

**NUTRITIONAL ASSESSEMENT OF 6-59 MONTHS CHILDREN OF  
KERABARI RURAL MUNICIPALITY, MORANG.**

by

**Samir Karki**

**Department of Nutrition and Dietetics**

**Central Campus of Technology**

**Institute of Science and Technology**

**Tribhuvan University, Nepal**

**November, 2022**

**Nutritional Assessment of 6-59 Months Children of Kerabari rural  
municipality, Morang**

*A dissertation submitted to the Department of Nutrition and Dietetics, Central Campus  
of Technology, Tribhuvan University, in the partial fulfillment of the requirements for  
the degree of B.Sc. Nutrition & Dietetics*

by

**Samir Karki**

**Department of Nutrition and Dietetics**

**Central Campus of Technology**

**Institute of Science and Technology**

**Tribhuvan University, Nepal**

**November, 2022**

**Tribhuvan University**  
**Institute of Science and Technology**  
**Department of Nutrition and Dietetics**  
**Central Campus of Technology, Dharan**

**Approval letter**

*This dissertation entitled Nutritional assessment of 6-59 months children of Kerabari rural municipality, Morang presented by Samir Karki has been accepted as the partial fulfillment of the requirements for the degree of Bachelor of Science in Nutrition and Dietetics.*

**Dissertation Committee**

1. Head of the Department .....  
(Mr. Kabindra Bhattarai, Asst. Prof.)
  
2. External Examiner .....  
(Mr. Dinesh Subedi, Food Research Officer, FTQCO)
  
3. Supervisor .....  
(Mrs. Babita Adhikari Dahal, Assoc. prof.)
  
4. Internal Examiner .....  
(Mr. Devendra Bhattarai, Teaching Asst.)

**Date: November, 2022**

## **Acknowledgements**

It is a genuine pleasure to express my deep sense of thanks and gratitude to my supervisor Assoc. Prof. Mrs. Babita Adhikari Dahal, Assistant campus chief, Central Campus of Technology, Dharan for her excellent guidance, encouragement, and inspiration throughout my dissertation. I am thankful to Assoc. Prof. Dr. Dil Kumar Limbu, campus chief of Central Campus of Technology for his kind co-operation and suggestion and for providing facilities to perform dissertation work easily and successfully. I am also thankful to Mr. Kabindra Bhattarai, Head of Department, Nutrition and Dietetics, Central Campus of Technology for sharing expertise, and sincere and valuable guidance and encouragement extended to me and also for providing me with all the necessary facilities for the research.

I take this opportunity to express gratitude to all of the Department faculty members & class mates of Nutrition and Dietetics for their help and support. Also, I would like to express my hearty thanks to senior's brother and sisters too for their guidance and suggestion for this research.

I cannot forget my classmates who went through hard times together, cheered me on, and celebrated each accomplishment. Also, I would like to acknowledge all the friends Samir, Naresh, Sagar, and Raj. I would also like to thank my parents, brothers and sister (Samiksha Karki) who were always there cheering me up and stood by me through the good times and bad.

I am indebted to all of the people of Kerabari rural municipality because of their enormous help and passion in providing data and support my research team during research activities.

Date of submission: November, 2022

.....

Samir Karki

## Abstract

A community based cross-sectional study was conducted in Kerabari rural municipality, Morang district to study the nutritional status of 6-59 months children. A total of 155 children residing in Kerabari Rural Municipality were taken for the study. Data was collected using pretested, semi-structured questionnaire to obtain information on socio-economic status, child and maternal characteristics, hygiene practices, feeding practices and vaccination status. Anthropometric measurements (height, weight, MUAC) were used to determine if the children were wasted, stunted or underweight based on WHO reference.

The study revealed that the prevalence of wasting, stunting and underweight were 7.1%, 28.4% and 14.8% respectively. Severe stunting was found to be 11.6% but none of the children's were found to be severely wasted and underweight respectively. The study found that there was significant association of underweight with type of the family ( $P=0.022$ ). Similarly, there was significant association of stunting with mother education status ( $P=0.028$ ), type of family ( $P=0.045$ ) and exclusively breastfeeding ( $P=0.018$ ). On the basis of MUAC 1.9% were moderately malnourished. The result shows that more nutritional education is needed on the part of the mother so that the poor nutritional status of the children can be improved to ensure healthy living for both mother and their children.

