are especially badly conditioned (Hosmer and Lemeshaw, 1989).
Wald Statistic: It is a way of testing the significance of particular independent variables in a statistical model. In logistic regression we have a binary outcome variable and one or more independent variables. For each independent variable in the model there was an associated parameter. The Wald test, described by (Polit, 1996; Agresti, 1990) is one of a number of ways of testing whether the parameters associated with a group of independent variables are zero. If for a particular independent variable of wald test is significant, then we would conclude that the parameters associated with these variables are significantly different from zero, so that the variables should be included in the model. If the Wald test is not significant then these independent variables can be omitted from the model. Wald χ^2 statistics are used to test the significance of individual coefficients in the model and are calculated as follows:

$$Z = \frac{\hat{\beta}_j}{SE(\hat{\beta}_j)} \quad (7)$$

Each Wald statistic is compared with a χ^2 distribution with 1 degree of freedom. Wald statistics are easy to calculate but their reliability is questionable, particularly for small samples. For data that produce large estimates of the coefficient, the standard error is often inflated, resulting in a lower Wald statistic, and therefore the independent variable may be incorrectly assumed to be unimportant in the model (Bewick *et al.*, 2005).

Likelihood-Ratio Test: An alternative and widely used approach to testing the significance of a number of independent variables is to use the likelihood ratio test. This is appropriate for a variety of types of statistical models. The likelihood ratio test is better, particularly if the sample size is small or the parameters are large (Polit, 1996; Agresti, 1990). The likelihood-ratio test uses the ratio of the maximized value of the likelihood function for the full model (L_1) over the maximized value of the likelihood function for the simpler model (L_0). The likelihood-ratio test statistic equals:

$$-2\log\left(\frac{L_o}{L_1}\right) = -2[\log(L_o) - \log(L_1)] \quad (8)$$

It is compared with a χ^2 distribution with p-k degree of freedom, where p and k are the parameters of simpler model and full model, respectively. This log transformation of the likelihood functions yields a chi-squared statistic.
As mentioned above, the binary logistic regression was used to analyze the determinant variables that affect prevalence of protein energy malnutrition status in selected area.

3. Results

3.1. Demographic Characteristics of the Respondents

Results of the study show that out of the 367 selected children, 61% were protein energy malnourished whereas 39% were not malnourished. Similarly, results revealed that 49% are male and 51% are female. With respect to marital status, 66% of them were married, 12% were single, while 22% were either widowed or divorced. In terms of parents educational status, about 28% of the respondents were uneducated, 25% can read and write, 30% attained primary school, while 17% were above secondary school. The average family size in the study area is 12.30 with standard deviation of 73.64. The study also illustrates that mean age of the children is 26.10 months with standard deviation of 13.70, whereas the mean age of the caregiver is 31.57

years with standard deviation of 6.46. The ethnic composition of the sample households includes 65% Oromo, 28% Amhara, and 7% belongs to other ethnic group. On the other hand, the distribution of religion from sample households shows that 38% are Orthodox, 44% are Muslim, and 18% belongs to other religion groups.

The distribution of the classification of World Health Organization (WHO) standard curve, weight for age, revealed that 12% were underweight children while marasmic, marasmickwash and kwash were not diagnosed. With respect to the classification of height for age, 46% of children were stunted, of which 24% were mild stunted, 14% moderate stunted and 8% severe stunted. In terms of weight for height, about 9% children were wasted. Among the wasted children 6% were mild wasted, 5% moderate wasted and 3% severe wasted. The results of the classification of weight for height also show that 7% of them were moderately malnourished, whereas 2% severely malnourished children. When we take measurement of upper arm circumference (MUAC) into consideration, results indicate that 31% were moderately malnourished and 5% severely malnourished children (Table 2).

Table 1. Descriptive statistics of demographic characteristics of respondents.

