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SURVIVAL ANALYSIS ON NUTRITIONAL STATUS OF CHILDREN UNDER FIVE YEARS

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ABSTRACT

Malnutrition in children is an important public health issue especially for developing countries like Nigeria. Weight-for-height (wasting), height-for-age (stunting) and weight-for-age (underweight) are three important parameters for assessing nutritional status in children. Malnutrition is estimated to contribute directly or indirectly to more than 33% of all child deaths globally. The aim of the study is to identify the prevalence of malnutrition in under five children, To develop a model that predict the prevalence of malnutrition in children of under five years, and To test the suitability of the model. A well-structured questionnaire was used to collect data from mothers and their children at Miri primary health care Centre at Bauchi. The software packaged that has been used to process data is SPSS version 21. the test of independence between the dependent variable (nutrition) and independent variable (age, sex, occupation of the father, occupation of mother, education status of the father,

Introduction:

Background of the study

Malnutrition in children is an important public health issue especially for developing countries like Nigeria. Weight-for-height (wasting), height-for-age (stunting) and weight-for-age (underweight) are three important parameters for assessing nutritional status in children. Malnutrition is estimated to contribute directly or indirectly to more than 33% of all child deaths globally (WHO 2016). Wasting implies that children are too thin for height, stunting indicates that children are too short for age while underweight means children are too thin for age. Malnutrition during childhood is the outcome of insufficient nutrient content,

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education status of the mother, age of the mother, types of breast feeding, immunization status, size of the households and birth order) was performed to verify whether they are statistically significant or not at 5% level of significance to the nutrition status of under-five children. A modified cox proportional hazard model containing all the predictor variable was fitted it was found that 52(28.4%) are stunted, 65(35.5%) are wasted and 66(36.1%) are underweight The study shows that various socio-demographic and health service covariates are significant determinants of malnutrition. Accordingly, the finding of the study show that age, sex, source of drinking water, mothers age, education status of the parent, occupation of the parent, age of the mother, immunization status, breast feeding practice, family size and birth order of the child have statistically significant effect on the outcome of the nutritional status of children under-five years of age. Finally, it has been recommended that access to education for both parent should be given due emphasis, and Children from mothers age range from 15-25 years are at the higher risk of malnutrition. Thus, educating women about the adverse effect of early marriage is of paramount importance.

Keyword: Malnutrition, Wasting, Stunting, Underweight and Children

diarrhea and other infections, lack of sanitation, and low parental education (Birara et al. 2014, Tibilla 2007). Poor diets and disease are due to food insecurity, inadequate maternal and child care, and poor health services and environment (UNAC 1997). These factors cause measurable adverse effects on body function and clinical outcome (WHO 2009). This problem leads to most of the anthropometric deficits found among children under age 5 in the world's least developed countries (WHO 1995). Despite existing interventions to address child malnutrition, it is still a major global public health problem (Akombi et al. 2017). Child malnutrition is an underlying cause for almost half (45%) of child deaths, particularly in low socioeconomic communities of developing countries (Black et al. 2013). Globally in 2018, an estimated 149 million children under age 5 were stunted and 49 million children were wasted (UNICEF 2019)

Wasting is usually below 5% in poor countries and prevalence of stunting is between 5%-65% (WHO, 2016). According to the recent National Demographic and Health Survey (NDHS) in Nigeria, 37% of children under-five are stunted, 18% are wasted and 29% are underweight (NDHS, 2015). In south east Nigeria,

marasmus is the most common form of protein energy malnutrition (PEM). A study in India reported that prevalence of underweight, stunting, and wasting is 60.4%, 55.4% and 43% respectively and is an indication of acute malnutrition in that population. Several factors have been associated with malnutrition such as Parental education, economic and nutritional characteristics, child feeding practices is important risk factors to severe underweight with children in developing countries. In Nigeria, a 10 year retrospective study in south east revealed that male children are more likely to be malnourished than female. Similarly, Yalew (2014) posited that sex of children is connected to malnutrition and prevalence of stunting was high among boys compared to girls. Similarly, a study in Uganda shows that male children are at increased risk of stunting. Yalew further shows that mothers with no formal education were 4 times more than mothers who had completed their primary education to have stunted children. A study in Maiduguri, Nigeria asserted that 80% of malnourished children were from low socioeconomic status. Lack of education especially among women is a strong determinant of malnutrition among children. The current national demographic and health survey in Nigeria shows that stunting is most common among children of less educated mothers (50%) and those from the poorest households (54%).

Age of child is associated with malnutrition. In Uganda, children aged between 3-24 months are at increase risks of suffering from acute malnutrition. Regional estimates of nutritional indices are usually not a reflection of the local estimate, hence, this study determine nutritional status of a selected population of under five children in Borgu Local Government of Niger state. This study will not only guide future studies, it will also provide a base line data for the local government. This will assist in planning nutritional support programs in the future.

Malnutrition is one of the biggest health problems that the world currently faces and is associated with more than 41% of the deaths that occur annually in children from 6 to 24 months of age in developing countries which total approximately 2.3 million. World Health Organization in 2001 reported that 54% of all childhood mortality was attributable, directly or indirectly, to malnutrition. Africa has a high prevalence of the different types of malnutrition, namely stunting, wasting and underweight.

Of the stunted 165 million children under 5 years in the world in 2011, 65 million were in Africa. Of the 53 million wasted children globally in 2011, 13.4 million were from Africa and of the 34 countries that accounted for 90% of global burden of malnutrition, 22 are in Africa (UNICEF; 2012, WHO; 2012, World Bank; 2012). Malnutrition contributes to nearly half of all deaths in children under 5years and is widespread in Asia and Africa. Between 2000 and 2016, stunting globally declined from 32.7% to 22.9%, and the number of children affected fell from 198 million to 155 million. In 2006, abouttwo out of every four stunted children lived in South Asia and one in three in sub Saharan Africa (UNICEF; 2017, WHO; 2017, World Bank; 2017).

Malnutrition is a medical condition which refers to deficiencies, excesses or imbalances in a person's intake of energy and or nutrients. (WHO; 2016).

Survival analysis is a branch of statistics for analysing the expected duration of time until one or more events happen, such as death in biological organisms and failure in mechanical systems it is often called as reliability theory or reliability analysis

The problem of analysing survival data, which is also called *failure time* data or *time-to-event* data, arises in many applied fields, such as medicine, public health, epidemiology, engineering and economics. A common feature of such data is that they usually contain censored observations. Censored data arise when the event for an individual is only known to occur in a certain time period. The most popular type of censoring is right censoring when the observed time is shorter than the actual failure time. There are other types of censoring, such as left censoring and interval censoring. Our focus in this research is on the case of right censoring.