## Contents

---

<b>Approval letter</b> .....	<b>iii</b>
<b>Acknowledgements</b> .....	<b>iv</b>
<b>Abstract</b> .....	<b>v</b>
<b>List of Tables</b> .....	<b>ix</b>
<b>List of Figures</b> .....	<b>x</b>
<b>List of Abbreviations</b> .....	<b>xi</b>
<b>Introduction</b> .....	<b>1</b>
1.1 Background of the study .....	1
1.2 Statement of the problem .....	2
1.3 Objectives of the study .....	3
1.3.1 General objective .....	3
1.3.2 Specific objective: .....	3
1.4 Research questions .....	3
1.5 Significance of study .....	4
1.6 Limitations of the study .....	4
<b>Literature review</b> .....	<b>5</b>
2.1 Nutritional status .....	5
2.1.1 Factors affecting the nutritional status .....	6
2.2 Conceptual Framework .....	9
2.3 Nutritional requirement .....	11
2.4 Malnutrition .....	12
2.4.1 Forms of malnutrition .....	13
2.4.4 Common prevalent forms of malnutrition .....	16
2.4.5 Micronutrient deficiencies .....	18
2.5 Weaning and complementary feeding status .....	20
2.6 Nutritional status of children below 5 years in Nepal .....	21
2.7 Assessment of nutritional status .....	22
2.8 Anthropometric measurement .....	23
2.9 Indicators in nutritional status .....	24
2.9.1 Height-for-age (H/A) .....	25
2.9.2 Weight-for-height (W/H) .....	26
2.9.3 Weight-for-age (W/A) .....	26

2.9.4	Mid-upper-arm circumference (MUAC).....	27
<b>Materials and methods.....</b>		<b>28</b>
3.1	Research instruments .....	28
3.2	Research method.....	28
3.3	Study variables.....	28
3.4	Study area.....	29
3.5	Target population .....	29
3.6	Sampling technique.....	29
3.7	Sample size .....	30
3.8	Pre – testing.....	31
3.9	Validity and reliability .....	31
3.10	Data collection techniques .....	31
3.10.1	Date of birth .....	32
3.10.2	Length/height .....	32
3.10.3	Weight .....	32
3.10.4	MUAC.....	33
3.11	Data Analysis .....	33
3.12	Logistical and ethical consideration: .....	33
<b>Results and discussion.....</b>		<b>34</b>
4.1	Socio economic and demographic factors .....	34
4.3	Child caring practices .....	37
4.4	Maternal characteristics .....	39
4.5	Environment and sanitation characteristics .....	41
4.6	Prevalence of malnutrition.....	42
4.6.1	Distribution of malnutrition based on gender .....	43
4.6.2	Distribution of malnutrition based on age.....	44
4.6.3	Distribution of malnutrition based on MUAC .....	45
4.6.4	Nutrition status comparison with WHO standard .....	45
4.6.5	Edema.....	48
4.7	Factors associated with under nutrition of Children .....	49
4.7.1	Factors associated with wasting .....	49
4.7.2	Factors associated with stunting.....	50
4.7.3	Factors associated with underweight.....	51

<b>Conclusion and recommendations .....</b>	<b>53</b>
5.1 Conclusion .....	53
5.2 Recommendations.....	54
<b>Summary .....</b>	<b>55</b>
<b>References.....</b>	<b>57</b>
<b>Appendices .....</b>	<b>63</b>



## List of Tables

<b>Table No.</b>	<b>Title</b>	<b>Page No.</b>
2.1	RDA for 6-59 months of children according to ICMR 2020	12
4.1	Religion and caste distribution	34
4.2	Socio-economic and demographic characteristics	35
4.3	Child characteristics	37
4.4	Child caring characteristics	38
4.5	Maternal characteristics	40
4.6	Environment and sanitation characteristics	42
4.7	Sex wise distribution of wasting, stunting and underweight	43
4.8	Distribution of wasting, stunting and underweight among different age group	44
4.9	Distribution of malnutrition based on MUAC	45
4.10	Factors associated with wasting	49
4.11	Factors associated with stunting	50
4.12	Factors associated with underweight	52