Demographic characteristic	Category/measure	Value/percent
PEM status	Malnourished	61%
	Not malnourished	39%
Sex of children	Male	49%
	Female	50%
Age of children in month	Mean	26.10
	Standard deviation	13.70
Age of caregiver in year	Mean	31.57
	Standard deviation	6.46
Family size	Mean	12.30
	Standard deviation	73.64
Family income	Mean	1070
	Standard deviation	988
Educational Status	Uneducated	28%
	Can read and write	25%
	Primary school	30%
	Secondary School	11%
	Prep. and higher level	6%
Ethnicity	Oromo	65%
	Amhara	28%
	Others	7%
Religion	Muslim	44%
	Orthodox	38%
	Protestant	18%
Marital status	Married	66%
	Single	12%
	Divorced and Widowed	22%

Table 2. The prevalence of protein energy malnutrition of under five year children.

WHO Standard curve	Status/ Category	Count	Percent (%)
Weight for age	Normal (>80%)	322	88
	Marasmic (<60%, edema absent)	-	-
	Marasmickwash(60-80% with edema)	-	-
	Kwash (<60% with edema)	-	-
	Underweight(60-80% with no edema)	45	12
Height for age	Normal (95%)	200	55
	Mild stunting (90-95%)	87	24
	Moderate stunting (85-90%)	50	14
	Severe stunting (<85%)	30	8
Weight for height	Normal (>90%)	315	86
	Mid wasting (85-90%)	23	6
	Moderate wasting (75-85%)	17	5
	Severe wasting (<75%)	12	3
MUAC	Normal (>12.5 cm)	235	64
	Moderately malnourished (11.5-12.5 cm)	115	31
	Severely malnourished (11.5 cm)	18	5

3.2. Factors affecting PEM status of under five-year children admitted to pediatric wards

Factors hypothesized to affect protein energy malnutrition status were sex of children, age of children, age of caregiver, educational level of caregiver, marital status of caregiver, number of siblings, family size, religion of caregiver, family income and distance of work place of caregiver from home. Finally, the model outputs of factors affecting protein energy malnutrition status of under five-year children are given in Table 3.

Results of binary logistic regression show that among proposed independent variables affecting protein energy malnutrition status, sex of children (female), age of children, age of caregiver or parents, educational level of parents (secondary school and above), marital status of caregiver (divorced and widowed), family size, family income and distance of work place of caregiver from home were found to be statistically significant in this study (Table 3). Accordingly, sex of children, educational level of caregiver, distance of work place of caregiver from home positively affect protein energy malnutrition status, whereas age of children, age of caregiver, marital status, family size, and family income negatively affect protein energy malnutrition status.

The result regarding the variable sex of child shows that female children are 1.684 times more likely malnourished as compared to male children, while the effects of the other variables are constant. The results also show that for an additional year in age of child and caregiver, the odds of malnourished children is lower by a factor of 1.075 and 0.956, respectively. This implies that older mothers or parents have more experience in child care than young mothers and are likely to find solutions to their problems. In line with this, education was grouped into four categories ranging from uneducated to those who have attended higher level (secondary school and above). The odds of being malnourished for uneducated caregivers were found to be 1.018 times higher than those attended secondary school and above. In terms of marital status, the odds of being malnourished for divorced and widowed caregivers were found to be 1.362 and 1.590 times that of those single caregivers (reference category), respectively.

Table 3. Factors affecting PEM status of under five year children admitted in pediatric wards.