Censoring In longitudinal studies is the exact survival time is only known for those individuals who show the event of interest during the follow-up period. For others (those who are disease free at the end of the observation period or those that were lost) all we can say is that they did not show the event of interest during the follow-up period. These individuals are called censored observations. An attractive feature of survival analysis is that we are able to include the data contributed by censored observations right up until they are removed from the risk set. The following terms are used in relation to censoring:

Right censoring: a subject is right censored if it is known that failure occurs some time *after* the recorded follow-up period.
Left censoring: a subject is left censored it it is known that the failure occurs some time *before* the recorded follow-up period. For example, you conduct a study investigating factors influencing days to first oestrus in dairy cattle. You start observing your population (for argument's sake) at 40 days after calving but find that several cows in the group have already had an oestrus event. These cows are said to be left censored at day 40.
Interval censoring: a subject is interval censored if it is known that the event occurs between two times, but the exact time of failure is not known. In effect we say 'I know that the event occurred between date A and date B: I know that the event occurred, but I don't know exactly when.' and in what time

In ordinary survival analysis, we only have one set of covariate. However, in survival analysis with a malnutrition fraction, we may have sets of covariates or multivariate In survival analysis, the most frequently used quantities are survival function $S(t)$, hazard function $m(t)$, cumulative hazard function $\Lambda(t)$ and probability density function $f(t)$. The basic quantity employed to describe the time-to-event phenomena is the survival function, which is defined as

$$S(t) = Pr(T > t) \quad (1.1)$$

Where T is a continuous random variable with probability density function (p.d.f) f(t) and cumulative distribution function (c.d.f) F(T) = Pr{ t< T), giving the probability that the event has occurred by duration t
And the other three quantities can be derived from the survival function, survival models are usually modelled through one of these quantities.

Statement of the Problem

Despite all efforts undertaken both nationally and internationally, poor nutritional status is still a fundamental cause of disease and shortened life-span. Most people are aware that many factors are either directly or indirectly responsible for under nutrition, including insecure food supply, lack of basic education, inadequate health services, deteriorated environment, low income,

and inadequate empowerment. The factors contributing to malnutrition vary from community to community. Stunted, underweight, and wasted children have an increased risk of death from diarrhea, pneumonia, measles, and other infectious diseases.

Thus to achieve this global target for 2025 in Nigeria, a situational analysis is required to determine how many children under age 5 are stunted and wasted and to assess key determinants of malnutrition in specific social and geographical locations (WHO 2018). This type of analysis will provide evidence for program intervention so that programmatic actions can be tailored to address the contextual needs in Nigeria

According to M. D. Sazedur Rahman et.al(2017) contributing factor of under five children malnutrition, he only consider the family income, proper diet during pregnancy period, proper diet maintain for children have negative significant effect on child malnutrition in Nigeria. While as an extension to his work, I want to consider the environmental factor and the child characteristics, in addition he used binary logistic for his analysis while am using proportional hazard so as to breach the gaps.

AIM AND OBJECTIVES OF THE STUDY

The aim of the study is to identify the factors that contribute to malnutrion, to provide possible solution, to develop a model that predict the prevalence and to test the suitability of the model. Through the following objectives

- To identify the prevalence of malnutrition in under five children
- To develop a model that predict the prevalence of malnutrition in children of under five years
- To test the suitability of the model

JUSTIFICATION OF THE STUDY

This study will help the health systems to detect malnutrition at an early stage so that appropriate measures could be taken to address the factors related to malnutrition and designing relevant and timely interventions with the view to reduce the incidence of malnutrition in under-five children in the country.

The result of the finding and determinations of the risk factors for the condition of malnutrition among under-five children may help the decision makers to

formulate appropriate policy and intervention guidelines aimed at combating these factors and improving the nutritional status of the under-five children in the Community.

Institutions need to have among their resource materials, such a useful research product, which could be used to upgrade their knowledge about the factors influencing malnutrition in under five children and as a result create more room for further research.

LITERATURE REVIEW

Nutritional status refers to the state of nurture of an individual or a specific group. The term refers specific nutrient or to a class of nutrients and many apply to either nutritional deficiency or excess. Nutritional status of a community attempts to map out the magnitude and geographical distribution of malnutrition as a public health concern and to identify and analyse ecological causes that are directly or indirectly responsible for such a situation and formulation of guidelines for improving nutrition and health status.

Malnutrition affects all groups with the general population but the problem is particularly significant among infants and young children worldwide. This is so because young children have increased nutritional needs for growth and development (Torun, 2006). Children under the age of five years are the most vulnerable and majority of those who are affected with malnutrition are in the developing world (Ashworth *et al.,* 2004).

Under nutrition is therefore a major threat to children's chances of survival as it hinders their optimal health, growth and development. It also increases the risk of infant child morbidity and mortality, diminished cognitive and physical development and impacts on child's future productivity in life (MOPHS, 2012).

Dietary supplements represent an important source of essential nutrients since they often contain 100%, or more of the daily value, of one or more nutrients (Ervin, *et. al.,* 2004; Radimer, *et. al.,* 2004). Individuals can be broadly categorized into having optimal nutritional status, or being undernourished, over nourished, and malnourished. It is important to realize that many other life style and environmental factors, in addition to nutrition, influence health and wellbeing, but nutrition is a major, modifiable and powerful factor in promoting health,

preventing and treating disease and improving quality of life (Hester, *et. al.,* 2002).

Goudet et al. (2016) showed that the effect of micronutrient supplements on malnourished children does not show a strong positive impact in low and middle-income countries. The African Union has established the New Partnership for Africa's Development (NEPAD), whose objectives include reducing hunger as well as improving nutritional development

Megha Mittal (2013) conducted a cross-sectional survey using both qualitative and quantitative data collection methods. The study involved interviews using a questionnaire for measurement of food nutrient intake, anthropometry observations of clinical signs of morbidities and assessment of their general knowledge, and awareness about health, nutrition and sanitation. The mean BMI of the women was found to be 21.12 ($\pm$3.7) kg/m^2 with 25% of them being underweight, and 16% being overweight or obese. The overall quality of food and nutrient intake was poor among all the food groups. Researcher felt that efforts are needed to improve diet quality and education for rural women so that they rise in economic status and are better nourished

Pascual (1971) analysed the influence of social and cultural factors on food habits and cause of malnutrition. He discussed the importance of socio-cultural factors like customs, beliefs, food habits and traditions that affect the nutritional status. According to him it is unfortunate that psychological, social and cultural factors, which create barriers against the change in food habits, are not understood properly, while many studies only focussed on the impersonal aspects of nutrition and malnutrition.

For the past two decades malnutrition has been the leading cause of morbidity and mortality in children below five years worldwide. 1 out of 3 (177 million) under five years children were found to be malnourished in 1990 (Torun & Chew, 1994) and by 2002, 199 million children were still suffering from malnutrition (Zere & McIntyre, 2003). In 2004, 55% of child deaths worldwide resulted from under nutrition (Caulfield *et al*., 2004). Again malnutrition contributed to 2.2 million deaths of children under five years old in 2008 (Black *et al.,* 2008) and in 2009 more than one third of all the children's deaths worldwide were caused by under-nutrition as well (UNICEF, 2009).

Sheetal et.al., (2013) analysed the age specific caries rates and found that malnutrition affects the oral health and a poor oral health in turn, may lead to malnutrition. This interdependent relationship, establishes good nutritional health as promoting factor in good oral health, and vice versa. Malnutrition may alter the homeostasis, which can lead to disease progression of the oral cavity, and reduce the resistance to the microbial bio-film, as well as the capacity of tissue healing. It may even affect the development of the oral cavity.