## List of Figures

<b>Figure No.</b>	<b>Title</b>	<b>Page No.</b>
2.1	UNICEF conceptual framework for malnutrition	10
2.2	The vicious cycle of malnutrition	15
2.3	Trends in nutritional status of children under five years of age (NDHS 2016)	22
4.1	Prevalence of under nutrition in Kerabari rural municipality compared to (NDHS 2016)	42
4.2	Malnutrition based on gender	43
4.3	Distribution of wasting among 6-59 months in Kerabari rural municipality based on WHO standard	46
4.4	Distribution of stunting among 6-59 months in Kerabari rural municipality based on WHO standard	47
4.5	Distribution of underweight among 6-59 months in Kerabari rural municipality based on WHO standard	48

## List of Abbreviations

Abbreviation	Full forms
MoHP	Ministry of Health and Population
UNICEF	United Nations International Child Emergency Fund
NDHS	Nepal Demographic Health Survey
CBS	Central Bureau of Statistics
MDG	Millennium Development Goal
RDA	Recommended Dietary Allowances
WHO	World Health Organization
MAM	Moderate Acute Malnutrition
SAM	Severe Acute Malnutrition
PEM	Protein Energy Malnutrition
FAO	Food and Agriculture Organization
MNDS	Micro-Nutrient Deficiency Symptoms
HIV	Human Immunodeficiency Virus
AIDS	Acquired Immunodeficiency Syndrome
UN	United Nations International Child Emergency Fund
WFP	World Food Program
MUAC	Mid-Upper Arm Circumference
FCHV	Female Community Health Volunteer
CB-IMCI	Community Based- Integrated Management of Childhood Illness
ORS	Oral Rehydration Salt
WHZ	Weight for Height
HAZ	Height for Age
WAZ	Weight for Age
INGO	International Non- Governmental Organization
NGO	Non- Governmental Organization
MoJP	Ministry of Law, Justice, Constituent Assembly and Parliamentary Affairs
DFTQC	Department of Food Technology and Quality Control

# **Part I**

## **Introduction**

### **1.1 Background of the study**

Food is the substance taken in the body that will help meet the body's needs for energy, maintenance of health, growth and reproduction. Nutrition is the science of food and its interaction with an organism to promote and maintain health. Thus, nutrition is a combination of processes by which all parts of the body utilize the materials necessary for the performance of their functions and for the growth and renewal of all components (Joshi, 2016). Malnutrition refers to the physical effects on the human body due to dietary intake inadequate in quantity and/or quality or poor nutrition due to an insufficient, poorly balanced diet, faulty digestion or poor utilization of foods. Nutritional status is the condition of the body as it relates to consumption and utilization of food. Good nutritional status refers to the intake of well-balanced diet, which supplies all the essential nutrients to meet the body's requirements. Poor nutritional status refers to an inadequate or even excessive intake or poor utilization of the nutrients to meet the body's requirements. A balanced diet is a diet which contains all the nutrients in the right amount as required by an individual's body need (Joshi, 2016).

Malnutrition is widely prevalent in many parts of the worlds. Malnutrition especially under nutrition is the most serious human health and social problems that affect the majority of the population of the developing country like Nepal. It is also associated with infection and with fertility, family size, physical and mental health and growth and development and immunity mechanism of the body (Gartaulla, 1998). A child's life is determined by food given to the child during his/her first five years. Nutrition is one of the influencing factor as faster growth and development occurs in this period (MoHP, 2001).

Globally, the prevalence of wasting, stunting and underweight is 8%, 37% and 16% respectively. South Asia has the highest prevalence of malnutrition as compared to other regions and the prevalence of wasting, stunting and underweight is 10%, 39% and 19% respectively (WHO, 2015). According to global nutrition report 2018, stunting children has declined and data showed that the percent of underage five stunting children was 32.6% in

2000 and it declined 10% and reached 22.2% in 2017. In Asia the rate of stunting children in under age five was 38.1% in 2000 to 23.2% in 2017.