Variables	Coef.	S.e	Z value	OR
Sex of child: 1=female	0.521	0.227	2.30	1.684**
Age of children	-0.072	0.107	-2.45	1.075**
Age of caregiver	-0.460	0.025	-2.37	0.956**
Educational level of caregiver				
2=Can read and write	0.101	0.320	0.32	1.107
3=Primary School	0.316	0.300	1.05	1.371
4=Secondary school & above	0.018	0.421	1.68	1.018*
Marital status of caregiver:				
2=Married	0.411	0.415	0.99	1.509
3=Divorced	-0.309	0.479	-1.72	1.362*
4=Widowed	-0.464	0.845	-1.76	1.590*
Number of siblings	0.120	0.086	1.40	1.127
Family size	-0.056	0.072	-2.35	0.946**
Religion of caregiver:				
2=Protestant	0.187	0.338	0.55	1.204
3=Orthodox	0.430	0.261	0.67	0.651
Family income:	-0.020	0.010	-2.33	1.020**
Distance of work place of caregiver from	0.027	0.021	1.66	1.027*
home Constant	1.278	0.772	1.66	3.591
Log likelihood = -230.18	LR chi2 (16) = 29.40	Prob > chi2 = 0.0214		

Note: **=Significant at 0.10; **= Significant at 0.05; S.e= Standard error; OR=Odds ratio*

Results show that an increase in family size by one decreases the odds ratio in favor of not malnourished by a factor of 0.946. One birr increment of family income, the odds of lowering malnourished of children increases by 1.020, when other variables remain constant.

4. Discussion

A number of related studies have been conducted in various parts of the world on the topic. The study conducted by (Abdulkarem and Jasim, 2009) stated that 22.33% of children were underweight, 31.98% were stunted while 4.35% of them were wasted. In addition, reports in Ethiopia shows that 25% were underweight, 25% were stunted and 9% were wasted children. Similarly, in Oromia region the prevalence of child malnutrition, as reports clarify, is that about 34.4% are underweight children of which 11% are severe underweight, 9.6% of them were wasted (2.4% severe wasted) while 41% were stunted (21.8% severe stunted) (CSA, 2012).

The study conducted in Gindhir hospital revealed that 32.3% were underweight children whilst 17.6% were marasmic, 10.6% were marasmickwash and 4.1% were kwashy children. The result of this study also expressed that 34.7% were stunted (14.4% severe stunted) whereas 42.4% were wasted (16.3% severely wasted) (Abdi *et al*., 2012). In line with this, the study conducted in Gimbi district, Oromia region shows that 32.4% children were stunted, 15.9% underweight and 23.5% wasted (Kebede *et al*., 2007). Although, the finding in Gobu Seyo district by (Gemede *et al*., 2014) on the prevalence of malnutrition of children age 36-72 months shows that 49% of children were stunted.

In contrary to this, the present study illustrated that 12% were underweight children while severe form of protein energy malnutrition (marasmic, marasmickwash and kwash) were not diagnosed or absent. The present finding also indicated that 46% were stunted with 8% severely stunted and 14% wasted with 3% severely wasted. With regard to the prevalence of underweight, the level found in the current finding (12%) is lower than the level reported 32.3%, 22.33%, 25%, 15.9% (Abdi *et al*., 2012; Abdulkarem and Jasim, 2009; CSA, 2012; Kebede *et al*., 2007) and the level of severe stunting found in the current study (8%) is less than the level reported 14.4%, 21.8% (Abdi *et al*., 2012; CSA, 2012).

According to the study conducted by (Fuad *et al*., 2017), the results show that the prevalence of stunting, wasting and underweight were 36.07% (11.44%, severe stunting), 14.43% (6.72%, severe wasting) and 23.63% (6.47%, severe underweight), respectively. Regarding the related factors of malnutrition status this study used chi-square test of association and the result revealed that age of child, sex of child, diarrhea infection, employment status of the mother, and household food security status were significant predictors of nutritional status of the children. The current finding is in agreement with this study regarding some predictors of nutritional status (sex of child and age of child); but, it contradicts with this study on the statistical model used and other predictors of malnutrition status. This finding in the study by (Fuad *et al*., 2017) used chi-square test of association whereas the present study applied logistic linear regression model which was employed to determine factors of protein energy malnutrition status and it is advanced than the earlier statistical model used. The finding of the present study revealed that age of caregiver, educational level of caregiver, marital status of caregiver, family size, family income and distance of work place of caregiver from home were other predictors of protein energy malnutrition.