A study in Bangladesh showed that maternal pregnancy intentions are associated with child stunting, wasting, and being underweight. If this association is proved to be causal, preventing unwanted pregnancies may help to reduce the prevalence of childhood malnutrition in Bangladesh. An interesting study conducted in South India showed that maternal mental depression at the time of pregnancy or a low level of intelligence in mothers are significant factors of malnutrition in children. (Rahman MM, 2015)

As childhood malnutrition is a persistent problem in almost all countries, governments are always working to eliminate it through the implementation of various programs. (Reddy et al,2019)

When a child is overweight or obese, their cost of medical care increases significantly in the future. A study from Germany shows that for overweight children, their medical costs are ϵ27 higher than a child of normal weight, and for an obese child medical costs are ϵ62 higher.(Tebeje et al,2017)

Goisis A., Martinson M., Sigle W.(2019)In less developed and developing countries, it has been observed that wealthier families are more prone to being overweight than poor families because of their tendency to consume less nutritious, but expensive, fast food. On the other hand, in developed countries, migrant people who are relatively poor typically eat traditional, non-nutritious food, while affluent people choose healthy food.

Reddy et al.2019 showed that Ethiopia is a low-income country that has been struggling with childhood malnutrition for a long time. The country has set a target to eliminate malnutrition by 2030. They have implemented policies including the National Nutrition Strategy 2005-06, and the National Nutrition Policy 2008 with this target in mind, but there is still a long way to go to achieve this objective.

Semba,2016 stated that the United Nation's Programmes are concentrated on protein malnutrition. However, the problem of micronutrient deficiency, which is currently more acute, is not addressed by these measures. Through a systematic literature review

Mohseni et al.(2017) showed that socioeconomic factors such as gender, a father's occupation, and a mother's education level play a significant role in the nutrition level of children in Iran. According to this article, malnutrition has a negative impact on the body due to the imbalance of energy and other nutrients. Many studies focus on economic and social environments and their inequality as the most important reasons for malnutrition.

Zakaria et al.(2019) also reported that childhood malnutrition is positively correlated to birth order. This means that children with a higher birth order have a higher chance of being malnourished.

(Babatunde; 2011). That educated mothers are better aware about the nutrition requirements of their children and by providing improved health care. This study also revealed that education plays an important role to improve knowledge of medical and health care particularly mothers' education enhances more effective health care practices that increases their productivity and influence infant and child mortality.

Yadav (1999) conducted a cross sectional survey among tribal children of Bihar to assess the nutritional status and dietary intake. The result of the study reveals that intake of protein was broadly in line with recommended dietary allowances (RDA). However, the average intake of energy and other nutrients was lower as compared to RDA. Calorie deficiency was 38% whereas protein deficiency was about 19%. In conclusion author stated that nutritional status and dietary intake of tribal children is very poor and urgent remedial measures are required.

Willby and Werry (2012) in fully immunized children, suggesting that immunization not only helps to prevent specific disease of focus but also leads to overall improvements in health

Mehta (2000) studied the socio-demographic factors, diet and health profile of 320 elderly men and women of the three income groups of urban Baroda. Nutrient intake data of elderly men of all the income groups revealed lower consumption of carbohydrates, proteins, iron and beta-carotene, whereas fats

and vitamin C intakes were higher as compared to the RDA ($p < 0.05$). The study reveals striking differences in diet, health and disease profile with advancing age. Labada (2014) research in baha Manado health centre that the age of the mother does not affect the nutritional status of the child.

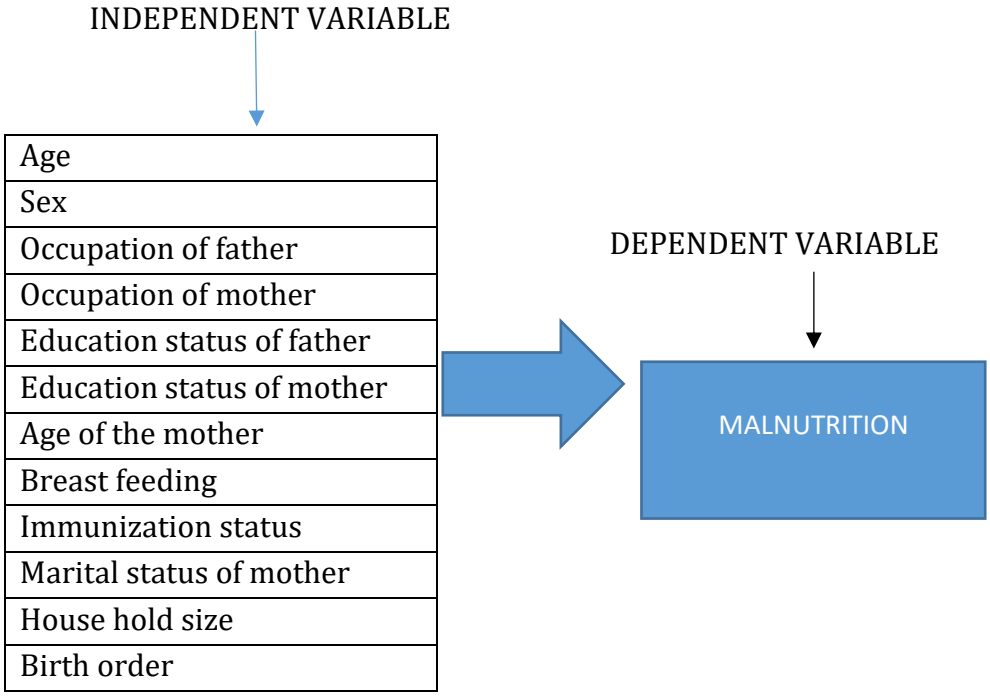
According to Parayato (2014) the older a person is the experience will increase so that he will increase his knowledge of an object .

World health organization (WHO 2016) estimate that 50% of malnourishment is associated with infection cause by unsafe water and inadequate sanitation.

CONCEPTUAL FRAME WORK

The following diagram illustrates the independent and the dependent variables. In this study, the factors responsible for malnutrition(age, sex, occupation of the father, occupation of mother, education status of the father, education status of the mother, age of the mother, types of breast feeding, immunization status, size of the households and birth order) will be considered to have or not responsible for malnutrition.

The indicators of malnutrition are the independent variable while the factors responsible for malnutrition is the dependent variable



INDICATORS OF MALNUTRITION

Underweight

A child is underweight when the weight is 15% to 20% below that normal for their age group. The child is underweight and undersize, while at the same time has relatively normal body proportions, weight-to-height ratios (Golden & Golden, 2000; Wittenberg, 2004). The underweight child is common and an important presentation of malnutrition, which is missed a lot of times. When a diet is insufficient in protein and/or energy there will be a slowing down of linear height, failure to gain weight or weight loss, and this is seen when the child is exposed to an acute food shortage. In the developing world, 129 million of children younger than five years are underweight and 10% are severely underweight. Progress has been slow and Kenya could not meet the MDGs with the prevalence being (20.3%) in 2009, whereas it was (21.2%) in 2000 (KNBS, 2010).