Adequate nutrition is essential in early childhood to ensure the healthy growth, proper organ formation and function, a strong immune system, and neurological and cognitive development. Children under the age of five are mostly prone to malnutrition (UNICEF, 2012).

The population of under five children in Nepal constitutes more than ten percent of total population. Around half of under-five mortality (54 per 1000 live births) in Nepal is associated with malnutrition (UNICEF, 2012). According to NDHS 2011, 10.3% of children of Eastern Terai region are wasted, 31.4% are stunted and 24% are underweight. It also reports that rural population are the most affected by wasting, stunting and underweight. Also though stunting prevalence is high in mountain region, the national data shows wasting is more significant in Terai (MoHP, 2011).

Kerabari rural municipality, Morang district lies in Terai region in Koshi Zone of south-eastern Nepal. The majority of population are Brahmin, Chhetri, Newar, Rai, Limbu, Magar, Gurung etc. and the minorities of the population are Medhesi, Tharu, Dalit. The major occupation and also large number of population work as labor in agriculture and construction. (CBS, 2015) But nowadays most of the people are dependent on remittance and also large number of population work as labor in agriculture and construction.

## **1.2 Statement of the problem**

Nepal is a developing country which falls in one of the top 10 countries which are more drastically suffering from malnutrition. The top trending malnutrition can be listed as: stunting, underweight and wasting. Among them 36% children of under five in Nepal are stunted, 10 % are wasted and 27% are underweight (NDHS, 2016). It has been reported that rural population is most affected by stunting, wasting, and underweight whereas stunting is major problem in mountain area. The prevalence of stunting and underweight increases with age of the children, peaking at age 24-35 months, while wasting is more prevalent among children younger than two years of age. Similarly, 53% of children under five in Nepal are anemic(NDHS, 2016) and the prevalence of anemia is highest in the Terai (60%), followed by the mountains (57%) and the hills (40%). Children in rural areas are more affected (56%) compared to their counterparts from the urban areas (49%). The

prevalence of anemia was higher among children age 6-23 months (68%) than among older children age 24-25 months (52%), 36-47 months (45%), and 48-59 months (36%) (NDHS, 2016).

There's no any study conducted before to assess the nutritional status of 6-59 months of children in Kerabari rural municipality, Morang. Thus, there was need for determining the current nutritional status 6-59 month's children of Kerabari rural municipality, Morang. Therefore, this study is designed to assess the prevalence of malnutrition and associated factors among children aged 6-59 months which can be used as a reference in priority setting and designing effective nutritional programs at Kerabari rural municipality.

### **1.3 Objectives of the study**

#### **1.3.1 General objective**

The main objective of this study is to find the nutritional status of 6-59 months old children of Kerabari rural municipality, Morang district.

#### **1.3.2 Specific objective:**

- i) To carry out anthropometric measurements (Ht, Wt and MUAC) of 6-59 months old children of Kerabari rural municipality, Morang.
- ii) To carry out household survey to find out the socioeconomic condition, feed practices, child caring practices, environment and sanitation condition and immunization condition with the help of questionnaire.
- iii) To identify the factors associated with prevalent nutritional status of children of Kerabari rural municipality.

### **1.4 Research questions**

Research question is set as

- i) What is the nutritional status and the contributing factors associated with nutritional status of 6-59 months of children in Kerabari rural municipality?

## **1.5 Significance of study**

The findings of the study will be helpful to

- a) Encourage local people to improve current nutritional status by improving feeding pattern and habit of children, pregnant and lactating women.
- b) Serve as helpful guide to plan suitable nutritional and health programs for this community based on the facts and figures discovered from this study.
- c) Provide information to government and voluntary institution like NGOs and INGOs about nutritional status as well as different demographic factors.
- d) Encourage government and other stake holders for the development of programs and policies related to nutrition.
- e) Discover the problems related to nutrition, care practices and feeding behavior of this study population.
- f) Act as tool to reflect sanitary condition, socio-economic variables, degree and types of malnutrition and condition of 6-59 months age group child.
- g) Identify individual or group of people who are at risk of being malnourished and who need special care and attention.