On the other hand, study conducted by (Tsedeke *et al*., 2014), shows that the overall prevalence of malnutrition in the community was high with 43.6% of the children being underweight, 53.1% stunted, and 28.2% wasted. Prevalence of severe stunting, underweight and wasting were 2.50%, 0.30% and 0.80% respectively. This finding also applied logistic regression model to determine the predictors of malnutrition status and the results show that age of child and economic status of parents were significantly affect the malnutrition status of children in the selected area. The present study is in agreement with this finding regarding statistical model used and some predictors of malnutrition status (age of child and economic status of parents). But, it contradicts with this study concerning the other predictors of malnutrition status such as sex of child, age of caregiver, educational level of caregiver, marital status of caregiver, family size and distance of work place of caregiver from home were which are found to be determinants of protein energy malnutrition status.

As mentioned above, most previous studies have employed different methods of data analysis and revealed different results on the prevalence of malnutrition status. This difference of results might be attributed to the study period and study area.

5. Conclusions and Recommendations

The study has revealed that there is a low rate of malnutrition among children admitted in to Asella referral and teaching hospital. This diagnostic study revealed less severe form of protein energy malnutrition status (underweight, wasting and stunting) but severe form of protein energy malnutrition like marasmus, marasmickwash and kwash were absent. In addition, the study revealed that educational level of parents is an important component for ensuring good nutritional of children, which implied that higher education level of parents is instrumental in minimizing protein energy malnutrition. Similarly, the economy of parents is an essential component to reduce the malnutrition of under five-year children.

Based on the findings of this study, the recommendations or policy implications that can be drawn includes the right for education and achieving 100% literacy will definitely go a long way in improving the nutritional status of under five-year children. Also, improving economy of parents is important for enhancing nutritional status of under five-year children. Moreover, it is advisable if nutritional status of children be assessed periodically to monitor the situation and to take appropriate measures for combating and preventing malnutrition in children.

6. Acknowledgments

The author sincerely acknowledges Haramaya University, College of Computing and Informatics, Department of Statistics for allowing me to undertake this study with great encouragement and providing facilities for conduct of the research work. The author also indebted to management of Arsi University Asella Referral and Teaching Hospital for allowing me to have access to the pertinent medical registers from which the author extracted the data used in this study. Finally, the author is grateful to Central Statistical Agency (CSA) of Ethiopia for providing me with the necessary materials and for making the data ready for analysis.

7. References

Abdi A., Adeba A. and Wondu G. 2012. Assessment of prevalence of protein energy malnutrition among under five children. *Journal of Applied Science and Research* 1:*50-72*

Abdulkarem K. and Jasim A. 2009. Malnutrition in children admitted to Karbala pediatric Teaching Hospital: Prevalence and Associated Risk factors. *Journal of medical Science* 12(2):215-230.

Anwar, F., Thomson, A., and Riyadi H. 2010. High participation in Paysandú nutrition program improved children nutritional status. *Journal of food science and nutrition practice* 4(3):208-214.

Bewick V., Cheek L., and Ball J. 2005. Statistics review 14: Logistic regression. Critical care, Landon, England, 9(1): 112-118.

CSA (Central Statistical Agency). 2012. Ethiopia Demographic and Health Survey 2011. Addis Ababa, Ethiopia.

Deriak, B. and Jellife, M. 1999. Child nutrition in developing countries, Universities of West Indians, Jamaica, 1,118.

FAO (Food and Agriculture Organization). 2012. The state of food insecurity in the world 2012. Economic Growth is necessary but not sufficient to Accelerate Reduction of Hunger and Malnutrition (FAO) Rome, Italy 1-61.

Faruque, A., Ahmed A., and Hassan, M. 2008. Nutrition for healthy children and mother in Bangladesh. *Health popular* ;210-213

Fuad R., Gudina E., Adem k. 2017. Prevalence of Malnutrition among Children Aged 6-59 in Haramaya District, Oromia, Ethiopia. *Journal Biometry and Biostatistics* 8: 114-118.

