NUTRITIONAL STATUS OF CHILDREN 6-59 MONTHS OF AGE AND FACTOR ASSOCIATED IN FLOOD AFFECTED AREA OF ITAHARI, SUB-METROPOLITAN CITY, SUNSARI, NEPAL

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Nutritional Status of Children 6-59 Months of Age and Factors Associated in Flood Affected Area of Itahari, Sub-Metropolitan City, Sunsari, Nepal

A dissertation submitted to the Department of Nutrition and Dietetics in Tribhuvan University in partial fulfillment of the requirements For the BSc. degree in Nutrition and Dietetics.

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Approval Letter

This ***dissertation*** entitled **"*Nutritional Status of Children 6-59 months of age and Factor Associated in Flood Affected Area of Itahari, Sub-Metropolitan City, Sunsari, Nepal"*** presented by **Muna Basnet** has been accepted as the partial fulfillment of the requirement for the **BSc. degree in Nutrition and Dietetics.**

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Abstract

Malnutrition is still a major public health problem in Nepal. Factors that contribute to malnutrition are many and varied, so integrated and multi-sectoral strategies are required to combat it. Thus, it is very important to determine its causative factors before implementation of any appropriate intervention to improve the nutritional status. This study tries to analyze the factors associated with nutritional status among 6-59 months age group children so that appropriate corrective actions can be implemented for the improvement of nutritional status. Cross-sectional descriptive survey using a structured questionnaire and measurements of weight, height and MUAC was carried out to determine the nutritional status of 6-59 months children and factors associated with it. A structured questionnaire was administered to the mothers or care- taker. Anthropometric measurement was then used to determine if children were underweight, wasting and stunting based on WHO reference. WHO Anthro version 3.2.2 and SPSS version 20 were used to analyze data. χ^2 - test was used to analyze the factors associated with it.

Prevalence of stunting, wasting and underweight was 30%, 10.7% and 18.5% respectively where 0.7 % were severely stunted, 0.7 % were severely wasted and 1.4 % were severely underweight. Study indicated that family income was significantly associated with stunting (P=0.001) and children from families with low annual income were more likely to be stunted than from families with high annual income. Birth order (P=0.000) and colostrum feeding of child (P=0.020) were found statistically significant with wasting .Birth order (P=0.000), family income (P=0.024), birth-weight (P=0.043) and age at first pregnancy (P=0.043) was significantly associated with underweight. Results of the study indicate that under nutrition is still an important problem among 6-59 months children in flood-affected area of Itahari. Furthermore, birth order of child, family income, colostrum feeding, birth weight and age at first pregnancy are the major risk factors for malnutrition.

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List of Abbreviations

Abbreviation	Full form
FAO	Food and Agriculture Organization
FCHV	Female Community Health Volunteer
GDP	Gross Domestic Product
HAZ	Height for Age Z Score
IDA	Iron Deficiency Anemia
IDD	Iodine Deficiency Disorder
I/NGO	International /Non – Governmental Organization
LBW	Low Birth Weight
MDG	Millennium Development Goal
MoHP	Ministry of Health and Population
MUAC	Mid – Upper Arm Circumference
NDHS	Nepal Demographic Health Survey
PEM	Protein Energy Malnutrition
RDA	Recommended Daily Allowance
SAM	Severe Acute Malnutrition
SCN	Standing Committee on Nutrition
UN	United Nations
UNICEF	United Nations International Child Emergency Fund
VDC	Village Development Committee
WAZ	Weight for Age Z Score

Part I

Introduction

1.1 Background to the study

Nepal is a land-locked country located in South Asia between China and India, with an area of 1,47,181 Square km, ranging from sea-level plains (Terai) to Mount Everest, the world's highest peak. The total population in the latest census (2011) was 26.6 million with an average annual population growth rate of 1.4% (Central Bureau of Statistics, 2011). Nepal is one of the world's least developed countries, and is ranked 157 of 186 in the 2013 Human Development Report; one-third of the Nepali population lives below the poverty line (United Nations Development Programme Human development report, 2013).

Nutrition is the cornerstone of socioeconomic development of a country. Nutrition is defined as the science of food and its relationship to health. It is concerned primarily with the parts played by nutrients in body growth, development and maintenance. Nutrition is one of the essential functions of living beings necessary for the utilization of food. Human beings need to have adequate nutrition to attain normal physical growth and for a healthy life. Adequate nutrition is a fundamental right for every human being. If people fail to consume sufficient quality and quantity of nutrients, they will suffer from hunger or malnutrition. The common types of malnutrition in Nepal are: protein energy malnutrition, iodine deficiency disorder, iron deficiency anemia and vitamin A deficiency (Lodhi *et al.*, 2010).

Nutritional status is the result of complex interactions between food consumption and the overall status of health and health care practices. Numerous socioeconomic and cultural factors influence patterns of child feeding and nutritional status of women and children (Macro, 2006). The nutritional status of children is important as it determines their health, physical growth and development, academic performance and progress in life. All children have the right to adequate nutrition, which is essential for attainment of the highest standard of health (WHO, 2004).

Malnutrition is a serious medical condition marked by a deficiency of energy, essential proteins, fats, vitamins, and minerals in a diet. Over 10 million children aged less than five years (<5 years children) die annually from preventable and treatable illnesses almost all these deaths occur in poor countries (Black *et al.*, 2008). Malnutrition is a silent killer -

under-reported, under-addressed and, as a result, under prioritized. Malnutrition-related deaths are often put down to the disease that the child eventually died from. As a result, malnutrition - although recognized as the underlying cause of a third of under-five deaths - does not tend to appear on children's death certificates, in country records or in global child mortality statistics. The statistical invisibility of malnutrition, especially stunting, is one possible explanation for the slow progress on reducing the proportion of stunted children in relation to reducing other causes of child mortality. Malnutrition and disease work in a deadly cycle. A malnourished child is more likely to suffer from disease, and the more they suffer from disease the more likely they are to be malnourished. Inadequate food intake leads to weight loss, and a weakened immune system, which means that childhood diseases will be more severe and will last longer. This in turn leads to a loss of appetite (Joshi, 2012).

There is substantial evidence that malnutrition, particularly micronutrient deficiencies, is a contributing factor in up to 35% of mortality in children less than 5 years of age and growing body of evidence exists that malnutrition plays a similar role in maternal mortality (Black *et al.*, 2008).

According to the NDHS 2016, 36% of children under 5 years of age are stunted (short for their age), 10% are wasted (thin for their height), 27% are underweight (thin for their age), and 1% are overweight (heavy for their height). Out of total 55% of children under age two are breastfed within 1 hour of birth, and 66% of children under age 6 months are exclusively breastfeed. Among them 47% of children age 6-23 months receive meals with minimum recommended diversity (at least four food groups), 71% receive two meals at the minimum frequency, and 36% meet the criteria of minimum acceptable diet. 86% of children age 6-59 months received a Vitamin A capsule, 76% of children age 12-59 months received deworming medication (NDHS, 2016).

1.2 Statement of Problem

Malnutrition at the early stages of life can lower child resistance to infections, increase child morbidity and mortality, and decrease mental development and cognitive achievement and nutritional status is the best global indicator of wellbeing in children (Rawe, 2012). Adequate nutrition is the keystone of survival, health and development not only of current generations but also of the ones to come. Malnutrition is the largest single underlying cause of death worldwide and is associated with over 1/3 of all childhood deaths (Engebretsen *et al.*,

2008).The situation of child Malnutrition in Nepal is very high due to the cultural, social, economical, educational and political structure of Nepal (Sharma, 2012). Moreover, good nutrition has been reported to be the corner stone for survival, health and development in the current and succeeding generations (Shahraki *et al.*, 2005).

Floods are the most common reported natural disaster worldwide, with an important impact on the health of human populations. In the last decade alone, floods have affected nearly one billion people worldwide (Sophal *et al.*, 2018). Despite their potential burden to society, the consequences of floods on human health remain rarely investigated, and the few studies that do suggest increased short-term risks of mortality, injury, certain communicable diseases and psychosocial trauma (Milojevic *et al.*, 2012). Floods can severely disrupt livelihoods, especially in low-resource settings. Daily care of children and breastfeeding practices is importantly challenged during floods as in worst scenarios all basic services become disrupted, including water and sanitation conditions, or the provision of community basic health and social services.

The reasons for the study of flood-affected areas in Itahari are as follows: -

1. They are not much aware of food habits and the nutrition.
2. Their economic status still not lies on the average. Most of them are poor.
3. There are not much researches carried out about them.
4. This is one of the most flood-affected area.

1.3 Objectives of the study

1.3.1 General objective

To assess nutritional status of children 6-59 months of age and factors associated in flood affected area of Itahari, sub-metropolitan city Sunsari, Nepal.

1.3.2 Specific objectives

a) To assess the nutritional status of children between 6–59 months of age in the community.
b) To find the factor associated with the nutrition status of 6-59 months of age in the community.

1.4 Research question

The thesis addresses the following question.

a) What is the existing nutritional status of 6-59 months children in flood affected area of Itahari?

b) What are the contributing factors of malnutrition in 6-59 months children in flood affected area of Itahari?

1.5 Significance of study

a) The finding of the result will encourage people for the improvement of their existing nutritional status by improving dietary pattern of the 6-59 months age children, pregnant and nursing mother of the concerned area.

b) It also provides information regarding the nutrition condition, to the government as well as voluntary organization to initiate steps to tackle the problem.

c) It will also serve as a helpful guide to make a proper nutritional program for this community, from the facts determined in this work.

1.6 Limitations

The hurdle that came during the work is listed as follows:
a) Only anthropometric method is used to access nutritional status of children.

1.7 Assumption

It is assumed that the majority of children of 6-59 months of age were malnourished in Itahari. It is because of the poor economic condition of the family child may not be exclusively breastfed and nutritious complementary food may not be provided to the child.

Part II

Literature review

2.1 Nutritional Status

Nutrition is the science of food and its interaction with an organism to promote and maintain health. Thus, nutrition is a combination of process by which all parts of the body receive and utilize the materials necessary for the performance of their function and for the growth and renewal of all the components. Nutrition status is the condition of the body as it relates to consumption and utilization of food. The good nutrition status refers to the intake of a well-balanced diet, which supplies all the essential nutrients to meet the body requirements. Such a person may be said to be receiving optimum nutrition. Poor nutrition status refers to an inadequate or even excessive intake or poor utilization of the nutrients to meet the body's requirements. Overeating can also result in poor nutritional status of a person (Joshi, 2004).

Nutritional status of children is an indicator of the level of development and future potential of the community. The nutritional status of infants and children under five years of age is of particular concern since the early years of life are crucial for optimal growth and development. Nutritional deficiencies affect long term physical growth and development and may lead to high level of illness and disability in adult life. Moreover, high prevalence of malnutrition jeopardizes future economic growth by reducing the intellectual and physical potential of entire population (Acharya *et al.*, 2013).

Under nutrition among children remains common in many parts of the world. According WHO (2011), about 178 million children under five years worldwide are too short for their age group; while 115 million are underweight. The same report showed that stunting rate among children is higher in Africa and Asia than elsewhere. In Kenya, 35% of children under five are stunted, while the proportion severely stunted was 14%; 16% are underweight (low weight-for-age) and 4% are severely underweight (Badake *et al.*, 2014).

The major types of nutritional problems in developing countries are under nutrition and malnutrition which result from inadequate food intake both in quality and quantity, particularly calories and protein, specific nutrients (e.g. vitamin A, iron, iodine) and parasitic infections (Burk, 1984). The vulnerable groups such as babies, adolescent of the poor and

uneducated, pregnant and lactating are badly affected. The prevalence of poor nutritional status in developing countries is mainly due to the low income, low production of food, low productivity of crops and livestock, unequal distribution of food, low literacy, socio culture or environmental sanitation (Nabarro, 1984).

2.1.1 Factor affecting the nutritional status

Childhood malnutrition existed in various degrees in different ecological zones and developmental regions of Nepal. Low birth weight, PEM and micronutrient deficiencies were most common forms of nutritional problems among under five years children in plain districts of Nepal. Despite the availability of nutritional products and good climatic opportunities for agricultural products, transportation facilities, easy access to health services most of the children suffered from malnutrition due to behavioural and sociocultural practices in Nepal (Bhandari and Chhetri, 2013).

Socio-cultural practices such as less consideration for supplementary child feedings, late weaning and poverty are major causal factors of malnutrition among under-five year. The factors affecting nutritional status are mother‘s food security, breast feeding practices, types of food given to young children, feeding frequency, status of women and child nutrition and last but not the least who feeds the child and how the child eats (Engle *et al.*, 2011).

There are many other factors that influence the nutritional status. Some of which are food availability and its distribution system, conditioning influences and cultural influences such as food habit, custom belief, tradition and attitude, religion, food fad, cooking practices, child rearing practices etc. Socio-economic factor also affects nutritional status of a person as byproduct of poverty, ignorance, insufficient education, lack of knowledge regarding nutritive value of food, inadequate sanitary environment and large family size. Health education, occupation, inadequate dietary intake and impact on immune function are some other factor that affects the nutritional status of an individual (Amruth, 2012).

2.1.2 Food availability and the nutritional status

Food insecurity is a critical variable for understanding the nutritional status of low-income populations (Matheson *et al.*, 2002). Food availability is a factor of production capacity, amount of imports and amount that is normally used at a given period in time and of the availability of storage. Food availability is also influenced by the availability of seeds, pest infestation, weather condition, and availability of pasture, land acreage under cultivation, labour and insecurity issues. The amount of food used by households, traded or stored all influence availability at the household level (Wandel and Holmboe-Ottesen, 1992).

Seasonal variation in food availability has long been recognized as a contribution to nutrition and health problems in many third world countries The extent and duration of the seasonal hardships has been related to a number of climatic characteristics, such as rainfall modality, the distinctness of the season and length of period (Wandel and Holmboe-Ottesen, 1992). Food plays a primary role in nutritional status; information on the composition of the foods incorporated in the diet is considered essential background material. Today the great contribution of the science of nutrition to the health and welfare of all the people are facts accepted without question by the professional and lay groups. Nutrition is vital, not only in the growth and development of humans and animals but also in the prevention and treatment of disease. Nutrition is also fundamental to the maintenance of good health and functionality (Ohlhorst *et al.*, 2013).

For the achievement of nutrition adequacy, increased production of food groups making the national diet balance is one of the most important measures. Adverse consequences are manifested themselves if the national diets are deficient in nutrients. Vitamin A deficiency followed by Iron deficiency, blindness among children etc., PEM and so on which could be overcome by supplying or consuming diets rich in these nutrients (Gyawali, 2002).