Stunting

This refers to reduced growth rate whereby height for age value is less than -2 standard deviations of the WHO child Growth Standards median (WHO, 2014). In infants and children younger than five years stunting is a greater problem than underweight and wasting usually an indicator of nutritional deficiencies or illness that occurred during times of growth and development (Shetty, 2002; UNICEF, 2009c). Stunting is the first clinical sign of malnutrition and it affects about 195 million children younger than five years in the developing world and about one in three children in Africa (Piercecchi Marti *et al.*, 2006). As of 2016 an estimated 25% children under 5years of age were stunted worldwide. More than 90% of the worlds stunted children live in Africa and Asia, where respectively 36% and 56% of children are affected (UNICEF and WHO, 2013).

Wasting

A child is moderately wasted when the weight for is less than –2 SD from the mean. If the child weight for height is less than 70% of the median and is equal to a standard deviation score of –3SD then the child is severally wasted (WHO, 2014).. Moderate and severe wasting represents an acute form of malnutrition and children suffering from wasting are at a greater risk of dying (Williams,

2005). In 2011, the proportion of children below the age of five years who were found to be wasted was about 52 million globally and 1 out of every 10 children in Africa (Liu *et al.*, 2012). In Nigeria the prevalence of wasting is at 4% (KDHS, 2016).

Signs and symptoms

Symptoms of malnutrition in children include; Slowing linear growth and Poor weight gain (Failure to grow at the expected rate, both in terms of weight and height), Behavioural changes (appearing unusually irritable, sluggish, anxiety, apathy, excessive crying, decreased social responsiveness and attention deficits), Changes in hair colour (Child's hair appears dull brown in color, thin, sparse and easily pulled out), Skin changes (The skin becomes dry and flaky and hair may turn dry, dull and straw like in appearance), Decreased subcutaneous tissue (the most affected are the legs, arms, buttocks and face), Muscle wasting and lack of strength in the muscles, limbs may appear stick like, Swelling of the abdomen and legs. This is caused due to lack of vital nutrients (Black Re *et al.,* 2008). These symptoms are seen in children with severe malnutrition.

Effects of malnutrition

Malnutrition generally affects the entire body, interfering with almost all body systems and functions and resulting in reduced functional capacity and body energy requirements

. Malnutrition impairs immune functions which may lead to presence of infection or liver dysfunction resulting in loss of appetite and fever. Low food intakes on the other hand weakens muscles and this may cause pathological changes of the heart resulting in longer circulation time thus reduced heart rate, blood pressure or even stroke (Torun, 2006).

RESEARCH GAP

Considering the above table most researchers focus on child caring practice and show less concern on child characteristic, environmental factor and socio-demographic factors

Data and Variable

This study used a structured questionnaire where the data were collected from the respondent parents at Miri PHC. SPSS version21 was used as statistical

package for analysis of the data. The data was collected on the nutritional status of children by measuring the height and weight of all the children under-five years of age which was used to calculate three anthropometrics indicators weight-for-age, height-for-age and weight-for-height. The nutritional status children was calculated using the new growth standards published by the World Health Organization (WHO) 2006

Explanatory variables are variables that are expected to potentially affect/determine the response/independent variables. Child characteristics, environmental condition, child caring practice and mother's characteristics are considered as the independent variable to develop the proportional hazard model (cox regression model). More generally, variables are listed in the following table. The data are analysed using SPSS package and the descriptive results are shown in the following tables.

DEPENDENT VARIABLES	CODE
nutritional status of children under-five years	1=stunted 2=wasted 3=underweight

INDEPENDENT VARIABLES	CODE
Age in months	1=0-11 2=12-23 3=24-35 4=36-49
Sex	1=male 2=female
Mode of delivery	1=normal delivery 2=caesarean section
Occupation of father	1=government work 2=non-government
Occupation of the mother	1=government work 2=non-government
Education status of the father	1=non formal 2=primary 3=secondary

	4=tertiary
Education status of the mother	1=non formal 2=primary 3=secondary 4=tertiary
Age of the mother in year	1=15-25 2=26-35 3=36-45 4=46above
Is the immunization status up to date	1=yes 2=no
How was the child feed in the first 6 month of life	1=exclusive breast feed 2=mixed
Marital status of the mother	1=single 2=divorced 3=monogamy 4=polygamy
Number of the member of the households	1=1-9 2=10-19 3=20-29 4=30above
Birth order of the child	1=1-9 2=10-19 3=20above
Mid arm circumference(MUAC)	1=1-11 2=11.1-12.5 3=12.6-13.5 4=13.6above

STATISTICAL MODEL

PROPORTIONAL *HAZARD MODEL DESCRIPTION*

$$m(t|x) = m_0(t)\exp(\beta x) \quad (1.1)$$

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where $m(t|x)$ is the *population* hazard function given covariate x; $m_0(t)$ is the *baseline* hazard function (i.e. the hazard function condition on $x = 0$) and $\exp(\beta x)$ is the multiplicative term with covariate x. In model (1.3),$m_0(t)$ is usually unspecified. The proportional hazards model has been extensively studied and applied in survival analysis since its origination and it is even treated as the corner-stone of modern survival analysis. As we see from the proportional hazards model, it is simply assumed that the covariate effects act multiplicatively on the hazard function

Note the *infinite dimensional* parameter $m_0(t)$.

$m_0(t)$ is called the **baseline hazard function**, and reflects the underlying hazard for subjects with all covariates $X_1,\ldots,X_p$ equal to 0 (i.e., the "reference group").

The general form is: $m(t|\mathbf{X}) = m_0(t)\exp(\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_p X_p)$

So when we substitute all of the X_j's equal to 0, we get:

$$m(t|\mathbf{X} = 0) = m_0(t)\exp(\beta_1 * 0 + \beta_2 * 0 + \cdots + \beta_p * 0) = m_0(t)$$

In the general case, we think of the i-th individual having a set of multivariates $\mathbf{X}_i = (X_{1i},X_{2i},\ldots,X_{pi})$, and we model their hazard rate as some multiple of the baseline hazard rate:

$$m_i(t) = m(t|\mathbf{X}_i) = m_0(t)\exp(\beta_1 X_{1i} + \cdots + \beta_p X_{pi}) \quad (1.2)$$

where $X = 1$ for treated and $X = 0$ for control. Then if we think of $m_1(t)$ as the hazard rate for the treated group, and $m_0(t)$ as the hazard for control, then we can write:

$$m_1(t) = m(t|X = 1) = m_0(t)\exp(\beta X) = m_0(t)\exp(\beta) \quad (1.3)$$

This implies that the ratio of the two hazards is a constant, e^{β}, which does NOT depend on time, t. In other words, the hazards of the two groups remain proportional over time.

$$\frac{m_1(t)}{m_0(t)} = e^{\beta} \quad (1.4)$$

- e^{β} is referred to as the **hazard ratio** (HR) or **relative risk** (RR)
- β is the **log hazard ratio** or **log relative risk**.

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This applied to any types of *X*, as they are the (log) HR for one unit increase in the value of *X*.