Gemede F., Tolera G., Wirtu D. 2014. Prevalence of wasting and associated factors among preschool children in Gubo Sayo, East Wollega, Ethiopia: *Journal of Food Science and Quality Management* 28:125-135.

Gernaat H. Dechoring W. and Voorhees W.2008. Mortality in sever protein energy malnutrition at Nichelenge Zambia. *Journal of Trop pediatrics* 44(4):211-217

Gugsa Y., EJHD. 2000. Malnutrition among children in Southern Ethiopia, Levels and Risk factors 14(3): 283-292.

Hosmer, D.W. and Lemeshaw. 1989. Applied Logistic Regression, Wiley, Delhi.

Israt Rayhan. Md. and Sekander H. K. 2006. Factors Causing Malnutrition among under Five Children in Bangladesh, *Pakistan Journal of Nutrition* 5 (6): 558-562.

Kamau, T. F., Omwega, A.M. and Muita, J. W. 2002. Childcare practices and nutritional status of children age 0-2 years in Thika, Kenya. *East African Medical Journal* 79(10): 524-529.

Kariuki, F., Monari, J. and Kibui, M. 2002. Prevalence and risk factors of malnutrition 51:44–50.

Kebede E. 2007. Prevalence and Determinants of Child Malnutrition Gimbi district, Oromia Region, Ethiopia: An M.Sc. Thesis submitted to the graduate studies of Addis Ababa University, Addis Ababa.

Kliegman, B. (2011). Text books of pediatrics, 19th edition.

Lisa A.B., Belinda S.G., and Timothy C.C. 2011. Hospital Malnutrition: Prevalence, Identification and Impact on Patients and the Healthcare System. *International Journal of Environment and Res Public Health* 8: 514-527.

Maddala G.S. 1997. Introduction to Econometrics 2nd edition.

Margaret, C. and Yaguett, V. 1976. Manual on feeding children and infants, 2nd edition.

Medhyg, K. R.2004. Management of protein energy malnutrition in Nigeria, an evaluation of regimen at the kersey nutrition rehabilitation center, Nigeria. *Journal of food science* 88:594-599.

MoFED (Ministry of Finance and Economic Development). 2002. Development and Poverty Profile of Ethiopia. Welfare monitoring unit of Finance and Economic Development. Federal Democratic Republic of Ethiopia, Addis Ababa.

Mullero, K. 2005. Malnutrition and health in developing countries 173(3); 279

Polit C.V.1996 and Agresti P.R. 1990. Introduction to logistic regression 3rd edition.

Rutherford, G., and Mahan J. A. 2005. Prevalence of malnutrition and causes and rates of death and illness among dislocated persons in Gaza and in Habana provinces. *Journal of Trop pediatrics* 31:143-149

Sununtar, S. 2005. Child malnutrition as poverty indicator, an evaluation in the context of different development interventions in Indonesia.

Tabachnik, B. G and Fidell, L.S. 2001. Using Multivariate Statistics, Boston: Allyn and Bacon.

Tadesse B. 2005. Assessment of causes of malnutrition in Ethiopia.

Tsedeke W., Tefera B., and Tadesse B. 2014. Prevalence of under nutrition and Determinant Factors among Preschool Children in Hawassa, Southern Ethiopia. *Food Science and Quality Management* 20:65-72.

UNICEF (United Nations Children's Fund). 2010. Strategy for Improved Nutrition of Children and Women in Developing Countries, New York.

WHO (World Health Organization). 2004. United Nation children's fund joint statement on the management of acute diarrheal, Geneva.

WHO (World Health Organization).2004. Why have mortality rate for severe malnutrition remained so high?

Yamane B. and Daman H. 2006. Helmutic loos; epidemiology and ecology of health and diseases in Ethiopia, 1st edition: 330-371.

Zewditu *et al*, EJHD. 2001. Review of the status of malnutrition and trends in Ethiopia 15(2): 55-74.