2.2 Nutrient requirement

Nutrient requirement can be defined as the minimum amount of the absorbed nutrient that is necessary for maintaining the normal physiological functions of the body. There are different dietary standards which are recommended dietary allowances, recommended nutrient intakes, recommended daily amounts of nutrient, or safe intakes of nutrients- are the average daily amounts of essential nutrients estimated, on the basis of available scientific knowledge,

to be sufficiently high to be meet the physiological needs of practically all healthy persons in a groups with specified characteristics (Srilakshmi, 2014).

The nutritional requirements are based on the requirements for different population groups specified by age, sex, weight and physical activity. The average requirements are a weighted average by using the size of each age-sex group as weights. This includes specific needs for pregnant and lactating women. These requirements are not the individual requirements of a particular individual, but an average for a group that is representative of the population in a developing country. Food aid programming guidelines usually give specific suggestions for adjustments based on climate, abnormal demographic distributions and specific nutritional needs of the beneficiary population (WFP, 2011).

Nutritional Requirements refers to the amount of food, energy and nutrient needed on an average per day by specific group and sex categories to meet the needs of healthy individuals for normal functioning of the body for work and growth (Burk, 1984).

The recommended daily allowance (RDA) of nutrients for preschool children (1-5 years) is shown in Table 2.1

Table 2.1 RDA of Pre-schoolers children

Nutrients	Age (in years)	
	1-3 years	**4-6 years**
Calories (Kcal)	1240	1690
Protein (g)	22	30
Fat (g)	25	25
Calcium (mg)	400	400
Iron (mg)	12	18
Vitamin A (µg)	400	400
Thiamine (mg)	0.6	0.9
Riboflavin (mg)	0.7	1
Nicotinic acid (mg)	8	11
Pyridoxine (mg)	0.9	0.9
Ascorbic acid (mg)	40	40
Folic acid (µg)	30	40
Vitamin B_{12} (µg)	0.2-1	0.2-1

Source: Srilakshmi (2014)

2.3 Malnutrition

2.3.1 Pathophysiology of Malnutrition

Malnutrition, encompassing both undernutrition and overweight, is a problem facing virtually every country in the world. The consequences of malnutrition have fundamental implications throughout the life cycle: reduced chances of survival, increased risk of acute and chronic disease, impaired learning in school, and lower economic productivity. The consequences are transmitted across generations via maternal-child nutrition linkages (Black *et al.*, 2013).

Malnutrition is a general term commonly used as an alternative to under-nutrition but technically it also refers to over-nutrition. A person is classified as being malnourished if his/her dietary intake does not provide adequate nutrients for growth and maintenance; or for increased requirements as a result of infections or disease; or if they are unable to fully utilize the food they eat (under-nutrition). They are also malnourished if they consume more

nutrients than needed by their body (over-nutrition) or have a nutrient imbalance (UNICEF., 2006). Malnutrition has been defined as a pathological state resulting from relative or absolute deficiency of one or more nutrients. This state is clinically manifested or detected only by biochemical, anthropometric or physiological tests (Jelliffe, 1996).

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 (Akorede and Abiola, 2013).

Brown (2013) defines malnutrition as the shortage of one or more nutritional elements needed for health and well-being. Primary malnutrition is caused by the deficiency of vital food-stuffs usually vitamins, minerals or proteins in the diet. This commonly leads to specific nutritional deficiency diseases (Brown, 2013). Poor eating habits and food preferences may lead to malnutrition through the exclusion of other foods and the habitual consumption of certain foods or eating large quantities of non-nutritious foods. In certain parts of Africa for example, the practice of weaning breastfed infants to a diet consisting mostly of one kind of starchy food, such as cassava, may lead to protein deficiency (Rabinowitz. *et al.*, 2014).

2.3.2 Ecology of Malnutrition

Some of ecological factor affecting malnutrition are:

a) Conditioning influences: - Infection diseases are important conditioning factor responsible for malnutrition, particularly in small children diarrhoea, intestinal parasite, measles, whooping cough, malaria, tuberculosis all contribute to malnutrition. It has been shown that where environmental condition are poor, small children may suffer from some infection or others for almost half of their first three years of life (Amruth, 2012)

b) Cultural influence: - Lack of food is not only cause of malnutrition. Too often there is starvation in the midst of plenty. People choose poor diet when good one are available because of cultural influence which vary wide from country to country and from region to region. These may be state as:

i) Food habit, custom, belief, tradition and attitude: - Food habits are among the oldest and most deeply entrenched of any culture. They have deeply psychological root and are associated with love, affection, self-image and social prestige. The family plays an important role in shaping of the food habit, and this habit are passes from one generation to another generation. The crux of the problem is that many custom and belief apply most often the vulnerable group; i.e. in infants, toddlers, expectant and lactating women. Papaya is avoided during pregnancy because it is believed to cause abortion. There is widespread belief that if the pregnant women eat more, her baby will beings large and delivery will be difficult. Certain food is "forbidden" as being harmful for the child. Then, there certain belief about hot and cold food, light and heavy food. In some communities, men eat first and women eat last and poorly. Consequently, the health of women in these societies may be adversely affected. Chronic alcoholism is another factor which may lead to serious malnutrition (Amruth, 2012)

ii) Religion: - Religion has powerful influences on the food habit of the people. Hindus do not eat beef and Muslim pork. Orthodox Hindu does not eat meat, fish, egg and certain vegetable like onion. These are known as food taboos which prevent people from consuming nutritious food even these are easily available (Amruth, 2012)

iii) Food fad: - In the selection of food, personal likes and dislike plays an important part. These are called food fad. The food fad may be stand in the way of correcting nutritional deficiencies (Amruth, 2012)

iv) Cooking practices:- Draining away the rice water at the end of cooking, prolonged boiling in open pans, peeling of vegetable all influences the nutritive value widely from region to region and influence the nutritive value food (Amruth, 2012)

v) Child rearing practices: - These vary widely from region to region and influence the nutritional status of infants and children. Examples of these situation are premature curtailment of breast feeding, the adoption of bottle feeding and adoption of commercially produced refined food, during eating time the roaming around, active eating and watching television also effect the nutrition status of child (Amruth, 2012).

c) Socio-economic factor: Malnutrition is largely the byproduct of poverty, ignorance, insufficient education, lack of knowledge regarding the nutritive value of food, inadequate sanitary environment and large family size (Amruth, 2012)

d) Food production: Increased food production should lead to the increase food consumption. But it will not solve the basic problem of hunger and malnutrition in much of the developing world. Scarcity of food, as a factor responsible for malnutrition may be true at the family level, but it is not true at global basis nor is it true for most of the countries when malnutrition is still a serious problem. It is a problem of uneven distribution between the countries and within the countries (Amruth, 2012).

e) Health education: - It is opined that by appropriate educational action, 50% of nutrition problem can be solved. Health education and nutrition education programmed in nutrition is often a weak component. Its reinforcement is a key element in all health service development (Amruth, 2012)

f) Occupation: - Occupation is the major factor that enhance to introduce the malnutrition in many habitats. As family is more engaged to earn by implying the occupational activities more chances of having the food intake by purchasing from marked or self-production. Among the group of different occupation mostly wage earner by daily purpose they spend all of money on food or daily commodities (Amruth, 2012)

g) Inadequate dietary intake: - This can mean both macronutrients (fat, protein and carbohydrate) and micro nutrients (vitamins and minerals) though insufficient macronutrient intake has serious implications for health and well-being, micro nutrient also play large role in immune function (Bhatta *et al.*, 1998)

h) Impact on immune function: - Insufficient macro nutrient intake can result in growth stunting (in children) as well as weight loss. Micro-nutrients such as vitamin A, zinc and a large number of others are essential to a number of immune responses, and deficiency can lead to suppressed immunity, which in term increases risk of acquiring infection. In addition, inadequate intake can also weaken immune response through changes in mucus membranes of the body (Bhatta *et al.*, 1998).

i) Infection: - Once immune function is lowered, it may lead to infectious disease. Malnutrition not only affects the occurrences infectious diseases, it can also increase the severity of illness, and the length of time they are experienced (Bhatta *et al.*, 1998)

j) Poverty: - At micro level, child malnutrition is related to poverty, but at the macro community level poverty does not appear to be strongly related to child malnutrition in many

cases. Others factors are equally important. One of these is related to the intra-household use of resources such as the time management and knowledge of the main caregiver, who is usually the mother. For example, how much time is allocated to feeding, caring and ensuring a healthy environment for child (Bhatta *et al.*, 1998)

k) Food availability and nutrition status: - Good health depends on adequate food supply and consumption. The food distribution determines the state of health and the incidence of disease among population. If the food supply is inadequate than the physiological needs, malnutrition and under nutrition could result (Yadav, 1994)

Increased production of food groups making the national diet balance is one of the most important measures of achieving nutritional adequacy. Where the national diets are deficient in nutrient, adverse consequences manifest themselves. For example, there is high prevalence of anemia due to iron deficiency, blindness among children due to vitamin A deficiency etc. Thus, the real solution to overcome the deficiencies disease is to consume diet rich in these nutrients. For a desirable nutrient balance, cereal contributes about 70-80% of the total dietary energy in the diet of people in developing countries. All other food commodities contribute only from 15 to 30% of total dietary energy. Diets in general are bulky, monotonous and nutritionally imbalanced. Household food insecurity can negatively affect food consumption, including reduced dietary variety, nutrient intake, and nutritional status of household members (Yadav, 1994)

2.3.3 Forms of Malnutrition

A well-nourished child is one with access to adequate food supply, care and health. Such a child will grow well. Growth is assessed using comparison of weight and height measurements with the standard normal distribution of heights and weights of healthy children of the same age and sex. Therefore, the best way to evaluate the nutritional status and overall health of a child is to compare the child's growth indices associated with adequate growth, with the set cut-off points in the standard normal distribution of well-nourished children (Walker *et al.*, 2007) .

2.3.3.1 Undernutrition

Under nutrition is the pathological state resulting from the consumption of an inadequate quantity of food over an extended period of time (Jelliffe, 1996). Under-nutrition is a consequence of consuming too few essential nutrients or using or excreting them more

rapidly than they can be replaced. In children, the outcome is growth (weight or height) faltering and/ or specific symptoms and signs of micronutrients deficiency disorder (WHO, 2012)

2.3.3.2 Over nutrition

It is the pathological state resulting from the consumption of an excessive quantity of food and hence a calorie excess, over an extended period of time (Jelliffe, 1996).

2.3.3.3 Specific deficiency

It is the pathological state resulting from a relative or absolute lack of an individual nutrient (Jelliffe, 1996).

2.3.3.4 Imbalance

The pathological state results from a disproportionate consumption of essential nutrients with or without the absolute deficiency of any nutrients as determined by the requirements of a balanced diet (Jelliffe, 1996).

2.3.4 Global situation of malnutrition

Most governments and international communities in developing countries have been unsuccessful in dealing with malnutrition over the past decades despite the acknowledgement that malnutrition destabilizes economic growth and propagates poverty, even though there are well tested approaches in place (World Bank., 2014). The results of this failure to act are now revealed in the world's inadequate progress towards the Millennium Development Goals and towards poverty reduction (World Bank., 2014).

The scarcity and deprivation of food has been a recognized problem among the poor in many nations. It is variously referred to as hunger, food poverty, food insufficiency, and household food insecurity. Food security is a broad concept which covers issues related to the nature, quality and security of food supply as well as issues of access. Food insecurity is a daily reality for hundreds of millions of people around the world. Food insecurity is a daily reality for hundreds of millions of people around the world (Barrett, 2010).

Food insecurity is experienced at the household and individual levels in different ways. The household level is defined by food supply management and acquisition issues whereas at individual level it is more defined by the issues of food consumption and allocation and

includes the psychological sensation of hunger. According to Webb *et al.* (2006) some areas of the world have poor economy or regional conditions such as drought or over population which then causes inadequacy of certain food stuffs and thus leads to a certain portion of the population being undernourished because of lack of vital nutrients. However, even when there is more than enough food, malnutrition can occur due to poor eating habits.

Nearly every country in the world experiences some form of malnutrition, and no country can take good nutrition for granted. Malnutrition is one of the leading causes of morbidity and mortality in children under the age of five in developing countries. Nutritional deficiencies are responsible for over 50 % of years lived with disability in children aged four and below (Vos *et al.*, 2012).

The World Health Organization estimates that by the year 2015, the prevalence of malnutrition will have decreased to 17.6 % globally, with 113.4 million children younger than 5 years affected as measured by low weight for age. The overwhelming majority of these children, 112.8 million, will live in developing countries with 70 % of these children in Asia, particularly the south central region, and 26 % in Africa (WHO, 2013).

2.3.5 Nutrition deficiency disorder

2.3.5.1 Protein energy malnutrition

Protein energy malnutrition, also known as starvation, is defined as a diet with insufficient amounts of all the major macronutrients: proteins, carbohydrates and fats. A starving person becomes skeletally thin and weak and is in danger of death. Protein energy malnutrition usually is seen during famines in Third-World countries and in eating disorders in Western societies (WFP, 2011).

PEM is a range of pathological condition arising out of coincident lack of protein and energy in varying proportion, most frequently seen in infants and young children and usually associated with infections (WHO, 1996). Protein-energy malnutrition (PEM) is one of the most important nutritional diseases in developing countries the prevalence of which has caused the mortality of children and their physical disturbance; lack of economic and social development in these countries. Imbalance between food intake and actual metabolic needs can cause clinical symptoms of PEM which is followed by a vast range of clinical disorders in varying degrees (Geissler and Powers, 2017).

PEM, due to suitable cultural and economic reasons, has more prevalence in developing countries. Intermittent population growth and unavailability of food in addition to low level of knowledge in different sectors of the community, are among the factors affecting the prevalence of PEM; particularly in under five year old children in these countries (Alleyne *et al.*, 1977). The term protein–energy malnutrition describes the cause (i.e., the imbalance between nutrient supplies and requirements) more than the pathogenesis of starvation (Reilly, 2002). The pathologic changes include immunologic deficiency in the humoral and cellular subsystem from protein deficiency and lack of immune mediators (e.g., tumour necrosis factor). Metabolic disturbances also play a role in impaired intercellular degradation of fatty acids because of carbohydrate deficiency. Synthesis of pigments in the hair and skin fails (e.g., hair colour may change and skin become hyper-pigmented) because of a lack of substrate (e.g. tyrosine) and coenzymes (Lerner, 1971).