This means we can write the log of the hazard ratio for the *i*-th individual to the baseline as:

$$log\left\{\frac{m_i(t)}{m_0(t)}\right\} = \beta_1 X_{1I} + \beta_2 X_{2i} + \cdots + \beta_p X_{pi} \quad (1.5)$$

One of the main advantages of the framework of the Cox Proportional Hazard model is that we can estimate the parameters β without having to estimate $m_0(t)$. And, we don't have to assume that $m_0(t)$ follows an exponential model, or a Weibull model, or any other particular parametric model.

This second part is what makes the model *semiparametric*.

The Cox (1972) Proportional Hazards model

$m(t|\mathbf{X}) = m_0(t)\exp(\beta\mathbf{X})$

is the most commonly used regression model for survival data.

Modified Cox Proportional Hazards models

$H(t|\mathbf{X}) = h_0(t)\, e^{\beta \mathbf{X}_0 \mathbf{X}_1 \mathbf{X}_2 \mathbf{x}_3 \mathbf{x}_4 \mathbf{x}_5 \mathbf{x}_6 \mathbf{x}_7 \mathbf{x}_9 \mathbf{x}_{10} \mathbf{x}_{11}}$ (1.6)

Where xo is the hazard function depend on stunted, wasted and underweight

Where $H(t|\mathbf{X})$ - hazard function that depend on time t and and vector of covariates x

$h_0(t)$- is the *baseline* hazard function (i.e. the hazard function condition on $x = 0$)

$\epsilon\beta$ is referred to as the hazard ratio (HR) or relative risk

β is the log hazard ratio or log relative risk

Here **X** is a vector of multivariate of interest, which may include:

- x_0 =nutritional status
- x_1= age
- x1=sex,
- x3=birth order
- x4=types of birth etc)
- x_5 water supply,
- $x_{6=}$ immunization,
- x7 feeding hygiene of the child, healthcare seeking)

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- x_8 education status of mother,
- x9 age of mother
- x_{10}marital status of mother ,
- x_{11}number of house hold member and working status)

with x_0 as the dependent variable while x_1,x_2,x_3 ……..$x_{11}$are the independent variable

RESULT DISCUSSION

Descriptive statistics

Table 1 Nutritional status of children under-five years

Indicator		Frequency	Percent
	Stunted	52	28.4
	Wasted	65	35.5
	Underweight	66	36.1
	Total	183	100.0

This table shows the nutritional status of children under- five years 52(28.4%)are stunted, 65(35.5%) are wasted and 66(36.1%) are underweight those are the three anthropometrics indices for indicating malnutrition for under five children

Table 2 frequency and percentage of the variables

Variables		frequency	percentage
Age	0-11	84	45.9
	12-23	78	42.6
	24-35	17	9.3
	36-47	4	2.2
Sex	male	68	37.2
	female	115	62.8
Source of drinking water	pipeborne	84	45.9
	Well treated	8	4.4
	Well-untreated	87	47.5
	Stream	4	2.2

Occupation of father	Government	16	8.7
	Non-government	167	91.3
Occupation of mother	Government	1	5
	Non-government	182	99.5
Education status father	Non-formal	82	44.8
	Primary	24	13.1
	Secondary	60	32.8
	Tertiary	17	9.3
Education status mother	Non-formal	119	65
	Primary	37	20.2
	Secondary	25	13.7
	Tertiary	2	1.1
Age of mother	15-25	121	66.1
	26-35	50	27.3
	36-49	12	6.6
Marital status of the mother	Single	1	5
	Monogamy	80	43.7
	Polygamy	102	55.7
Immunization status	yes	106	57.9
	No	77	42.1
Number of household member	1-9	105	57.4
	10-19	61	33.3
	20-29	16	8.7
	30above	1	5
Birth order	1-9	133	72.7
	10-19	46	25.1
	20above	4	2.2

A Cross-tabulation of Nutritional status versus covariates

Table 3

Variable		Nutritional status of children under-five years			Total
		stunted	wasted	Underweight	
AGE	0-11	19 22.6%	32 38.1%	33 39.3%	84 100
	12-23	27 (34.6%	25 32.1%	26 33.3	78 100
	24-35	4 23.5%	7 41.2%	32.3%	17
	36-49	2 50%	1 25%	1 25%	4 100

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SEX	Male	16 23.5%	27 39.7%	25 36.8%	68 100
	Female	36 31.3%	38 33%	41 35.7%	115 100
source of drinking water	pipe borne	18 21.4%	31 36.9%	35 41.7%	84 100
	well treated	4 50%	1 12.5%	337.5%	8 100
	well untreated	27 31%	32 36.8%	28 32.2%	87 100
	Stream	3 75%	1 25%	0	4 100
occupation of father	government	2 12.5%	7 43.75%	7 43.75%	16 100
	non government	50 29.9%	58 34.8%	59 35.3%	167 100
occupation of mother	government	1 100%	0	0	1 100
	non government	51 28%	65 35.7%	66 36.3%	182 100
education status of father	non formal	25 30.5%	29 35.4%	28 34.1%	82 100
	Primary	9 37.5%	10 41.7%	520.8%	24 100
	Secondary	16 26.7%	18 30%	26 43.3%	60 100
	Tertiary	2 11.8	8 47.1%	7 41.2%	17 100
education status of the mother	non formal	36 30.3%	43 36.1%	40 33.6%	119 100
	Primary	12 32.4%	13 35.2%	12 32.4%	37 100
	Secondary	4 16%	7 28%	14 56%	25 100
	Tertiary	0	2 100	0	2 100
age of the mother	15-25	34 28.1%	44 36.4%	43 35.5%	121 100
	26-35	15 30%	18 36%	17 37%	50 100
	36-49	3 25%	3 25%	6 50%	12 100
is the immunization status up to date	Yes	25 23.6%	43 40.6%	38 35.8%	106 100
	No	27 35.1%	22 28.6%	28 36.3%	77 100
	exclusive breast feed	6 18.2%	17 51.5%	10 30.3%	33 100

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how was the child feed in the first 6 month of life	Mixed	25 31.3%	25 31.3%	30 37.4%	80 100
	pre-dominantly breast feed	21 30%	23 32.9%	26 37.1%	70 100
marital status of the mother	Single	1 100	0	0	1 100
	Monogamy	20 25%	31 38.75%	29 37.1%	80 100
	Polygamy	31 30.4%	34 33.3%	37 36.3%	102 100
number of the household(mother, father, cowives, others, children)	1-9	29 27.6%	38 36.2%	38 36.2%	105 100
	10-19	18 29.5%	19 31.1%	24 39.4%	61 100
	20-29	5 31.25%	8 50%	3 18.75%	16 100
	30above	0	0	1 100	1 100
birth order of the child	1-9	36 27.1%	47 35.3%	50 37.6%	133 100
	10-19	15 32.6%	18 39.1%	13 28.3%	46 100
	20above	1 25%	0	3 75%	4 100
Mid Upper Arm Circumference	1-11	37	46	49	132
	11.1-12.5	14	19	17	50
	12.6-13.5	1	0	0	1

Table 3 present the descriptive statistics of the covariates considered in this study. As shown in the table, among those that have up to date immunization, are 23.6% are stunted, 40.6% wasted and 35.8% are underweight 35.1% and those that do not have up to date 35.1% are stunted, 28.6% are wasted and 36.3% are underweight.