2.3.5.2 Kwashiorkor

Dr. Ciceley Millons (1953) first introduce the word Kwashiorkor, given to the disease by people of gold coast in Africa in 1935. The term Kwashiorkor means, the disease which the child gets when the next baby born i.e. sickness of the disposal child (Jelliffe, 1996).

This form of severe under nutrition is also common in children between the ages of 6 month and 3 years; a period of life when complementary feeding plays an important role in child's growth and development. The child may have complaints like inactivity, loss of interest in the surroundings, increase swelling of the body and refusal fat, diarrhea for a prolonged period of time, excessive crying and irritability, vomiting, oozing ulcers in the skin etc. The child may appear moon face but on a close look wasting of muscle is observed over the buttocks and thighs. The child weighs less than 80% of expected for age; sometimes if there is severe edema, the weight may be above 80% of expected. Oedema is present, initially mild and involving only the lower limbs, becoming gradually generalized later on. The child may have feature of vitamin A deficiency such as dry conjunctiva or cornea, clouding or ulcer in the cornea or night blindness. The child may be anemic and have cold and pale extremities due to poor circulation (Adhikari and Krantz, 2013)

2.3.5.3 Marasmus

This is common form of PEM. It is a child version to starvation. It usually occurs in a second six months of life. The cause is the diet very low in calories and incidentally in protein and

other essential nutrients. The symptoms include, severe wasting of muscle mass, shrunken eyeball, depressed cheeks, and ribs becomes prominent etc. It mainly occurs 6 to 18 months of age (Davidson., 1992).

Marasmus is the result of calorie deprivation and is more common between 9 months to 3 years of age. It is characterized by decreased anthropometric measurements and is usually well tolerated in the absence of stress, unless it is severe. Failure to gain weight due to the marked loss of subcutaneous fat may result in emaciation and loss of skin turgor. General body functions decrease as indicated by a subnormal temperature, decreased pulse and metabolic rate, and constipation. Starvation diarrhea (frequent small stools containing mucus) and respiratory illness may be present (Castiglia, 1996)

2.3.5.4 Marasmic Kwashiorkor

When the incidence of PEM is high, a large number of case shows some of the features of both marasmus and kwashiorkor (Passmore and Eastwood, 1986).

2.3.6 Vitamin A Deficiency

Vitamin A deficiency remains a leading public health problem in the developing world (Chytil, 1997) with its health consequences most apparent and severe among infants, young children, and women of reproductive age. Severe vitamin A deficiency typically entails clinical signs of xerophthalmia and very deficient serum levels of vitamin A (0.35μmol/dl), whereas subclinical deficiency (mild and moderate VAD) is defined as tissue concentrations of vitamin a low enough to have adverse health consequences, even if there is no evidence of clinical xerophthalmia. Sixty-nine percentage of children in Southeast Asia have vitamin A deficiency (Ramakrishnan, 2002).

Vitamin A is integral to the mucosal lining of small intestine that protects the body from bacteria; thus, vitamin A deficiency is associated with higher risk of diseases, such as measles and malaria. Vitamin A supplementation is most effective when received twice a year and it administered in bi-annual dose to children under the age of five in many developing countries (Bhaskaram, 2002). The availability of stored vitamin A also depends on a child‘s general nutritional status (NDHS, 2016)

2.3.7 Anemia

Anemia is a condition in which the red blood cells are insufficient to meet the physiologic needs of the human body (WHO, 2011). Anemia is a prevalent public health problem which affects about a quarter of the world population (Benoist *et al*., 2008), notably pre-school aged (Pre SAC) children with global prevalence in the 0–5 year-old age group rising to 47.4 % (McLean *et al.*, 2009). In Nepal, the prevalence among children <5 years was 46 % (Chaparro *et al.*, 2014).

Anemia in children is of particular interest since it can negatively and irreversibly impact their future development. Although the etiology of anemia among children is multi-factorial, the most significant correlates to the onset of childhood anemia is iron deficiency with a smaller proportion due to deficiencies of such micronutrients as folate, Vitamin A and B_{12} (Villalpando *et al.*, 2003).

More than half (53%) of the children age 6-59 months and 41% of the women age 15-49 are anemic (NDHS, 2016)

2.3.8 Iodine Deficiency Disorder

Iodine is essential for the normal functioning of the thyroid gland. If iodine intake is inadequate, the thyroid gland enlarges (goiter). In some children iodine deficiency may cause delay in mental development resulting in a condition known as cretinism. Till recently Nepal used to have a very high prevalence of iodine deficiency disorders. However, with continued efforts to supply the total population with iodized salt becoming successful, goiter is almost non-existent in the country. The latest health surveys show that almost 80% of the households in Nepal consume iodized salt thus reducing the possibility of suffering from IDD (Joshi, 2004).

Mainly iodine deficiency causes cretinism and goiter. Cretinism has two types; nervous cretinism and myxedematous cretinism. The principle feature of nervous cretinism are unsteadiness of gait, deaf mutism, spasticity of limbs and mental deficiency. The myxedematous cretin have short stature, mental deficiency and feature of myxedema (coarse skin, non-pitting oedema, lethargy, cold intolerance etc.). Adequate iodine intake is the main approach to prevent IDD. So, use of iodine packaged salt should encouraged. Goiter is characterized by abnormal growth of the thyroid gland. Hypothyroidism causes dullness,

gain in weight, decreased work efficiency and protrusion of the eyeballs and low levels of thyroxin (Joshi, 2004).

2.3.9 Zinc Deficiency

Zinc deficiency can occur due to a diet poor in zinc or it may develop after prolonged diarrhoea or infection. People with diarrhea excrete zinc in their stools, often losing many times their daily intake of zinc. Malnourished children with diarrhea especially those with marasmus or kwashiorkor are often lacking in zinc. Zinc is also lost as a result of tissue damage that causes fever. The common features include poor growth, less resistance to infection, poor inflammatory response to infection, and excessive fluid loss during diarrhea or persistence of diarrhea and skin changes. Skin becomes dry, hyper or hypo pigmented and there will be scales seen in the skin. Zinc deficiency can be stopped or prevented by eating nuts, legumes, yeast and whole grains. Zinc is also found in beef, pork and lamb. Continued breast feeding is a good source of zinc (Adhikari and Krantz, 2013).

2.4 Nutritional situation

2.4.1 Incidence of under nutrition

Under nutrition defined as the outcome of insufficient food intake and repeated infectious diseases. Under nutrition includes being underweight for one's age, too short for one's age (stunted), dangerously thin (wasted), and deficient in vitamins and minerals (micronutrient malnutrition). When individuals are undernourished, they can no longer maintain natural bodily capacities, such as growth, resisting infections and recovering from disease, learning and physical work, and pregnancy and lactation in women. Poor feeding of infants and young children, especially the lack of optimal breastfeeding and responsive complementary feeding, along with such illnesses as diarrhea, pneumonia, malaria and HIV/AIDS, often exacerbated by Helminths, are major causes of under nutrition (UNICEF., 2006).

According to NDHS 2016, Thirty-six percent of children under age 5 are stunted (short for their age), 10% are wasted (thin for their height), 27% are underweight (thin for their age), and 1% are overweight (heavy for their height). -five percent of children under age 2 are breastfed within 1 hour of birth, and 66% of children under age 6 months are exclusively breastfed. Forty-seven percent of children age 6-23 months receive meals with the minimum

recommended diversity (atleast four food groups), 71% receive meals at the minimum frequency,and 36% meet the criteria of a minimum acceptable diet.

Eleven percent of women age 15-49 are short (less than 145 cm), and 17% are thin (BMI less than 18.5). Another 22% of women are overweight or obese (BMI greater than or equal to 25.0). Among men, 17% percent are thin, and 17% are overweight or obese. Forty-two percent of women age 15-49 with a child born in the past 5 years took iron tablets for at least 180 days, and 69% took deworming medication during the pregnancy of their last child. Ninety-five percent of households use iodized salt for cooking.(NDHS, 2016)

2.4.2 Infant Mortality, Life Expectancy, and Birth-weight

Infant mortality, Life expectancy and birth-weight are commonly used indicator to reflect malnutrition. According to Nepal Demographic Health Survey 2011 Infant and under-five mortality rates in the past five years (2006-2007 to 2011-2012) are 46 and 54 deaths per 1,000 live births, respectively. At these mortality levels, one in every 22 Nepalese children dies before reaching age 1, and one in every 19 does not survive to his or her fifth birthday. Infant mortality has declined by 42 percent over the last 15 years, while under-five mortality has declined by 54 percent over the same period. Childhood mortality is relatively higher in the mountain ecological zone than in the Terai and hill zone and is highest in the Far-western region. The neonatal mortality rate in the past five years is 33 deaths per 1,000 live births, which is two and a half times the post neonatal rate. The perinatal mortality rate is 37 per 1,000 pregnancies. The average life expectance of Nepalese men and women is around 60.1 and 60.7 respectively (MoHP., 2011).

2.4.3 Nutrition status of Nepal

There is wide variation in rates of malnutrition throughout Nepal both ecologically and regionally. Nepal Demographic and Health Survey indicates that more rural children are stunted (low height for age), 42% than urban children (27%). Regional variation of nutritional status of children is substantial. Stunting levels are way above the national average in mountains (53%). Whereas wasting (low weight for height) and underweight (low weight for age) are also high in mountains with 11% and 36% respectively in comparison with Terai and Hills. In Terai there is 37% stunting, 11% of wasting and 29% of underweight and in Hills it shows 42% of stunting, 11% of wasting and 27% of underweight (MoHP., 2011).

In general, the nutritional status of children in Nepal has improved over the past 15 years and is close to achieving the Millennium Development Goal (MGD) target of reducing the percentage of underweight children age 6-59 months to 29 percent by 2015. The prevalence of stunting and of underweight among children under age 5 have markedly decreased, from 57% to 36%, and from 42% to 27%, respectively, in the last 20 years (1996-2016). This indicates stunting in children declined by 8% between 2001 and 2006, declined by an additional 8% between 2006 and 2011, and dropped by 5% between 2011 and 2016. A similar downward trend is observed for underweight children. However, in the same time period, changes in wasting were minimal (NDHS, 2016).

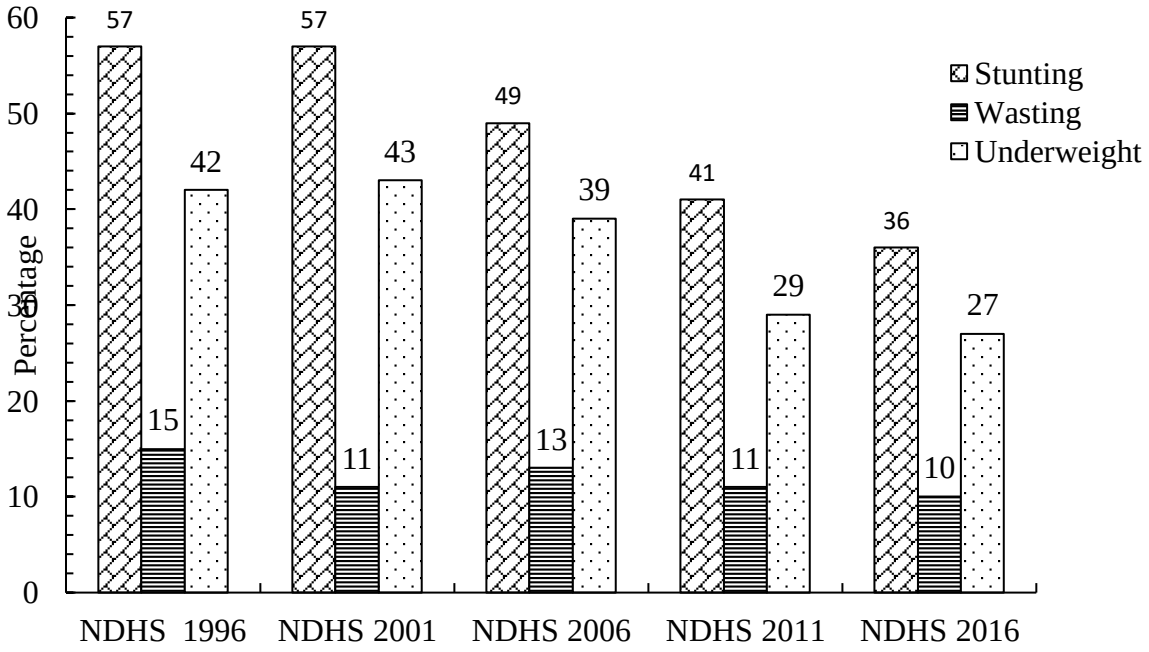

Fig 2.1: Trends of malnutrition prevalence in Nepal

Source: NDHS (2016)

2.5 Breastfeeding and Weaning Process in Nepal

Breastfeeding in the first years of life protects children from infection, provides an ideal source of nutrients, and is economical and safe. However, many mothers stop breastfeeding too soon and there are often pressures to switch to infant formula, which can contribute to

growth faltering and micronutrient malnutrition and is unsafe if clean water is not readily available. WHO/UNICEF provide the following feeding recommendations (NMISC, 2010).

a) Exclusive breastfeeding for first six months of life.
b) Continued breastfeeding for two years or more safe, appropriate and adequate complementary foods beginning at six months of age.
c) Frequency of complementary feeding: two times per day for 6–8 months old; three times per day for 9–11 months old.
d) It is also recommended that breastfeeding be initiated within one hour of birth.

Breast-feeding is nearly universal among the Nepalese mothers, but its duration and frequency are not always optional. In most communities, a mother begins feeding their infants almost immediately, but in some parts of the country feeding doesn't begin for a two days or after the colostrum has been discarded (Gibbons and Griffiths, 1984).

According to Nepal Demographic Health Survey 2016, Two-thirds of the children (66%) under age 6 months were exclusively breastfed, whereas 76% under 3 months were exclusively breastfed. Exclusive breastfeeding sharply declines with age. Only 41% of children age 4-5 months were exclusively breastfed compared with 80% in 0-1 months and 72% in 2-3 months. Contrary to the recommendation that children under 6 months should be exclusively breastfeed, 6% received breastmilk with non-milk liquids, 10% received breastmilk with other milk, and 12% received breastmilk with complementary foods. Nine percent of children 0-5 months, 18% of children 6-9 months, and 13% of children 12-23 months are bottle fed. Exclusive breastfeeding among children under age 6 months increased from 53% in 2006 to 70% in 2011. However, in 2016, there was a slight decline in the percentage of exclusively breastfed children, to 66% (NDHS, 2016).

2.5.1 Weaning practice

The children are considered to be the most nutritionally vulnerable member of any community. The period of childhood especially the second year of life is notoriously fraught with risk. The young child is "transitional" as regard diet immunity to infection and psychologically dependence. This is a period of rapid growth with high nutrients needs, particularly of proteins for swiftly increasing muscle tissue. It is a time when several meals a day required and when foods should be easily mistakable and digestible (Jelliffe, 1996).

If the baby is to maintain the expected rate of growth, remain healthy and well nourished, supplementary feeding has to be restored to around 6th month (Srilakshmi, 2014).
Common traditional weaning foods include:
Porridge (*lito*)- made from roasted rice flour (occasionally maize or millet), ghee (clarified butter) and sugar.
Jaulo- made from rice and turmeric or rice and salt.
Dhindo- made from maize flour (or millet or wheat)
Maar- made in lowland areas by cooking rice, cracked maize and soybeans together
Khichari- a mix of rice, pulses and vegetables.

2.6 Nutritional status of women in Nepal

Dietary intake pattern plays a significant role in human health. Improper and inadequate dietary intake pattern especially in women of reproductive age have resulted in the deficiency of essential nutrients especially during pregnancy and lactation in Nepal, where 18 % of women are malnourished and 35 % are anemic (Lakew *et al.*, 2015), which pose threat to physical, mental and social well-being of women. In addition, reproductive biology, poverty, lack of education, socio-cultural traditions and disparities in household contribute to under nutrition in women (Ransom and Elder, 2003). Those women who consume limited animal source foods, fruits and vegetables, increase their risk of micronutrient deficiencies. Women on low protein and carbohydrate diets can be severely malnourished mothers and are at increased risk of child mortality (Demissie *et al.*, 2003).

The nutritional status of women of reproductive age is still poor especially in Terai and the dietary intake pattern is not adequate. It suggests improving nutritional status and feeding habits especially intake of meat, fruits and vegetables focusing on reproductive aged women (Bhandari *et al.*, 2016).

2.7 Population growth in Nepal

Although Nepal's birth and death rate are both relatively high, the population is growing at a fairly rapid rate. More than two fifths of the population is younger than 15 years of age. However, the population growth rate in 2011 is 1.41 % (NDHS 2011).

2.8 Assessment of nutritional status

2.8.1 Nutritional assessment

Nutritional assessment can be defined as "The interpretation of information from dietary, laboratory, anthropometric and clinical studies". The information thus obtained is used to determine the type, magnitude and distribution of malnutrition of individuals and population groups as influenced by the intake and utilization of nutrients. Presently, the nutritional assessment in low income countries (such as Nepal) emphasizes new simple, noninvasive approaches that can be used to measure the risk of both nutrient deficits and excesses, as well as to monitor and evaluate the effects of nutrition (Romana, 2004).

2.8.2 Methods used to assess nutritional status

The assessment of nutritional status can be done using the following information (Jellife, 1966).

a) Direct method: Deals with the individual and measures objective criteria. e.g. Anthropometric, Clinical examination, Biochemical and Bio- physical parameters.

b) Indirect method: Use community indices that reflect the community nutritional status or need. e.g. Dietary intake, morbidity and mortality rates, as specific mortality and vital statistics.

c) Ecological factors: e.g. Socio-economic status, housing and environmental hygiene, health and education services, conditioning infection.

2.8.2.1 Direct methods

a. Anthropometric measurements

Anthropometric measurements are based on the measurements of body dimensions and proportions without giving any harm to the body. Although, it is used to evaluate both under and over nutrition, it doesn't differentiate between chronic and acute malnutrition. The most commonly used anthropometric measurements as defined by Hartog *et al.*,(2006) are:

- **Weight for height**: Weight and Height of child is measured using standard Seca digital balance and stadiometer respectively and index is expressed in standard deviation units from the median of WHO child growth standards adopted in 2006. Children whose weight-for-height is below minus one standard deviation is considered mildly wasted similarly below minus 2 and 3 standard deviations are considered moderately and severely wasted respectively.

- Weight for age: Children whose weight-for-age is below minus two standard deviations from the median of the reference population are considered underweight. The measure reflects the effects of both acute and chronic under nutrition.

- Height for age: Children whose height-for-age is below minus two standard deviations from the median of the reference population are considered stunted or short for their age. Stunting is the outcome of failure to receive adequate nutrition over an extended period and is also affected by recurrent or chronic illness.

- Mid upper arm circumference (MUAC): When the measurement of height and weight is difficult, MUAC is used as an alternative index. Children whose mid upper arm circumference is below 12.5cm are considered malnourished. Hence it is significant during the diagnosis of protein energy malnutrition. Measurement should be taken by flexible, non-stretch tape made of fiber glass or steel.

- Oedema: Accumulation of fluid in interstitial cells is called as oedema it also reflects PEM.

- Head/chest circumference ratio: Measurement of head circumference is important in clinical settings as part of health screening for potential development or neurological disabilities in children. It is often used with other measurements to detect pathological conditions too.

The circumference of chest should be same to the head circumference at 1 year of age. After this skull grows slowly and the chest more rapidly. Between the ages of 1 year and 5 years, if head /chest circumference ratio is less than 1, it indicates the wasting of muscle and fat of chest wall. It can also be used as an indicator of PEM (Swaminathan, 2008).

b. Biochemical methods

Variations in the intake of different nutrients present in the diet are reflected by changes in the concentration of the corresponding nutrients or metabolites influenced by the nutrients, in blood, tissues and in urine. Hence the biochemical assessment can reveal sub clinical states of deficiency of one or more nutrients due to lowered intake or absorption or impaired transport or abnormal utilization of nutrients. Some of the biochemical tests includes:

- Measurement of individual nutrient in body fluids such as serum retinol, serum iron, urinary iodine, vitamin etc.

- Analysis of hair, nails and skin for micronutrients.
- Stool examination for the presence of intestinal parasites.
- Detection of abnormal amounts of metabolites in the urine (e.g. Urinary creatinine/ hydroxyproline ratio) (Swaminathan, 2008).

c. Clinical assessment

Anthropometry alone cannot assess accurate child's nutritional status. A child with normal weight and height may have different nutrient deficiency disorders. Therefore, a documented process called clinical examination is used to evaluate and diagnose individuals overall well -being, whether mental, physical or both by observing certain signs and symptoms which are associated with various nutrient deficiencies. Some of the clinical signs of nutritional disorders are:

- Hair: thinness, sparseness, depigmentation and easily pluck ability: kwashiorkor and marasmus.
- Face: nasolabial dyssebacia (dryness and scaling in the area extending from nose to the corner of lips), moon face: kwashiorkor
- Eyes: Bitot's spot, conjuctival xerosis, keratomalacia: vitamin A deficiency
- Lips: angular stomatitis, angular scars, cheilosis: riboflavin deficiency
- Tongue: magneta tongue: riboflavin deficiency: Scarlet and raw tongue: nicotinic acid deficiency
- Teeth: mottled enamel: fluorosis
- Gums: spongy bleeding gums: Ascorbic acid deficiency
- Skin: Xerosis, per follicular keratosis: vitamin A deficiency
  - ♣ Flaky paint dermatosis: kwashiorkor
  - ♣ Scrotal and vulval dermatosis
- Nails: koilonychias: iron deficiency
- Glands: Thyroid enlargement: iodine deficiency
  - ♣ Paratoid enlargement: starvation

Since, this method is based on observation of physical signs, it is relatively inexpensive and does not require any elaborate field equipment or even a laboratory but cannot detect the early cases (Adhikari and Krantz, 2013).

d. Biophysical methods

i. Radiographic examination- Though this method is not feasible in routine examination but is valuable to carry out if the physical signs and symptoms suggest that rickets, osteomalacia, fluorosis, or beriberi may be present, e.g. rickets can be identified with widened concave, rarefied, frayed distal ends of long bones, usually the radius and ulna (Joshi, 2015).

ii. Tests for physical function- These are devised to determine deviations in visual acuity, dark adaptation of the eyes, capillary fragility, nerve accommodation, physical performance (dynamometry, etc.), and muscle coordination. The most widely used test is the dark adaptation since vitamin A deficiency is a very common one and this test can be used objectively to evaluate the complaint of night blindness (Joshi, 2015) .

iii. Cytological test- This test assesses the buccal smears and shows the good correlation with malnourished children. Cornified and non-cornified cells can be differentiated by the color reaction to Schorr's stain. The buccal smears from healthy children shows 60-70% non-cornified cells while in PEM, this proportion drops to about 20% or less (Joshi, 2015).

2.8.2.2 Indirect Methods

a) Vital statistics

A variety of vital statistics such as maternal, infant and childhood mortality rates, fertility index, prevalence rates have been considered as indirect indicators of nutritional status of community.

b) Economic factors

Per capita income, population density and social habit have indirect effect in nutritional status.

c) Ecological Information

The nutritional status of an individual or community is affected by socioeconomic and ecological factors. Therefore these parameters are likely to serve useful indirect indicators (Rajalakshmi,1987).

d) Dietary assessment

Dietary intake is assessed by following methods:

i) 24 hours dietary recall: It aims to ascertain the food intake of an individual during the immediately preceding 24 hours. This method estimates the food actually eaten, as recalled from memory. A structured questions with specific probes helps the respondent to remember all foods consumed throughout the day (Hartog *et al.*, 2006).

ii) Food dairy technique: In this method all the foods eaten by an individual during a specified period is recorded at the time of consumption and listed by the subject. Often the ingredients and amounts used in the preparation of dishes are also measured and nutrient and calorie intake are calculated. Though this method can give a fairly exact picture of the actual food intake of an individual, sometimes not every individual is able to weigh and record the intake in household measures (Rodrigo *et al.*, 2015).

iii) Food Frequency method (Questionnaires): A Food Frequency Questionnaire (FFQ) is a limited checklist of foods and beverages with a frequency response section for subjects to report how often each item was consumed over a specified period of time. Food frequency method focus on the intake of specific nutrients, dietary exposures related to a certain disease, or comprehensively assess various nutrients (Coulston and Boushey, 2008).

The frequency responses can be open-ended or multiple choice ranging from several times per day to number of times per year, depending on the type of food. A better representation of usual dietary patterns than only a few days of observation is its main advantage. Whereas, disadvantages include comprehensive list of all foods eaten cannot be included and reported intake is limited to the foods contained in the food list and particularly complex for children and elderly people. A relatively high degree of literacy and numeracy skills are required if self-administered (Rodrigo *et al.*, 2015).

2.9 Conceptual framework

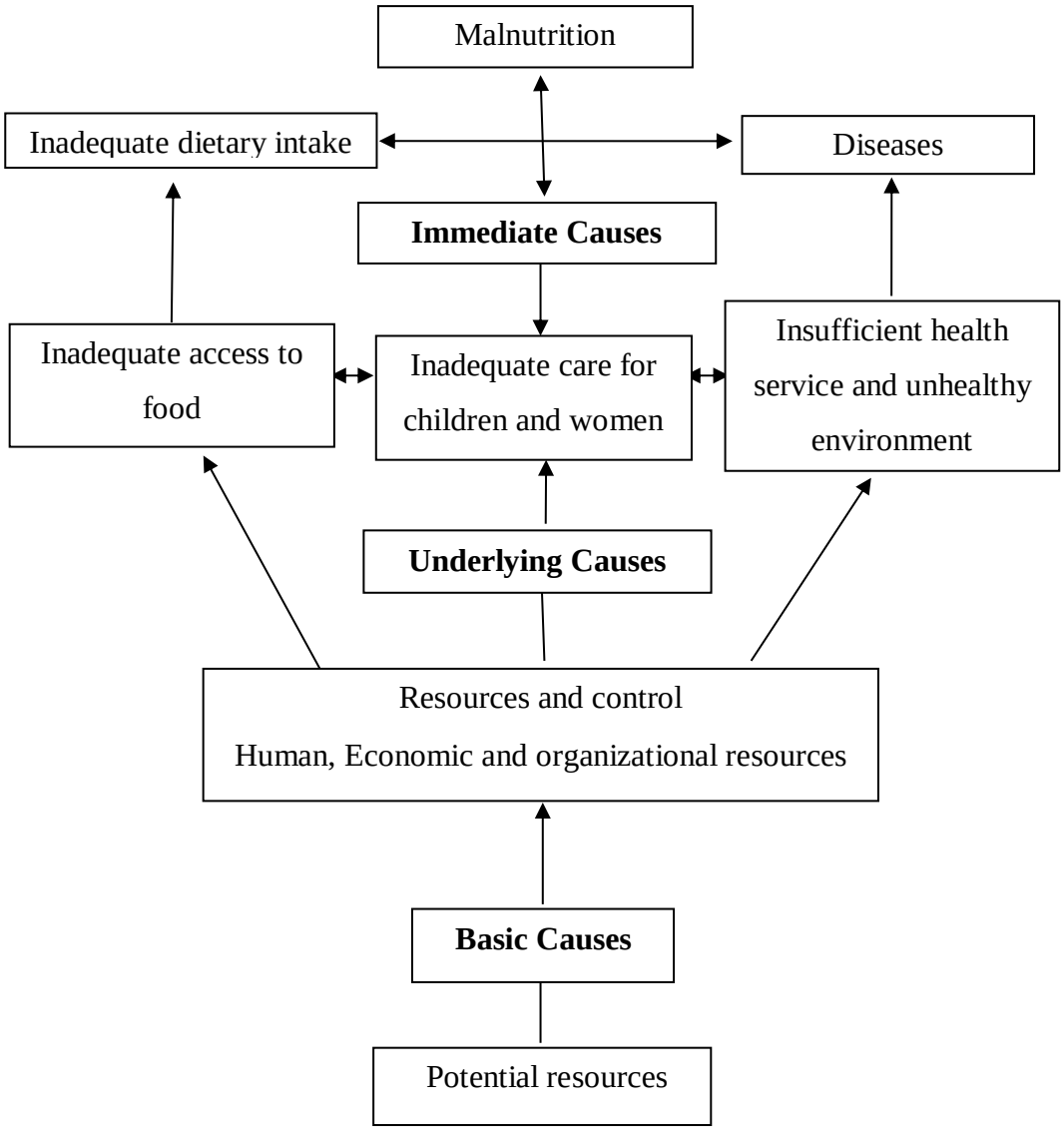

Figure 2.2: UNICEF conceptual framework for causes of malnutrition

Source: UNICEF (2006)

Part III

Materials and methods

3.1 Research method

The study was quantitative and based on primary data. A community based cross-sectional survey was conducted from 21st to 29th May, 2018 in flood affected area of Itahari, sub-metropolitan city to assess the nutritional status of 6-59 months children and factor associated using semi-structured questionnaire.