Age range for age between 0-11, 22.65 % are stunted, 38.1% are wasted and 39.3%, for age 12-23 were 34.6% are stunted,32.1% are wasted and 33.3% are underweight 24-35% were 23.5% are stunted, 41.2% are wasted and 32.3% underweight and lastly 36-49 were 50% are stunted, 25% are wasted and 25% are underweight.

Sex for the male 23.5% are stunted, 39.7% are wasted and 36.8% are underweight and for the female 31.3% are stunted, are wasted and 35.7% are underweight.

Source of drinking water pipe borne 21.4% are stunted, 36.9% are wasted and 41.7% are underweight for well treated water 50% are stunted, 12.5% are wasted and 37.5% are underweight for well untreated water 31% are stunted, 36.8% are wasted and 32.2% are underweight and lastly for those source of drinking water is stream 75% are stunted and 25% are wasted

Occupation of the father those that are government worker were 12.5% are stunted, 43.75% are wasted and 43.75% are underweight while those that are non-government worker are 29.9% are stunted, 34.8% are wasted and 35.3% are underweight while for the occupation of the mother of those that are government workers 100% are stunted while those that are non-government workers 28% are stunted, 35.7% are wasted and 36.3% are underweight.

Among those that have their immunization up to date 23.6% are stunted, 40.6 are wasted and 35.8% are underweight while those that do not have up to date immunization 35.1% are stunted, 28.6% are wasted and 36.3 are underweight.

Breast feeding practise of the children for those that practise exclusive breast feeding 18.2% are stunted, 51.5% are wasted and 30.3% are underweight, for those with mixed breast feeding 31.3% are stunted, 31.3% are wasted and 37.4% are underweight and lastly for those that pre-dominantly breast feed 30% are stunted, 32.9% are wasted and 37.1 are underweight.

Among the mothers age range 15-25 28.1% are stunted, 36.4% are wasted and 35.5% are underweight age range of 26-35 30% are stunted, 36% are wasted and 34% are underweight lastly the age range36-49 were25% are stunted, 25% re wasted and 50% are underweight

Among their marital status for single 100% stunted for the divorce none was for those monogamy 25% are stunted, 38.75% are wasted and 36.25% are underweight and lastly for polygamy 30.4% are stunted, 33.3% are wasted and 36.3 are underweight

The educational status of the mother for non-formal education 30.5% are stunted, 35.4% and 36.3% are underweight for the primary education 37.5% are stunted,41.7% are wasted and 20.8 are underweight for the secondary education 26.7% are stunted, 30% are wasted and 43.3% are underweight and lastly for the tertiary education0.1% are stunted, 47.1% are wasted and 52.8 are underweight

The educational status of the father for non-formal education 30.3% are stunted, 36.1% and 33.6% are underweight for the primary education 32.4% are stunted,

35.2% are wasted and 32.4% are underweight for the secondary education 16% are stunted, 28% are wasted and 56% are underweight and lastly for the tertiary education 100% are wasted

Member of the house holds 1-9 27.6 are stunted, 36.2 are wasted and 36.2 are underweight for 10-19 29.5 are stunted, 31.1% are wasted and 39.4% are underweight and lastly 20 and above 100% are underweight

The birth order of the children 1-9 27.1 are stunted, 35.3% are wasted and 37.6% are underweight for 10-19 32.6% are stunted, 39.1% are wasted and 28.3% are underweight and lastly 20-29 25% are stunted and 75% are underweight.

ANALYSIS OF THE RESULT

Table 4 Omnibus Tests of Model Coefficients

	Chi-square	Df	Sig.
Step1step	7.385	12	.831
Block	7.385	12	.831
Model	7.323	12	.836

The overall model is statistically significant, $X^2(12) = 7.385, p<0.05$

Table 5 Nutritional status of children under-five years

	Observed N	Expected N	Residual
Stunted	52	61.0	-9.0
Wasted	65	61.0	4.0
Underweight	66	61.0	5.0
Total	183		

Test Statistics	
	Nutritional status of children under-five years
Chi-Square	2.000[a]
Df	2
Asymp. Sig.	.368

The table above, test statistics provides the actual result of the chi-square goodness-of-fit test. We can see from this table that our test statistic is $X^2(2) =$

0.368,p>0.05 Therefore, we reject the null hypothesis and conclude that the variable are independent or are significance

MODIFIED COX PROPORTIONAL HAZARD MODEL RESULT

Table 6 Wald's test of significance of the predictor variables

Variable	B	SE	Wald	Df	Sig.	Exp(B)	95.0% CI for Exp(B)	
							Lower	Upper
Initial model SOURCEOFWATER	.146	.135	1.178	1	.278	1.158	.889	1.507
OCCUPATIONOFFATHER	.584	.566	1.067	1	.302	1.794	.592	5.438
OCCUPATIONOFMOTHER	-1.054	1.103	.912	1	.340	.349	.040	3.031
EDUCATIONSTATUSOFFATHER	.016	.177	.008	1	.929	1.016	.718	1.438
EDUCATIONOFMOTHER	.020	.222	.008	1	.929	1.020	.660	1.577
AGEOFMOTHER	.205	.221	.859	1	.354	1.228	.795	1.895
IMMUNIZATIONSTATUS	.011	.280	.002	1	.968	1.011	.585	1.749
CHILDFEEDING	-.127	.170	.559	1	.455	.880	.631	1.229
NUMBEROFTHEHOUSEHOLDMEMBER	-.192	.329	.341	1	.559	.825	.433	1.572
BIRTHORDER	.064	.428	.023	1	.880	1.067	.461	2.470
NUTRITIONALSTATUSOFCHILDREUNDERFIVEYEARS			2.335	2	.311			
NUTRITIONALSTATUSOFCHILDREUNDERFIVEYEARS(1)	-.432	.330	1.706	1	.192	.649	.340	1.241
NUTRITIONALSTATUSOFCHILDREUNDERFIVEYEARS(2)	.048	.284	.029	1	.865	1.049	.602	1.829

The regression coefficients predict the hazard for the terminal event as a function of the covariates in the model A positive coefficient (the B values) are associated with increase hazard and decrease survival time. i.e as the predictor increases the hazard of the event increases and the predicted survival duration decreases A negative coefficient (the B values) are associated with decrease hazard and increase survival time. i.e as the

For source of drinking water (pipe borne, well treated, well untreated, stream) signify positive coefficient(b= .146) children whose source of drinking water is well untreated or stream are likely to be malnourish compare to those who take pipe borne water. World health organization (WHO 2016) estimate that 50% of

malnourishment is associated with infection cause by unsafe water and inadequate sanitation.

For the fathers occupation (government and non-government) signify positive coefficient (b=.584) For the mothers occupation (government and non-government) signify negative coefficient (b= - 1.054) that is children whose father are not working (non-government) worker have more malnourished children compare to those who are government workers. Mothers occupation have no impact on child malnourishments. According to Mohseni et al.(2017) showed that socioeconomic factors such as gender, a father's occupation, and a mother's education level play a significant role in the nutrition level of children in Iran.