3.2 Study variables

Study variables were categorized into two groups: dependent variable and independent variable. Dependent variable of the study was nutritional status of 6-59 months children as indicated by stunting, wasting and underweight. Whereas, independent variables of the study were:

a) Socio-economic and demographic variables: head of household, ethnicity, family size, income, occupation, education

b) Child characteristics: age, sex, birth order, breastfeeding status and morbidity status.

c) Child care practices: Feeding, hygiene

d) Maternal characteristics: age, iron and folate intake, number of children born,

e) Environmental health condition: water supply, sanitation and housing condition.

3.3 Study area and its justification

Itahari is a Sub-Metropolitan and largest city in Sunsari District in the Koshi Zone of south-eastern Nepal. There were total 20 ward in Itahari. The study was conducted in flood affected areas of Itahari which include only ward number 3, 4, 9 and 10. According to National Population and Housing Census 2011, flood affected area (ward 3, 4, 9 & 10) of Itahari constituted 2,400 households with 15,845 total populations. There were 835 under five children.

3.4 Target population

The target population of the study was 6-59 months children for nutritional status assessment and parents or caretakers were the targets for the assessment of factors associated with nutritional status of children. In this study, 6-59 months children of flood-affected area in Itahari were involved as study population.

Inclusion and exclusion criteria:

3.4.1 Inclusion criteria

Children aged 6-59 months living in flood-affected area of Itahari were included in the study.

3.4.2 Exclusion criteria

The study participants who were seriously ill, disabled or who were not available at household during the time of survey were not included in the study.

3.5 Sampling techniques

Cross-sectional descriptive study was conducted in flood-affected area of Itahari. Simple random sampling method was used to select children from households. From 20 wards of the Itahari, only 4 wards (ward no. 3, 4, 9 and 10) were affected by flood. The basic criterion for the selection of household sample was that the household with at least one child of 6-59 months of age was included in the sample. In households with more than one children of age between 6-59 months, one child was chosen by lottery method.

3.6 Sample size

The sample size was determined by using a single proportional formula assuming the prevalence rate of malnutrition to be 50% in the survey area, 95% confidence interval (CI), 8 % margin of error (d) and 10% non-response rate was added to the total calculated sample size.

Mathematically,

Sample size (NO) = $Z^2 \times p\ (1\text{-}p)/d^2$

Where, z = confidence interval at 95% (standard value of 1.96)

p = estimated prevalence of malnutrition (50 %)

d = margin of error (8 %)

Now

$NO = Z^2 \times p\,(1-p)/d^2$

$NO = 1.96^2 \times 0.5 \times (1-0.5)/(0.08)^2$

$= 150.0625$

≈ 150

The sample size was adjusted for finite population.

Where, SS = New sample size for finite population

NO = Sample size in infinite population

POP = Total number of population (in this case total number of population under 5 years age children).

SS = NO / [1+ {(no-1)/pop}]

SS = 150 / (1+ (150-1)/835)

= 127.2866

≈ 127

Thus, the actual sample size was determined by adding 10% attrition rate on calculated sample size.

The actual sample size = 127+10% of 127

=139.7

≈ 140

3.7 Research instruments

Instruments and equipment's used during survey were:

a) Weighing Machine: Weighing machine with the capacity of 100 kg and having the least count of 0.1 kg. (Microlife pvt. ltd)

b) Height measuring scale (Stadiometer)

c) MUAC Tape: For measuring mid-upper arm circumference.

d) Questionnaire: A well designed and pretested set of questionnaire to collect household information. (Appendix - A)

3.8 Sampling frame

All the 6-59 months children were included in the sampling frame from the selected wards (3, 4, 9 and 10) of Itahari.

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3.9 Validity and reliability of the research

To ascertain the degree to which the data collection instruments measure what they purposed to measure, the instruments was validated by comparing with standard known weights (for weighing balance). Reliability refers to quality control measure of data collected. Questionnaire was checked for completeness, consistency and clarity.

Validity and reliability of the study was ensured by pre-testing of the tools, using standardized instruments. Instruments was set at 0 reading before taking measurements with standardized reference one. Close supervision was done in the field.

3.10 Data collection techniques

Primary data was collected using semi-structured questionnaire and anthropometric measurement. Interview was conducted with parents/care takers of the children to fill the questionnaire.

Secondary data was obtained from Village Development Committee office, Nepal Demographic Health Survey (NDHS 2011), Primary Health Centre (PHC), Central Bureau of Statistics, and key informants like Female Community Health Volunteers (FCHV), local leaders etc.

There were two sets of tools to gather the information. Part I is the structured interview schedule to generate data pertinent to factors associated with nutritional status of children and Part II is a form, consisting of child information anthropometric measurements was recorded in it. Form was developed to record the measurements of height, weight, Mid Upper Arm Circumference and structured pre-tested interview schedule was used to collect information from the respondents. The questionnaires comprised mainly of details on household profiles like age, sex, education level and occupation of household members and household size. Data on sources of income was also collected. Anthropometric measurements taken for children aged (6-59) months included.

Date of birth- The date of birth for each child was inquired from the caretaker/ mother and recorded in months.

Length/height- The length of each child aged 6 - 24 months was measured lying flat and centrally on measuring boards placed on a hard flats surface on the ground. The length was read to the nearest 0.1 cm (head and feet against the base of the board and foot piece

respectively) (Tamiru *et al.*, 2015). The height of children aged above 24 months was measured standing straight on measuring board placed on hard flat surface with line of sight perpendicular to the horizontal surface. Children were made to stand bare foot on height board and with feet parallel and joined together and with heels and buttock touching the wall. It was made sure that that head was held erect and hands were hung closely at the sides. The child's height was measured to the nearest one decimal place.

Weight. Weight was measured by electronic digital weight scale and read to the nearest 0.1k.g with minimum/ lightly/ clothing and no shoes. Calibration was done before and after weighing every child by setting it to zero. In case of children age below two years and those who were unable to stand alone, their weight was obtained from the difference between weights of mother as she/he holds the child and the weight of the mother alone (Tamiru *et al*., 2015)

MUAC. Shakir's tape was used. MUAC was taken on the left hand midway between the elbow and shoulder joint so that the hand was simply relaxed and hanging by the side.

3.11 Data management

Collected data was managed carefully and safety of raw information had a paramount importance. Thus, collected data was coded by giving numbers starting from 001 and end at 097 then these were stored safely. Thus, stored data was utilized for the purpose of analysis.

3.12 Data analysis

The data was checked for completeness and consistency. The collected data was first edited, organized, coded and entered into Microsoft excel 2010 and then into statistical package for social science (SPSS) version 20.0 and into WHO Anthro version 3.2.2. The collected data was analyzed by using both descriptive and inferential statistics. Descriptive analysis was used to describe the percentages and number distributions of the respondents by socio-demographic characteristics and other relevant variables in the study. The data were presented in different table. The nutritional status was measured by WHO Standards and Mid Arm circumference (MUAC).

Anthropometric indices were calculated using reference medians recommended by the World Health Organization (WHO) and classified according to standard deviation units (z-scores), based on the WHO criteria. Wasting (weight-for-height z-score–WHZ) indicates

thinness. It is usually the result of recent nutritional deficiency and is affected by seasonal shifts associated with availability of foods and/or prevalence of disease. A WHZ of <-2 defines the presence of acute malnutrition (wasting). Stunting, represented by low height-for-age z-score (HAZ), results from extended periods of inadequate food intake, poor dietary quality, increased morbidity, or a combination of these factors. A HAZ of <-2 defines chronic malnutrition (stunting). Weight-for-age z-score (WAZ) is essentially a composite of weight-for-height and height-for-age, thus a measure of both acute and chronic malnutrition. A WAZ of <-2 is used for defining a child as underweight. A z-score of <-3 defines severe levels of each of the indices (Tamiru *et al.*, 2015). The chi-square test was applied to test the association between the nutrition status and its associate factors.

3.13 Logistic and ethical considerations

Ethical clearance was obtained from Nepal Health Research Council and permission to conduct survey in flood affected area was obtained from office of the Village Development Committee of flood affected area. Verbal consent from parents/care taker of study subjects was obtained and the objective of the study was explained lucidly to them. Privacy and confidentiality of collected information was ensured at all level.

Part IV

Results and discussion

A cross–sectional descriptive study was conducted in flood-affected area of Itahari, Sub-metropolitan city. Among 140 respondents, all the respondents responded to the study with 100% response rate. The results and findings of the study are expressed into following headings.

4.1 Demographic and socio-economic characteristics

Table 4.1 Religion of study population (N=140)

Variable	Frequency	Percent (%)
Religion		
Buddhism	4	2.9
Christian	16	11.4
Hinduism	119	85.0
Others	1	0.7
Total	140	100.0

Out of 140 households, 50% (70) households were headed by male while 50% (70) household was headed by female. Among them 85.0%, 11.4%, 2.9% and 0.7% families were found to be Hindu, Christian, Buddhism and Others respectively which is shown in Table 4.1.

Table 4.2 Economic characteristics of population (N=140)

Variable	Frequency	Percentage (%)
Father occupation		
Unemployed	7	5
Unskilled worker	26	18.6
Skilled worker	34	24.3
Semi-skilled worker	73	52.1
Family income		
<30121	130	92.9
≥30121	10	7.1

Table 4.2 shows that the occupation of father was unemployed (5%), unskilled worker (18.6%), skilled worker (24.3%), semi-skilled worker (52.1%). There were 92.9% of family with annual income <30,121 which is higher than family with annual income ≥30,121.

Table 4.3 Socio - demographic characteristics of study population (N=140)

Variable	Frequency	Percentage (%)
Family type		
Joint	34	24.3
Small	106	75.7
Number of family members		
<5	122	87.1
>5	18	12.9
Father's educational status		
Illiterate	34	24.3
Primary school	49	35
Middle school	25	17.9
High school	27	19.3
Diploma	4	2.9
Graduate	1	0.7

There were 75.7% (106) small families and 24.3% (34) joint families. The breakdown for family size of household is as follows, household with < 5 members (87.1%) had the highest percentage while household with >5 members had 12.9%. The educational status in father of children was superseded by primary school (35%) followed by illiterate (24.3%), middle school (17.9%), high school (19.3%), diploma (2.9%), Graduate (0.7%).

4.2 Child characteristics

From the total of 140 children included in this study, 70 (50%) were males and 70 (50%) were females. Among them 3.6% of children were found of age group 6-11months, 17.1% of age group 12-23 months and same percent 26.4% were found of age group 24-35 months, 36-47 months and 48-59 months.

From the study, 33.6% of children's weight at birth was below normal (less than 2.5 kg), 66.4% was above normal (above 2.5 kg). Among them 55% of children under study were eldest child of the household, 33.6% were second child, 9.3 % were third child and 2.1 % child were fourth child.

Table 4.4 Child characteristics of study population (N=140)

Variable	Frequency	Percentage (%)
Gender		
Female	70	50.0
Male	70	50.0
Weight of child during birth		
<2.5 kg	47	33.6
>2.5kg	93	66.4
Age group(months)		
6-11 months	5	3.6
12-23 months	24	17.1
24-35 months	37	26.4
36-47 months	37	26.4
48-59 months	37	26.4
Birth order		
First	77	55.0
Second	47	33.6
Third	13	9.3
Fourth	3	2.1

4.3 Child Caring practices

Feeding practices of colostrum to the neonate was 82.9 % and 17.1% did not feed colostrum. Breastfeeding in Nepal is almost universal and 66% of children under six months are exclusively breastfeed(NDHS, 2016). Among 140 respondents, 99.3% were exclusively breastfed for six months and 0.7% were not exclusively breastfed which is remarkably higher than NDHS 2016.

Almost all household use packaged iodized salt. Regarding Vitamin A and deworming tablet supplementation, 112 (80%) children were supplemented with Vitamin A and deworming tablet while 28 (20%) were not supplemented. Out of total 83.6% children had received their vaccination and 16.4% did not. The preference of health services for treatment of children during acute illness was highest 75 (53.6%) to both nearby health post and traditional healer followed by 61 (43.6%) to health post, 3 (2.1%) to traditional healer and 1 (0.7 %) to others.

The type of complementary food given to children was same as other family members was highest 90% (126), followed by lito 1.4% (2), jaulo 7.9% (11) and sarbattom pitho (supper flour porridge) 0.7% (1).

Table 4.5 Distribution of different child caring practices (N=140)

Variable	Frequency	Percentage (%)
Colostrum Feeding		
Yes	116	82.9
No	24	17.1
Exclusive breastfeeding		
Yes	139	99.3
No	1	0.7
Type of salt		
Iodized	140	100
Non-iodized	0	0
Vit A/Round worm medicated		
Yes	112	80
No	28	20
Vaccination given to child		
Yes	117	83.6
No	23	16.4
Treatment centre		
Health post	61	43.6
Dhami	3	2.1
Both	75	53.6
Others	1	0.7
Type of complementary food		
Sarbottam pitho	1	0.7
Jaulo	11	7.9
Lito	2	1.4
Similar to other family member	126	90

4.4 Maternal characteristics

In a survey, 2.1% of mother's were found with age <20 years,75% of mother's with 20-30 years and 22.9% of mother's with ≥30 years. Out of total 60% of mother were unemployed, 5% were unskilled, 17.9 % were skilled worker and 17.1% were semi-skilled worker.

Table 4.6 Distribution of different maternal characteristics (N=140)

Variable	Frequency	Percent (%)
Mother age during marriage		
<20	3	2.1
20-30	105	75.0
≥30	32	22.9
Mother occupation		
Unemployed	84	60.0
Unskilled	7	5.0
Skilled worker	25	17.9
Semi-skilled worker	24	17.1
Mother educational status		
Illiterate	33	23.6
Primary school	44	31.4
Middle school	31	22.1
High school	26	18.6
Diploma	3	2.1
Graduate	1	0.7
Age at first pregnancy		
<20	15	10.7
>20	125	89.3
Iron/Folate consumption		
Yes	134	95.7
No	5	3.6
Not revealed	1	0.7
Vaccination during pregnancy		
Yes	130	92.9
No	9	6.4
Not revealed	1	0.7
Round worm medicated		
Yes	96	68.6
No	43	30.7
Not revealed	1	0.7

The educational status in mother of children was superseded by primary school (31.4%) followed by illiterate (23.6%) middle school (22.1%), high school (18.6%) Diploma (2.1%) and graduate (0.7%).

Out of total, 15(10.7%) of mother had their first pregnancy below 20 years of age while 125 (89.3%) were pregnant for the first time above 20 years of age. From the study, 95.7 % had taken iron and folate tablet during pregnancy, 3.6 % had not taken while 0.7 % did not revealed. Among them 92.9% of mother had received their vaccination, 6.4% had not while 0.7 % did not revealed. From the study 68.6% of mother were medicated with de-worming tablet, 30.7 % were not medicated and 0.7% did not revealed.