For the fathers education (non formal, primary, secondary, tertiary) signify positive coefficient (b= .016) .For the mothers education (non formal, primary, secondary, tertiary) signify positive coefficient (b= .020) moreover, children whose father/mother is illiterate are more likely to experience malnutrition as compared to those children whose father/mother are literate. Our result is consistent with that of (Babatunde; 2011). That educated mothers are better aware about the nutrition requirements of their children and by providing improved health care. This study also revealed that education plays an important role to improve knowledge of medical and health care particularly mothers' education enhances more effective health care practices that increases their productivity and influence infant and child mortality.

Age of the mother (15-25, 26-35, 36-49) signify positive coefficient (b= .205) age of the mother have impact on malnourishments in children. Labada (2014) research in baha Manado health centre that the age of the mother does not affect the nutritional status of the child. According to Parayato (2014) the older a person is the experience will increase so that he will increase his knowledge of an object

Immunization status (yes or no) signify positive coefficient (b= .011) children who have no up to date immunization are likely to be malnourish compare to those who have up to date immunization Willby and Werry (2012) in fully immunized children, suggesting that immunization not only helps to prevent specific disease of focus but also leads to overall improvements in health

From the result of Child feeding practise (exclusive and mixed) the significant negative coefficient (b= -.127) that is both child breast feeding practise has no effect on the child malnourishment. (WHO 2001) recommended that infant should exclusively breastfed for 4-6 months after which they can be introduce to complementary foods (any fluid or food other than breast milk)

Number of the member of the households (0-9.10-19, 20-29 30above) signify negative coefficient (b= -.192) number of house hold members does not have impact on malnourishments in children.

The For Birth order of the child (0-9, 10-19, 20-29) signify negative coefficient (b= .064) birth order of the child has no impact on the prevalence of malnourishment of the children. Zakaria et al.(2019) also reported that childhood malnutrition is positively correlated to birth order. This means that children with a higher birth order have a higher chance of being malnourished.

Nutritional status (stunted, wasted, underweight) signify positive coefficient (b = .048) Dietary supplements represent an important source of essential nutrients since they often contain 100%, or more of the daily value, of one or more nutrients (Ervin, *et. al.,* 2004; Radimer, *et. al.,* 2004). nutritional status have impact on the prevalence of having malnourishments in children Individuals can be broadly categorized into having optimal nutritional status, or being undernourished, over nourished, and malnourished. It is important to realize that many other life style and environmental factors, in addition to nutrition, influence health and wellbeing, but nutrition is a major, modifiable and powerful factor in promoting health, preventing and treating disease and improving quality of life (Hester, *et. al.,* 2002).

Considering the predictor with their respective parameters (β) from the above table after the stepwise method the final model is

$H(t/x) = ho(t)x \exp (b_{sourceofwater}.sourceofwater+b_{occupationof\ father}.occupation\ of\ father\ldots\ldots\ldots\ldots+b_{birthorder}.\ birthorder$

= 0.486exp(0.146*source of water+0.584*father occupation-1.054*mothers occupation+ 0.016*education status of father+0.020*education of mother+0.205*age of mother+0.011*immunization-0.127* feeding practise-0.192* household member+0.064*birth order

The Exp(B) column is the hazard ratio and reflects the multiplicative change in the hazard for the terminal event per unit increase on a predictor.

For source of water the hazard ratio was 1.158 this indicates that the hazard (malnutrition) rate is 15.8% high for stream water compared to the other source of drinking water it is non-significant. For occupation of the father the hazard ratio was 1.794 this indicates that the hazard (malnutrition) rate is 79.4% high for non-government worker compared to government work it is non-significant. Occupation of the mother it is statistically significant the hazard decreases by (1-0.349)*100=65.1%. Education status of the father the hazard ratio was 1.016 this indicates that the hazard (malnutrition) rate is 1.6% high for non-government worker compared to those with formal it is non-significant. Education of the mother the hazard ratio was 1.020 this indicates that the hazard (malnutrition) rate is 2% high for those in tertiary level compared to those with non-formal. it is non-significant. Age of the mother the hazard ratio was 1.228 this indicates that the hazard (malnutrition) rate is 22.8% high for 36-49 compared to those 15-25 it is non-significant. Immunization status the hazard ratio was 1.011 this indicates that the hazard (malnutrition) rate is 1.1% high for those who have no up to dates immunization compared who have up to dates immunization is non-significant. Child feeding it is statistically significant the hazard decreases by (1-880)*100=12%. Number of households member it is statistically significant the hazard decreases by (1-0.825)*100=17.5%. Birth order the hazard ratio was 1.067 this indicates that the hazard (malnutrition) rate is 6.7% high for those with child birth of 20above compared to those with birth order of 1-9it is non-significant Nutritional status(2) it is statistically significant the hazard decreases by (1-0.649)*100=35.1%.Nutritional status the hazard ratio was 1. 049 this indicates that the hazard (malnutrition) rate is 49% high for underweight compared to stunted it is non-significant.

The latter two columns contain the 95% confidence interval for the hazard ratio. The null hypothesis for testing the hazard ratio using the confidence interval is that The population value is 1

EXISTING COX PROPORTIONAL HAZARD MODEL RESULT

Table 7

VARIABLE	B	SE	Wald	Df	Sig.	Exp(B)	95.0% CI for Exp(B)	
							Lower	Upper
NUTRITIONALSTATUSOFCHILDREUNDERFIVEYEARS			1.827	2	.401			
NUTRITIONALSTATUSOFCHILDREUNDERFIVEYEARS(1)	-.344	.321	1.153	1	.283	.709	.378	1.329
NUTRITIONALSTATUSOFCHILDREUNDERFIVEYEARS(2)	.070	.278	.063	1	.802	1.072	.622	1.847

Fitted model

=0.070exp

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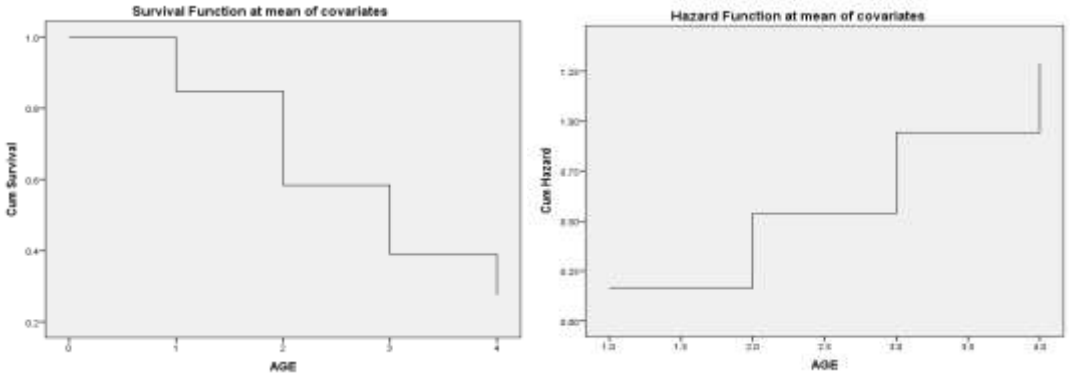
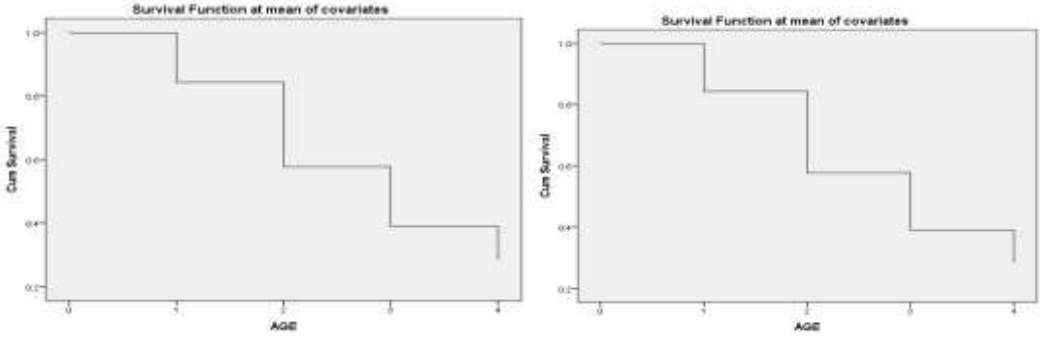
Table 8 Comparing the cox proportional hazard model and the modified cox proportional hazard model