4.5 Environmental characteristics

Table 4.7 Distributions of different environmental characteristics (N=140)

Variable	Frequency	Percent (%)
Source of water		
Tap water	119	85.0
Tube well	21	15.0
Water purification		
Yes	84	60.0
No	56	40.0
Source of fuel		
Gas	103	73.6
Firewood	14	10.0
Both	23	16.4
Kitchen garden		
Yes	48	34.3
No	92	65.7
Waste management process		
Burning	71	50.7
Burying	17	12.1
Throwing in river	52	37.1
Use of toilet		
Yes	139	99.3
No	1	.7

The main source of drinking water used by household was 119 (85%) tap water and 21 (15 %) tube well. Only 84 (60%) households treated/purified water before they drink while rest of household 56 (40%) did not. Major sources of cooking fuel as shown in Table 4.7, indicated that larger percentage of households in flood affected area of Itahari used gas (73.6%), followed by firewood (10%) and 16.4% used both gas and firewood. Out of total 34.3% of household had kitchen garden and 65.7% did not have kitchen garden. Among them 50.7 % of household managed their wastage by burning, 12.1% burying and 37.1% by throwing in water. In a survey, only 1 (0.7%) households under the survey did not have toilet facility and 139 (99.3%) had toilet facility.

4.6 Prevalence of Malnutrition

Anthropometric indices are the major tool for the assessment of nutritional status of children. Deviation of anthropometric indices from the reference standard of those indices is the evidence of malnutrition. Generally, underweight, stunting and wasting are widely used indicators of malnutrition (Shrestha, 2014).

In survey, among 140 children, the overall magnitude of malnutrition among 6-59 months children in flood affected area were 30%, 10.7% and 18.5% for stunting, wasting and underweight respectively as shown in Figure 4.1.

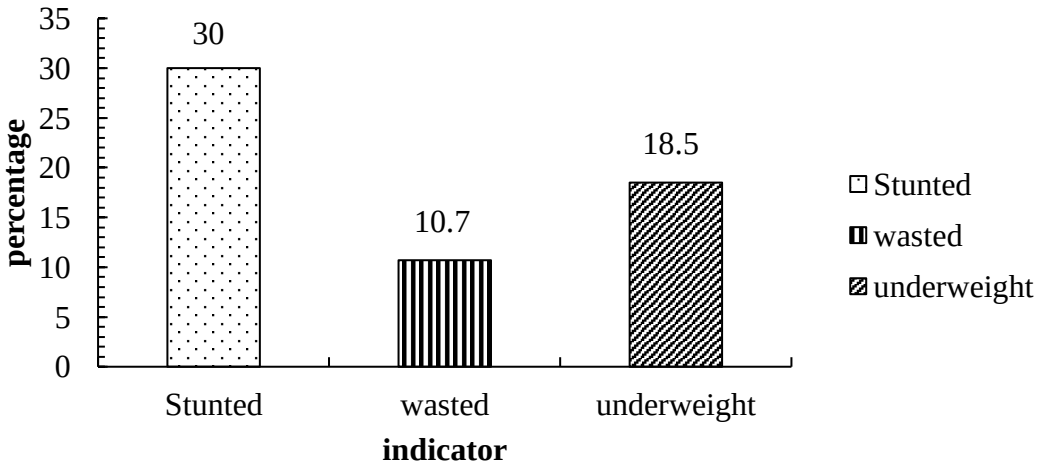

Figure 4.1 Prevalence of stunting, wasting, and underweight in flood-affected area of Itahari

This result shows that according to the Z-score, 30% were stunted where 0.7% are severely stunted and 29.3% are moderately stunted. Among them 10.7% are wasted, where 0.7% are severely wasted and 10% are moderately wasted. Out of total 18.5% underweight 1.4% are severely underweight and 17.1% are moderately underweight when severe and moderate malnutrition defined as less than minus 3 Z-Score and less than -2 and greater than minus 3 Z- Score respectively. No overweight or obese children were found in the survey population. NDHS 2016 shows the nation al data on stunting, wasting and underweight to be 36%, 10% and 27% respectively (NDHS, 2016). The survey results concluded that flood affected area of Itahari had better nutritional status than National data while they are similar to stunting, wasting and underweight of Eastern Terai sub - region. A survey conducted in under five children of Western Nepal by Shrestha B in 2014, revealed that out of 556 children, 20.2% were underweight, 34% were stunted and 15.1%. were wasted (Shrestha, 2014).

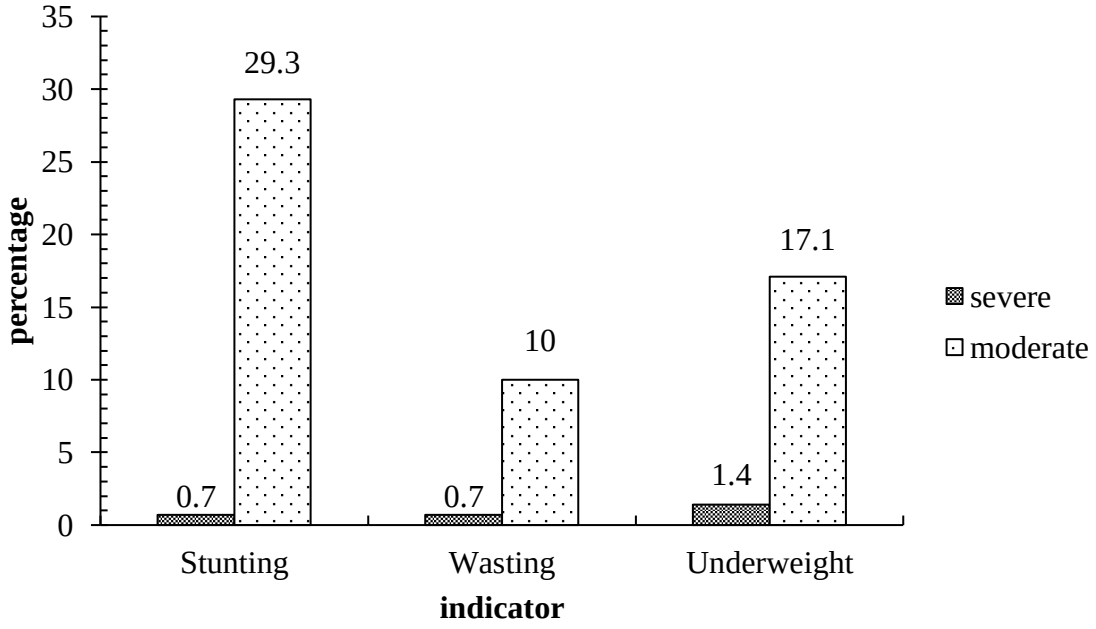

Figure 4.2 Prevalence of malnutrition in flood affected area of Itahari

Gender-wise distribution of malnutrition

The result of prevalence of malnutrition on Itahari in flood affected area is shown in table 4.8**.** Among total of 140 children, 70 were female and 70 were male where 30% children are stunted, 10.7% are wasted and 18.5% are underweight. The magnitude of under nutrition among 6-59 months children in that area was seen higher in males for wasting and

underweight and higher in females for stunting. According to the WHO growth standards of under-nutrition indicator; 18% of males are stunted, 11.4% are wasted, 22.8% are underweight and among them 1.4% are severely stunted, 0% are severely wasted and 1.4% are severely underweight which comprises of 1, 0 and 1 number respectively. In females 24% are stunted, 10% are wasted, 14.3% are underweight and among them 0% are severely stunted, 1.4% are severely wasted and 1.4% are severely underweight which comprises of 0, 1 and 1 number respectively.

Table 4.8 Distribution of Nutritional situation of 6-59 months of children according to gender (N=140)

	<-3Z score count (%)	**<-2Z score count (%)**	**>-2Z score count (%)**	**Total malnourished(%)**
Wasting				
Female	1(1.4%)	6(8.6%)	63(90%)	10%
Male	0(0%)	8(11.4%)	62(88.6%)	11.40%
Stunting				
Female	0(0%)	24(34.3%)	46(65.7%)	24%
Male	1(1.4%)	17(24.3%)	52(74.3%)	18%
Underweight				
Female	1(1.4%)	9(12.9%)	60(85.7%)	14.30%
Male	1(1.4%)	15(21.4%)	54(77.1%)	22.80%

Age-wise Distribution of malnutrition

Among total of 140 children, 5, 24, 37, 37 and 37 were of age group 6-11 months, 12-23 months, 24-35 months, 36-47 months and 48-59 months respectively where 30% children are stunted, 10.7% are wasted and 18.5% are underweight. According to the WHO growth standards of under-nutrition indicator in age group 6-11 months 20% are stunted, 0% are wasted, 20% are underweight. In age group 12-23months, 52.7% are stunted, 8.4 % are wasted, 25% are underweight. Age group 24-35 months comprises 24.3% stunted, 16.2% wasted and 18.9% underweight. In age group 36-47 months, 21.6 % of them are stunted, 16.2% are wasted and 24.3% are underweight. And in age group 48-59 months, 29.7 % are stunted, 2.7% are wasted and 8.1% are underweight.

Table 4.9 Distribution of Nutritional situation of 6-59 months of children according to age (N=140)

	<-3Z score count (%)	**<-2Z score count (%)**	**>-2Z score count (%)**	**Total Malnourished(%)**
Wasting				
6-11 months	0(0%)	0(0%)	5(100%)	0%
12-23 months	1(4.2%)	1(4.2%)	22(91.7%)	8.4%
24-35 months	0(0%)	6(16.2%)	31(83.8%)	16.2%
36-47 months	0(0%)	6(16.2%)	31(83.8%)	16.2%
48-59 months	0(0%)	1(2.7%)	36(97.3%)	2.7%
Stunting				
6-11 months	0(0%)	1(20%)	4(80%)	20%
12-23 months	1(2.7%)	12(50%)	11(47.3%)	52.70%
24-35 months	0(0%)	9(24.3%)	27(73%)	24.3%)
36-47 months	0(0%)	8(21.6%)	29(78.4%)	21.60%
48-59 months	0(0%)	11(29.7%)	26(70.3%)	29.7%
Underweight				
6-11 months	0(0%)	1(20%)	4(80%)	20%
12-23 months	1(4.2%)	5(20.8%)	18(75%)	25%
24-35 months	1(2.7%)	6(16.2%)	30(81.1%)	18.90%
36-47 months	0(0%)	9(24.3%0	28(75.7%)	24.30%
48-59 months	0(0%)	3(8.1%)	34(91.9%)	8.10%

The magnitude of under nutrition among 6-59 months children in that area was seen higher in age group 12-23months for stunting and underweight and higher in age group 24-35 and 36-47 months for wasting. This study is similar to the study conducted in North Ethiopia where children aged 6-24 months were 52.1% at reduced risk to be wasted when compared to children of age ≥ 25 months (Kahsay *et al.*, 2015). This age group may be benefited from the combined effect of the continuous breast-feeding and complementary feeding which they were at reduced risk to be wasted. This study is in contradictions to the study carried out in Nairobi, Kenya which shows the prevalence of wasting in younger age group of 6-11 months (Olack *et al.*, 2011).

The results of this study indicated that the highest risk of stunting was among children aged 12-23 months which is similar to the study conducted by Hien & Kam in Vietnam (2008). The high rates of stunting observed after 12 months are linked to inappropriate food supplementation during the weaning period to stopping breastfeeding earlier than the suggested 24 months (Hien and Kam, 2008). In the second year of life, with introduction to the family diet, children become more responsible for feeding themselves but often do not have access to adequate amounts of solid food.

4.6.1 Prevalence of wasting (weight for height) of under-five year children

From the study 10.7% children were found to be wasted among them 0.7% were severely wasted. The prevalence of wasting was higher in age group 24-35 and 36-47 months and lowest in 6-11 months.

The median weight for height z-score of survey children was found to be -0.78 which is less by 0.78 with the reference to WHO standard. This cause the curve slightly skewed to the left side of WHO standard curve showing the prevalence of wasting among study population. The inappropriate time of initiation of complementary feeding, outbreaks of diarrhea and other disease may be the reason behind the prevalence of wasting. This may be due to poor hygiene and sanitation in the shelters which may cause disease outbreak and parasitic infection in children causing wasting in children. The other causes may be inadequate amount of diversified food consumption result in calorie and protein deficit. The prevalence of wasting is low as compared to stunting and underweight in this survey. The NDHS report 2011 in Terai region also reported low percentage of wasting (11.2%) which is similar to this study. The study of NDHS report 2011 found that wasting was the result of maternal, socio-economic and child individual factors and so on (Ruwali, 2011).

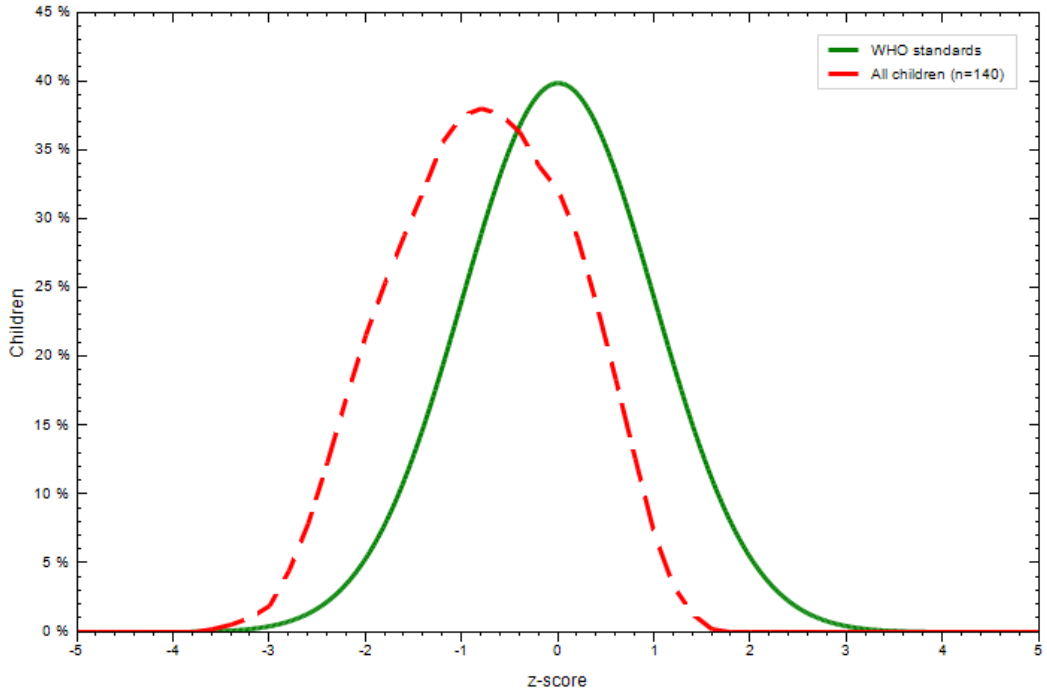

Fig 4.3 Distribution of wasting among 6-59 months children of flood affected area in Itahari based on WHO standard.