Measure	Cox proportional hazard model	Modified cox proportional hazard model
Likelihood	630.508	625.059
Chi-square	1.936	7.385
Sig.	0.380	0.831

MODIFIED COX PROPORTIONAL HAZARD MODEL CHART



EXISTING CHART FOR THE COX PROPORIONAL HAZARD MODEL



SUMMARY CONCLUSION AND RECOMMENDATION

SUMMARY

The prevalence of stunting is low compare to those that are wasted and underweight. age , sex and the source of drinking water also have a significant effect on the health of the child approximately 48% are taking well untreated water which has significant effect on their health. Mother's age has a significant

effect because 66% of those mother who have age range betwee 15-25 are more likely to have malnourish children it may be due to early marriage or lack of knowledge on how to take good care of the child. For the marital status those that came from the polygamous family with 56% are more likely to be malnourish due to the family size. 65% of the mother have not under gone formal education which may affect them not to have knowledge on how to care for the child. . 44% of the father have not under gone formal education which may have significant effect on them not to have knowledge on how to care for the child. 91% of the fathers are non-government worker that is they may not have money to provide the necessary food for the family. finally 44% are been breast feed mixed for the first six month which may lead them to easily contact disease due to not been exclusive breast feed.

CONCLUSION

The study shows that various socio-demographic and health service covariates are significant determinants of malnutrition

Accordingly, the finding of the study show that age, sex source of drinking water, mothers age, education status of the parent, occupation of the parent, age of the mother, immunization status, breast feeding practise, family size and birth order of the child have statistically significant effect on the outcome of the nutritional status of children under-five years of age

For instance, the education of the mother is important because if the mother is educated she will know how to take care of the child so that the child will not be malnourish as well as the age of the mother also contribute to the malnourishment of the child . The child that come from a large family are likely to be more malnourish due to family size and finally. The marital status, the child that come from a polygamous family are more malnourish because the father has many children so he wouldn't care for the child nutrient.

The parent should endeavour to be educated, early marriage should be reduced and the parent should try to practise exclusive breast feeding so as to reduce the rate of malnutrition in children under-five years of age

RECOMMENDATION

The result obtain using cox proportional hazard model indicates certain directions to come up with recommendations that can help tackle the problem of

malnutrition of children under-five years of age. Some of the recommendations are:

- access to education for both parent should be given due emphasis
- parent should be encourage on exclusive breast feeding
- Children from mother's age range from 15-25 years are at the higher risk of malnutrition. Thus, educating women about the adverse effect of early marriage (conception) is of paramount importance.
- Children of earlier age(less than 11 months) are more vulnerable to malnutrition. Thus special attention should be given for children in this age group.

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CYTOGENETIC EFFECTS OF ASH POTASH OF CORN STALK ON THE ROOT TIPS OF *CAPSICUM SPECIES.*

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ABSTRACT

The use of ash potash as a food additive in north eastern Nigeria is a common phenomenon with no any information on the cytological and clastogenic effects of its long-term consumption. The seeds of Capsicum species (Capsicum frutencence) where pre-soaked in various concentrations of 5%, 10%, 15%, 20% and 25 of Ash Potash for 48 hours, while some seeds pre-soaked in tap water/Ethyl Methyl Sulphate (EMS) as control, then planted. Cytological analysis of the germinated root tips where carry out. The results of the Capsicum frutencence root test responded to different concentrations of Ash potash in comparison with the distilled water. The result showed dose-dependence. Reduction in C. frutencence mean root length that was significant at 10- 25 g/ I but not significant at 5 g/ l, suggesting cytotoxicity. Significant reduction in Mitotic index (MI) of the C frutencence meristematic cells with

Introduction:

Plants and plants materials have been major source of food, medicine clothing and housing to man, right from the era of early man to the present era, therefore, man's continuous quest for food and other resource has plunged him into a trial and error sort of a search, which in many cases ,not minding the consequences that may arise from eating certain food materials that may contain substances that have mutagenic effects, Kafaru, 1996.

Between 0.43 and 1.82 percent of the mass burned wood (dry basis) result in Ash

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increasing concentration of Ash potash. Unlike EMS, which elicited chromosomal aberrations in meristematic cells of C. frutencence, no chromosomal aberrations were seen in C. frutencence placed in the distilled water control. However chromosomal aberrations, suggestive of clastogenicity and impaired tubulin biogenesis were observed in 17-51 of the 300 C. frutencences cells examined at each of the different concentrations of Ash potash. Highest and lowest number of aberrant cells was numbered. Chromosome damage has been observed to be caused by various physical, chemical and biological agents, including food additives, the research showed that ash potash can cause chromosomal damages in living cells at higher doses, hence the need for safe dosage during consumption.

Keywords: Ash Potash, Chromosomal Aberration, Cytogenetics, Mitotic Index (MI), Capsicum frutescence, cytological analysis.

(Misra *et al*., 1993). Much wood Ash contains calcium carbonate as its major component representing 25 to 45 percent and more than 10 percent potash (Hume, 2006).

Potash is any of the various forms mined and manufactured salt that contains potassium in water soluble form. The name was derived from "Pot Ash" which refers to plant Ashes soaked in water, in a pot, primary means of manufacturing potash before the industrial era. Potassium thus refers to potassium compounds and bearing minerals, the most common being potassium chloride (KCI). The oldest method of making potassium chloride was by leaching of wood ashes and then evaporating the resulting solution in large iron pots, leaving a white residue called "pot-ashes"(Denis 2006). Later "Potash" became the term widely applied to naturally occurring potassium salt and the commercial products derived from them.

The Capsicum pepper, wild or domesticated, belong to the genus Capsicum.The genus is one of the 85 genera that make up the family Solanaceae (the night shades) (Gill, 1998) The family comprises of many economically important food and industrial crop such as potato, tobacco, tomato, garden egg, petura and pepper (Capsicum). Earlier workers recognized the genus Capsicun has been made of twenty-five species. More recent workers have expanded the list to between thirty to thirty-one species (Eduardo *et al*, 1996; Oyama *et al*., 2006). Among this vast number of species, only five species are generally gecognized as