4.6.2 Prevalence of stunting (height for age) of under-five year children

The study shows that 30% children were stunted among them 0.7% was severely stunted. Comparing with the age group highest prevalence of stunting was found in the group 12-23 months and lower in 6-11 months.

The median height for age Z score of survey children was found to be -1.41 which is less by 1.41 with reference to WHO standard. This cause the curve slightly skewed to the left side of WHO standard curve showing the prevalence of stunting among study population. The stunting was less in the study area than national data. In the study area, there was poor knowledge about nutrition among mothers and poor feeding practices was found. Hence, long-term inappropriate feeding behavior causes nutrient deficiency in children leading them towards malnutrition. Due to very low income, family couldn't invest enough amounts for food, quality of food might not be maintained, and there was a poor healthcare service which may be the reason of stunting in child. The similar lower prevalence of stunting was found in the study for assessing nutritional status of under-five children conducted in Padampur VDC, Chitwan. Study conducted in Padampur found 22.7% children stunted among study population. The NDHS report 2011 in terai region also reported low percentage of stunting

(37.4%). That study found that stunting was the result of maternal, socio-economic and child individual factors and so on (Ruwali, 2011).

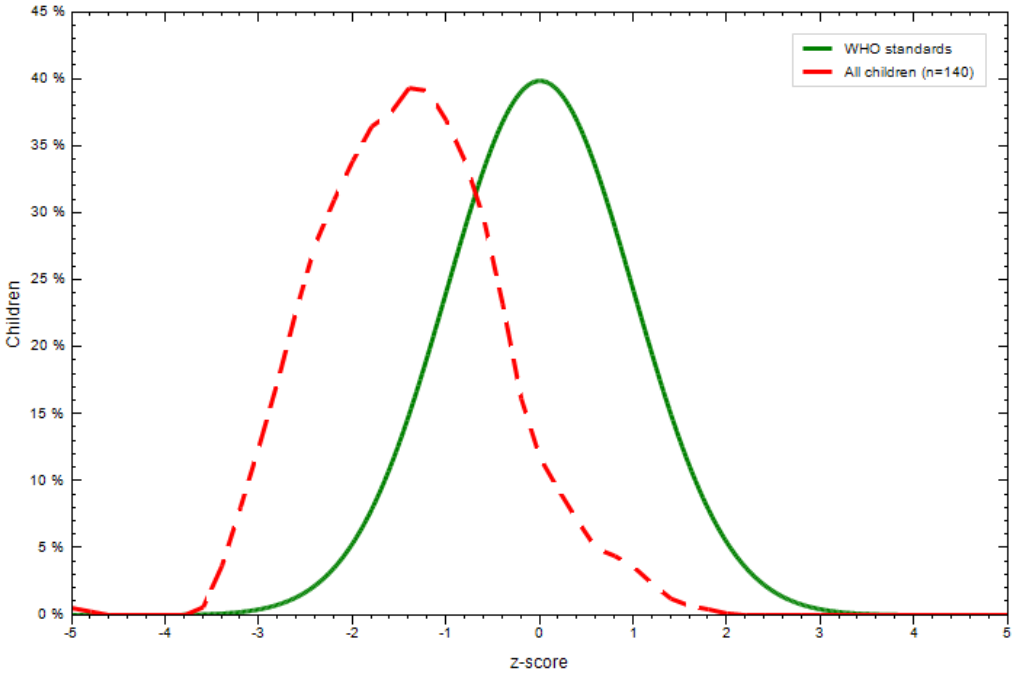

Fig 4.4 Distribution of Stunting Among 6-59 Months Children of Flood Affected Area In Itahari Based On WHO Standard.

4.6.3 Prevalence of underweight (weight for age) of under-five year children

The study shows that 18.5% children are underweight among them 1.4% are severely underweight. The prevalence of underweight was found higher in age group of 12-23 months and lower in 48-59 months.

The median weight for height z-score of survey children was found to be -1.33 which is less by 1.33 with the reference to WHO standard. This cause the curve slightly skewed to the left side of WHO standard curve showing the prevalence of wasting among study population

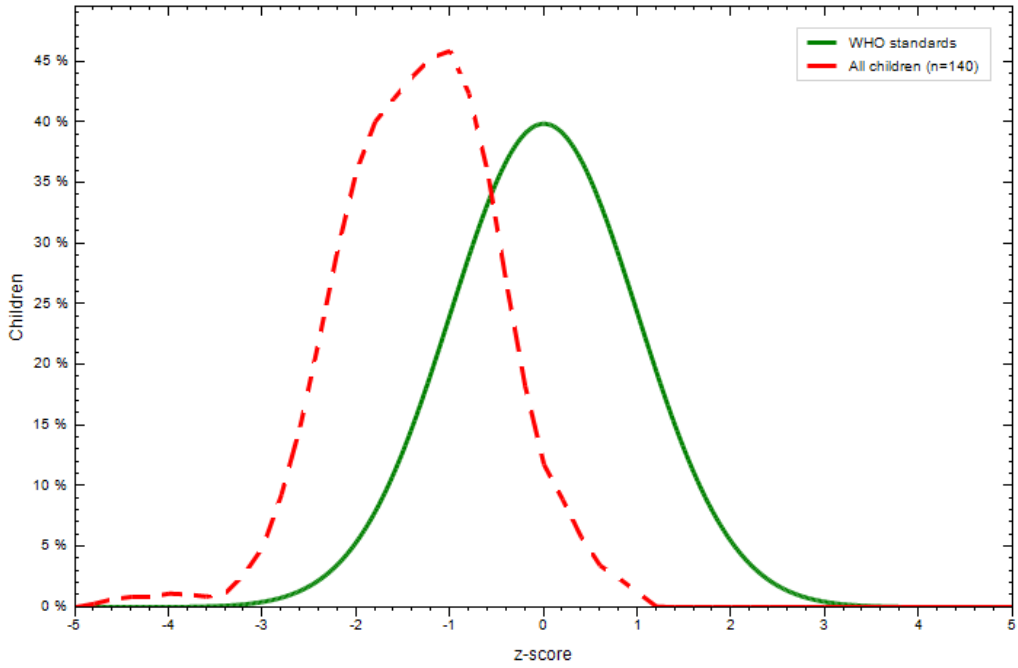

Fig 4.5 Distribution of underweight among 6-59 months children of flood affected area in Itahari based on WHO standard

4.6.4 Prevalence of malnutrition by MUAC of under-five year children

Table 4.10 Distribution of wasting based on MUAC measurement (N=140)

MUAC	Frequency	Percent
Severe (<11.5cm)	0	0
Moderate ((≥11.5-<12.5)	2	1.4
Normal (>12.5)	138	98.6

On the basis of mid-upper arm circumference measurement 1.4% children are found malnourished and no any children were severely malnourished. Similar type of study carried out in Chitwan; for prevalence of protein-calorie malnutrition among Tharu and Bhoote (fisherman) children: A case study of Chitwan district shows that the prevalence of malnutrition based on MUAC as 48.3% of mild malnutrition and severe malnutrition is 30.9% (Bhandari, 1985) in which prevalence is higher than the present study.

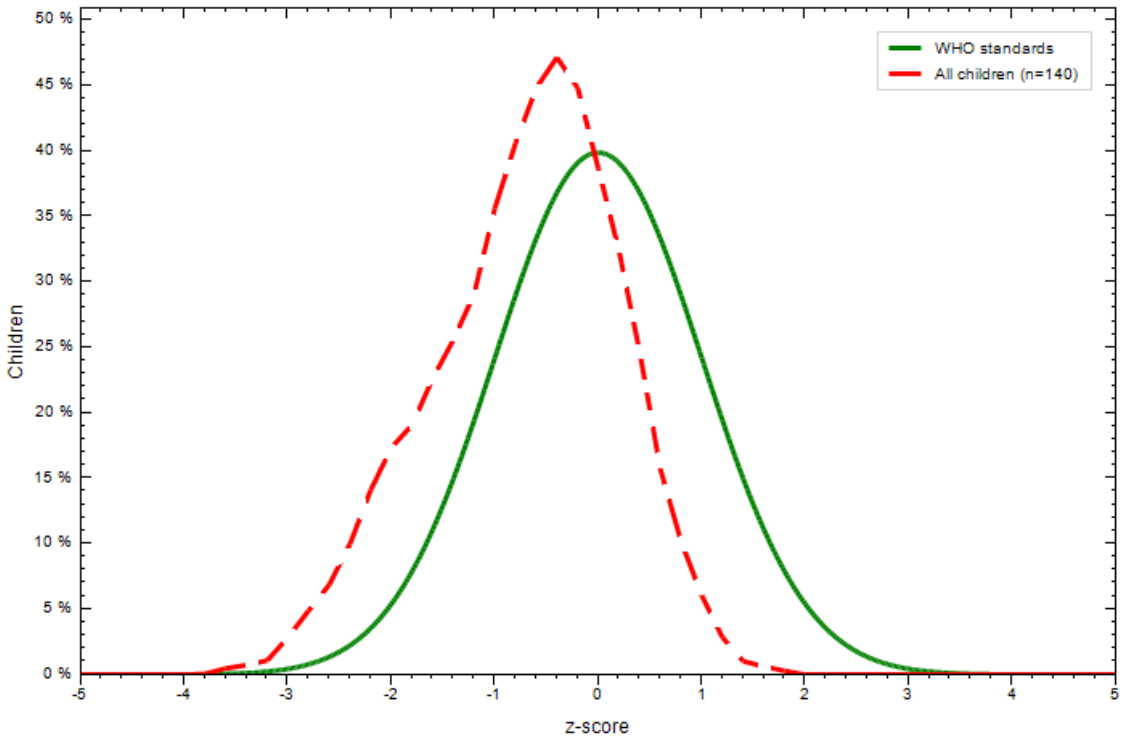

Fig 4.6 Distribution of wasting among 6-59 months children of flood affected area in Itahari based on MUAC

4.7 Factors associated with Under nutrition

Under nutrition was assessed by stunting, wasting and underweight. Chi-square test was used to identify the characteristics that were related to nutritional status of children. In order to successfully tackle the malnutrition problem flood affected area, there appears a need to investigate the contribution of a number of factors influencing malnutrition. Accordingly, this study has tried to look into factors associated with malnutrition in the study area by incorporating as many risk factors as possible.

4.7.1 Factors associated with stunting

Table shows Chi-square test analysis results of factors associated with stunting. The Chi-square test revealed that there is significant association for stunting with family-income (P=0.001) .While there was no significant association between birth order (P=0.785), birth weight (P=0.315), family size (P=0.597), gender (P=0.278), mother education (P=0.159) and colostrum feeding (P=0.319).

Table 4.11 Factors assocated with stunting of 6 - 59 months children (N=140)

Factors	Stunted	Normal	χ2 value	P value
Family income				
<30121	40(30.8%)	90(69.2%)	14.522	0.001*
≥30121	2(20%)	8(80%)		
Birth order				
First	24(31.2%)	53(68.8%)	3.189	0.785
Second	13(27.7%)	34(72.3%)		
Third	3(23.1%)	10(76.9%)		
Fourth	2(66.7%)	1(33.3%)		
Birth weight				
<2.5 kg	16(34%)	31(66%)	2.311	0.315
>2.5 kg	26(28%)	67(72%)		
Gender				
Male	18(25.7%)	52(74.3%)	2.562	0.278
Female	24(34.3%	46(65.7%)		
Family size				
<5	35(28.7%)	87(71.3%)	1.031	0.597
≥5	7(38.9%)	11(61.1%)		
Mother Education				
Illiterate	16(48.5%)	17(51.5%)	14.306	0.159
Primary school	14(30.4)	32(69.6)		
Middle school	6(19.4%)	25(80.6%)		
High school	5(19.2%)	21(80.8%)		
Diploma	1(33.3%)	2(66.7%)		
Graduate	0	1(100%)		
Colostrum feeding				
Yes	32(27.6%)	84(72.4%)	2.286	0.319
No	10(41.7%)	14(58.3%)		

Meat/Fish per week				
<2 times	12(22.2%)	42(77.8%)	4.886	0.559
2-4 times	24(35.3%)	44(64.7%)		
>4 times	3(37.5%)	5(62.5%)		
Don't consume	3(30%)	7(70%)		
Vegetable per week				
<2 times	11(33.3%)	22(66.7%)	7.255	0.298
2-4 times	15(22.7%)	51(77.3%)		
>4 times	7(33.3%)	14(66.7%)		
Don't consume	9(45%)	11(55%)		

*Statistically significant (P < 0.05)

Statistically significant association was found between family income and stunting in present study (P=0.001). This study shows that there is greater risk of stunting in children from families with annual income <30121 than children from families with annual income ≥30121. The study informed that 30.8% of children from families with annual income <30121 were stunted while 20% of children from families with annual income ≥30121 were stunted in flood affected area of Itahari.

This study is similar to the study conducted in Cambodia and Kenya which found that children from the poorest families were more likely to be stunted. This could be because they lack the resources for obtaining health-care services and for adequate nutrition (Ettyang and Sawe, 2016). Our study agrees with a study by Miller and Rodgers that found no association between birth weight with child stunting (Miller and Rodgers, 2009).

4.7.2 Factors associated with wasting

The analysis of survey revealed the significant relation between birth order of children and wasting (P =0.000). Also, colostrum feeding of child (P=0.020) was significantly associated with wasting. While there was no significant association between family income (P=0.962), birth weight (P=0.36), gender (P=0.524), family size (P=0.563) and mother education (P=0.889) with wasting.

Table 4.12 Factors associated with wasting of 6 - 59 months children (N=140)

Factors	Wasted	Normal	χ2 value	P value
Family income				
<30121	14(10.8%)	116(89.2%)	0.078	0.962
≥30121	1(10%)	9(90%)		
Birth order				
First	5(6.5%)	72(93.5%)	48.467	0.000*
Second	5(8.5%)	42(89.4%)		
Third	4(30.8%)	9(69.2%)		
Fourth	1(33.3%)	2(66.7%)		
Birth weight				
<2.5 kg	6(12.7%)	41(87.2%)	2.041	0.36
>2.5 kg	9(9.7%)	84(90.3%)		
Gender				
Male	8(11.4%)	62(88.6%)	1.294	0.524
Female	7(10%)	63(90%)		
Family size				
<5	12(9.8%)	110(90.2%)	1.148	0.563
≥5	3(16.7%)	15(83.3%)		
Mother Education				
Illiterate	4(12.1%)	29(87.9	5.034	0.889
Primary school	5(10.9%)	41(89.1%)		
Middle school	2(6.5%)	29(93.5%)		
High school	4(15.4%)	22(84.6%)		
Diploma	0	3(100%)		
Graduate	0	1(100%)		
Colostrum feeding				
Yes	10(8.6%)	106(91.4%)	7.869	0.020*
No	5(20.83%)	19(79.17%)		
Meat/Fish per week				
<2 times	5(9.3%)	49(90.7%)	4.188	0.651

2-4 times	8(11.8%)	60(88.2%)		
>4 times	0	8(100%)		
Don't consume	2(20%)	8(80%)		
Vegetable per week				
<2 times	4(12.1%)	29(87.9%)	6.261	0.395
2-4 times	8(12.1%)	58(87.9%)		
>4 times	3(14.3%)	18(85.7%)		
Don't consume	0	20(100%)		

*Statistically significant (P < 0.05)

The association of birth order and wasting was found to be statistically significant. The findings of the study depict that more children with birth order ≥2 were suffering from wasting as compared to children having first birth order. Similarly birth order was statistically significant with wasting in the finding of the study in India (Panigrahi and Das, 2014). Children with higher birth order might get less attention and care compared to children of first order.

Deprivation of colostrum came out to be significant risk factor for stunting which was also concluded by a study conducted by Kumar *et al.* (2006) at Anganwari areas of urban Allhabad in 2006. Child who are not fed colostrum have high chance of reduced immunity and increased risk of infection, illness and hence malnutrition. This study is similar to the study in Ethiopia which showed that children who didn't feed on colostrum were more likely to be wasted than those who received it (Darsene *et al.*, 2017). Similar findings are also reported in India (Kumar *et al.*, 2006). This is probably because colostrum is full of nutrients and antibodies which provide protective effect to the children and prevent them from infections that may cause malnutrition.

4.7.3 Factors associated with underweight

Birth order (P=0.000), family-income (P=0.024), birth weight (P=0.043) and age at first pregnancy (P=0.043) was found to be significantly associated with underweight. Colostrum feeding (P=0.387), gender (P=0.403), family size (P=0.858) and mother education (P=0.654) were statistically insignificant with underweight in the study.

Table 4.13 Factors associated with underweight of 6 - 59 months children in (N=140)

Factors	Underweight	Normal	χ2 value	P value
Family income				
<30121	25(19.3)	105(8)	7.482	0.024*
>30121	1(10)	9(90)		
Birth order				
First	10(13%)	67(87%)	24.307	0.000*
Second	11(23.4%)	30(63.8%)		
Third	4(30.7%)	9(69.3%)		
Fourth	1(33.3%)	2(66.7%)		
Birth weight				
<2.5 kg	13(27.7)	34(72.3)	6.293	0.043*
>2.5 kg	13(14)	80(86)		
Gender				
Male	16(22.8)	54(77.1)	1.816	0.403
Female	10(14.3)	60(85.7)		
Family size				
<5	23(18.8)	99(81.1)	0.307	0.858
≥5	3(16.7)	15(83.3)		
Mother Education				
Illiterate	8(24.2)	25(75.8)	7.74	0.654
Primary school	10(21.7)	36(78.3)		
Middle school	5(16.1)	26(83.9)		
High school	2(7.6)	24(92.3)		
Diploma	1(33.3)	2(66.7)		
Graduate	0	1(100)		
Colostrum feed				
Yes	20(17.3)	96(82.8)	1.897	0.387
No	6(25)	18(75)		
First pregnancy age				
<20	6(40)	9(60)	6.307	0.043*
≥20	20(16)	105(84)		

Meat/Fish per week				
<2 times	7(13%)	47(87%)	10.010	0.124
2-4 times	16(23%)	52(76.5%)		
>4 times	0	8(100%)		
Don't consume	3(30%)	7(70%)		
Vegetable per week				
<2 times	4(12.1%)	29(87.9%)	10.681	0.099
2-4 times	14(21.2%)	52(78.8%)		
>4 times	3(14.3%)	18(85.7%)		
Don't consume	5(25%)	15(75%)		

*Statistically significant ($P < 0.05$)

A study conducted in Iran also showed significant association between birth order and underweight while no significant association between child's gender and parent educational status with underweight (Mahyar *et al.*, 2010). Findings of Mahyar *et al.* (2010) revealed that the youngest child of a household was more likely to be underweight which is similar to our study. Risk of being underweight increases significantly with birth order which was also reported according to the study conducted in Addis Abba Ethopia (Degarege *et al.*, 2015).

In the study family income were significantly associated with underweight .This study is in contradiction with study performed by Mishra in Mahottari, Nepal where family income were not significantly associated with family income (Mishra and Sharma, 2010).

The study indicate birth weight as the important factor for underweight which is similar to the study conducted in Bangladesh (Rayhan and Khan, 2006) . The findings were similar to the study conducted by Sapkota and Gurung where age at first pregnancy was found to be significant factor with underweight (Sapkota and Gurung, 2009).

Part V

Conclusions and recommendations

5.1 Conclusions

Conclusively, the study has assessed the nutritional status of children in flood-affected area of Itahari which was not explored before and findings are important to understand prevalence and determinants of under–nutrition among 6-59 months children in flood-affected area Itahari. The results of the study indicate that under nutrition is still an important problem among under-five children in flood affected area in Itahari.

Following points can be concluded from the study.

a) Prevalence of malnutrition among 6-59 months children in flood affected area Itahari were 30%, 10.7 % and 18.5% for stunting, wasting and underweight respectively where 0.7 % were severely stunted, 0.7 % were severely wasted and 1.4 % were severely underweight.
b) Family income was significantly associated with stunting, colostrum feeding and birth order was significantly associated with wasting and birth order, family income, birth weight and age at first pregnancy was significantly associated with underweight. Family income, birth order, birth weight, colostrum feeding and age at first pregnancy was the risk factors that were associated with malnutrition in children.
c) The prevalence of wasting was found to be more in 24-35 and 36-47 months children and underweight and stunting was found more in 12-23 months children.
d) The prevalence of wasting and underweight was found to be more in male and stunting was found more in female.

5.2 Recommendations

Based on the results of the study following recommendations could be made in order to improve the nutritional status of children under five years in the survey area.

a) There is urgent need for more attention on feeding and hygienic practices, so that problem of malnutrition can be reduced to minimum.
b) Appropriate intervention programs like supplementary feeding programs should be implemented to improve the nutritional status of severely acute malnourished children.
c) Public awareness programs should be launched in the area in regard to improve the anti-natal and post-natal care of mother which is important for better nutritional status of child.
d) Furthermore, further studies should be done to see unexplored variables (dietary diversity, seasonal factors and household food security) which were not included in the present study.

Part VI

Summary

Nutritional condition of children does not only serve as a health indicator, but it is also vital for the children susceptibility of many other diseases. The study was conducted to assess the factors associated with the nutritional status of children aged 6-59 months in flood-affected area of Itahari.

The study included 140 children selected randomly from four wards of flood-affected area Itahari. Cross-sectional descriptive survey using a structured questionnaire and measurements of weight, height and MUAC was carried out to determine the nutritional status of 6-59 months children and factors associated with it. A structured questionnaire was administered to the mother or care-taker of children to determine the associated factors while anthropometric measurement was used to determine the prevalence of malnutrition among survey children based on WHO reference. Data collected was analyzed using WHO Anthro version 3.2.2 and SPSS version 20. Chi-square test was used to analyze the factors associated with nutritional status. Out of 140 children, 70 were female and 70 were male. Prevalence of stunting wasting and underweight was 30%, 10.7% and 18.5% respectively.

$\chi 2$ – test analysis of the determinants of nutritional status indicated that family income was significantly associated with stunting (P=0.001). Birth order (P=0.000) and colostrum feeding of child (P=0.020) were found statistically significant with wasting .Birth order (P=0.000), family income (P=0.024), birth-weight (P=0.043) and age at first pregnancy (P=0.043) was significantly associated with underweight.

Results of the study indicate that malnutrition among 6-59 months children is still an important problem in flood-affected area of Itahari. Also, study confirmed that family income, birth order, birth weight, colostrum feeding, age at first pregnancy were the risk factors associated with malnutrition in flood affected area of Itahari. Thus, to reduce the existing prevalence of malnutrition in flood affected area of Itahari, appropriate interventional program should be implemented.

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Appendices

Appendix - A

Survey Questionnaire

Code no.:

A. General Information

1. Name of head of household:
2. Ward No.:
3. Respondent:
   a. Mother b. Father c. Other Family Members
4. Mother's Name:
5. Father's Name:
6. Mothers Age:
7. Child Name: DOB:

B. Family Description

8. No. of total family members:
   Female: Male:
   No. of children: Boys: Girls:
   No. of children below 5 year:
9. Has any children died in your family till now?
   a. Yes b. No
   If yes, how many ……
   Cause of death …….
10. Type of family?
    a. Small b. Joint
11. What is your religion?
    a. Hinduism b. Buddhism c. Christian d. Others
12. What is the occupation of mother?
    a. Unemployed b. Unskilled worker c. Skilled worker d. semi-skilled worker

13. What is the occupation of Father?

    a. Unemployed b. Unskilled worker c. Skilled worker d. semi-skilled worker

14. Mother's educational qualification

    a. Illiterate b. Primary school c. Secondary school

    d. High school e. Diploma f. Graduate

15. Father's educational qualification

    a. Illiterate b. Primary school c. Secondary school

    d. High school e. Diploma f. Graduate

16. What is the annual income of your family?

    a. <30121 b. ≥30121

C. Child and Maternal Health Related Information

17. Mother's age when she got married? …….. years
18. Mother's age when she was pregnant for first time? ……. years
19. Type of birth?

    1. Natural 2. Caesarian

20. Weight of child during birth?

    1. less than 2.5 Kg 2. More than 2.5 Kg 3. Don't know

21. Birth order of child under study :-……

D. Personal and environmental hygiene

22. What is your source of drinking water?

    1. Tube well 2.Tap water 3. Others

23. Do you purify drinking water?

    1. No 2.Yes

24. Do you have toilet facility in your house?

    1. No 2. Yes

25. What cooking fuel do you use for cooking?
26. How do you manage garbage coming out from your house?

    ……

27. Do you wash your hand after toilet?

    1. No 2. Yes

28. Do you wash your hand before feeding meal to a child?

1. No 2. Yes

29. Use of material for washing hand.

1. Soap and water 2. Ash and water 3. Mud and water 4. Others

E. Questions to be asked for mother of under 5 children

30 Did you feed colostrum to your baby?

1. Yes 2. No

31. Did you exclusively breast fed your baby for six months?

1. Yes 2. No

32. Did you extensively breast fed your baby for two years?

1. Yes 2. No

33. Are you feeding food other than breast milk to your baby?

1. Yes 2. No

34. How many times do you feed food other than breast milk to your child?

…….. times /day

35. What do you feed to your child?

1. Lito 2. Jaulo 3. Sarbottam pitho

4. Same as other family members 5. Others

36. Did you feed bottle milk to your baby?

1. Yes 2. No

37. What type of salt do you use in your home?

1. iodized 2. non-iodized

38. Do you have kitchen garden in your home?

1. Yes 2. No

39. How often do your child have meat in a week?

1. <2 times 2. 2-4 times 3. >4 times 4. No

40. How often do your child have legumes in a week?

1. <2 times 2. 2-4 times 3. >4 times 4. No

41. How often do your child have green vegetables in a week?

1. <2 times 2. 2-4 times 3. >4 times 4. No

42. How often do your child have milk or milk products in a week?

1. <2 times 2. 2-4 times 3. >4 times 4. No

F Diseases and vaccination

43. Did you have all vaccination during pregnancy?

    1. Yes 2. No

44. Did you take iron and folate tablet during pregnancy?

    1. Yes 2. No

45. Did you give "Vit.A" capsule and "De-worming" tablet to your baby?

    1. Yes 2. No

46. Do your child have any type of medical complications?

    1. Yes 2. No

    If yes, then type of illness ……..

47. Do you have any type of medical complications?

    1. Yes 2. No

48. Do your child have any type of medical complications since 2 week ?

    1. Yes 2. No

    If yes, then type of illness ……..

49. Where do you take your children for treatment during illness?

    1. Hospital 2. Dhami 3. Both 4. Others

50. Did you have "De-worming" tablet during pregnancy?

    1. Yes 2. No

51. Did your child complete all vaccination?

52. Do you have the habit of smoking?

    1. Yes 2. No

53. Do you have the habit of drinking alcohol?

    1. Yes 2. No

G. Anthropometric measurements

Age (months)	Sex (M/F)	Weight (Kg)	Height (Cm)	MUAC (mm)

Appendix -B

Consent letter

Namaste!

I Mrs. Muna Basnet, graduate student in Department of Nutrition and Dietetics conducting a dissertation work for award of Bachelor's degree in Nutrition and Dietetics.

The topic for the study is NUTRITIONAL STATUS OF CHILDREN 6-59 MONTH OF AGE AND FACTOR ASSOCIATED IN FLOOD AFFECTED AREA OF ITAHARI, SUB-METROPOLITAN CITY, SUNSARI, NEPAL.

I have been told in a language that I understand about the study. I have been told that this is for a dissertation procedure, that my and my son/daughter's participation is voluntary and he/she reserve the full right to withdraw from the study at my own initiative at any time without having to give reason and that refresh to participate or withdraw from the study at any stage will not prejudice my/his/her rights and welfare. Confidentiality will be maintained and only be shared for academic purposes.

I hereby give consent to participate in the above study. I am also aware that I can withdraw this consent at any later date, if I wish to. This consent form being signed voluntarily indicates participate in the study until I decide otherwise. I understand that I will receive a signed and dated copy of this form.

I have signed this consent forms before my participation in the study.

Signature of parent/guardian: _____ Sign of witness: _____

Date: Date:

Place: Place:

I hereby state the study procedures were explained in the detail and all questions were fully and clearly answered to the above mention participant /his/her relative.

Investigators sign:

Date:

Appendix – C

Photo Gallery

Plate 1 Measuring height

Photo 2 Measuring MUAC

Plate 3 Respondent