## **1.6 Limitations of the study**

- i) Dietary intake during 24 hours of survey considered as major determinants of nutritional status, was not included in the study.
- ii) Due to the matter of hesitation and memory bias the right information might not be provided by the respondent about family's income, age of first pregnancy, child's age, food availability and consumption pattern and their utilization.
- iii) This study was conducted with limited resources due to which other important assessments like biochemical, dietary survey and clinical assessment could not be done.

## **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. Nutritional status is the result of complex interactions between food consumption and the overall status of health and health care practices. Also it can be defined as the condition of health of the individual as influenced by the utilization and interaction of nutrients in body. It can be determined through a careful medical, dietary history, physical examination, and appropriate laboratory investigation (Robinson, 1972). The nutritional status of children is important as it determines their health, physical growth and development, academic performances and progress in life. All children have the right to adequate nutrition, which is essential for attainment of the highest standard of health. The nutritional status reflects the degree to which physiologic needs for nutrients are being met (Joshi, 2008).

Children's nutritional status is a reflection of their overall health. When children have access to an adequate food supply, are not exposed to repeated illness, and are well cared, they reach their growth potential and are considered well nourished. Malnutrition is associated with more than half of all child deaths worldwide. Undernourished children are more likely to die from common childhood ailments and, for those who survive, have recurring sicknesses and faltering growth. Three quarters of the children who die from causes related to malnutrition are only mildly or moderately malnourished-showing no outward sign of their vulnerability. One of the MDGs is to halve the proportion of people who suffer from hunger between 1990 and 2015. A reduction in the prevalence of malnutrition will also assist the MDG on reducing child mortality (NMICS, 2012).

Good nutrition signals the realization of people's rights to food and health. Without good nutrition, human beings cannot achieve their full potential. When nutrition status improves, it helps to break the intergenerational cycle of poverty, generates broad-based economic growth, and leads to a host of positive consequences for individuals, families, community and countries. Good nutrition provides both a foundation for human development and the scaffolding needed to ensure it really its full potential. Good nutrition,



in short is an essential driver of sustainable development (Development, 2015) . Broadly speaking the development of nation depends on the nutritional status of its people (Katwal, 1989).

### **2.1.1 Factors affecting the nutritional status**

The factor affecting nutritional status are; mother's food security, types of food given to the young children, feeding frequency, poverty, illiteracy, ignorance of the child and feeding status of women and child nutrition and who fed the child and how the child eats (UNICEF, 1996). Also, factor influencing the nutritional status are food availability and its distribution system, consumption, income and purchasing power, price of commodities, family size, socio-culture and religious belief, environment sanitation and health facilities. These factors play integral roles in the nutritional status of the people in developing countries and are explained as follow (FAO, 2005):

Some of them are given below:-

i) Conditioning influences: - Infection diseases are important conditioning factors responsible for malnutrition. In children, mainly diarrhea, intestinal parasite, measles, whooping cough, malaria, tuberculosis all contribute to malnutrition. It has been shown that where environmental condition is poor, children are more prone to infections on their first three years of life (Amruth, 2012).

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

ii) 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 is available because of cultural influences which vary wide from country to country and region to region. These may be stated as below (FAO, 2005):

a) 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 these habits are passed 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 woman eat more, her baby will big in size and delivery will be difficult. Certain food is “forbidden” as being harmful for the child. There is certain belief about hot and cold food and 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 (FAO, 2005).

b) 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).

c) Food fads: - In the selection of food, personal likes and dislikes play an important role. These are called food fads. The food fads may stand in the way of correcting nutritional deficiencies (Amruth, 2012).

d) 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).

e) 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 roaming around, inactive eating and watching television also effect the nutrition status of the child (Amruth, 2012).

iii) 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). 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. Others actors 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 caretakers, 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).

iv) Food production: - Increased food production leads to increase in food consumption. 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 and within the countries (FAO, 2005).

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

vi) Occupation: - Occupation is the major factor that enhances 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 market or self-production. Among the group of different occupation mostly wage earner by daily purpose are likely to spend all of their money on food or daily commodities (Amruth, 2012).

vii) Inadequate dietary intake: - This means 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. Insufficient macro nutrient intake can result in growth retardation (in children) as well as weight loss. Micro nutrient such as vitamin A, zinc and a large number of other nutrients 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 (Amruth, 2012).

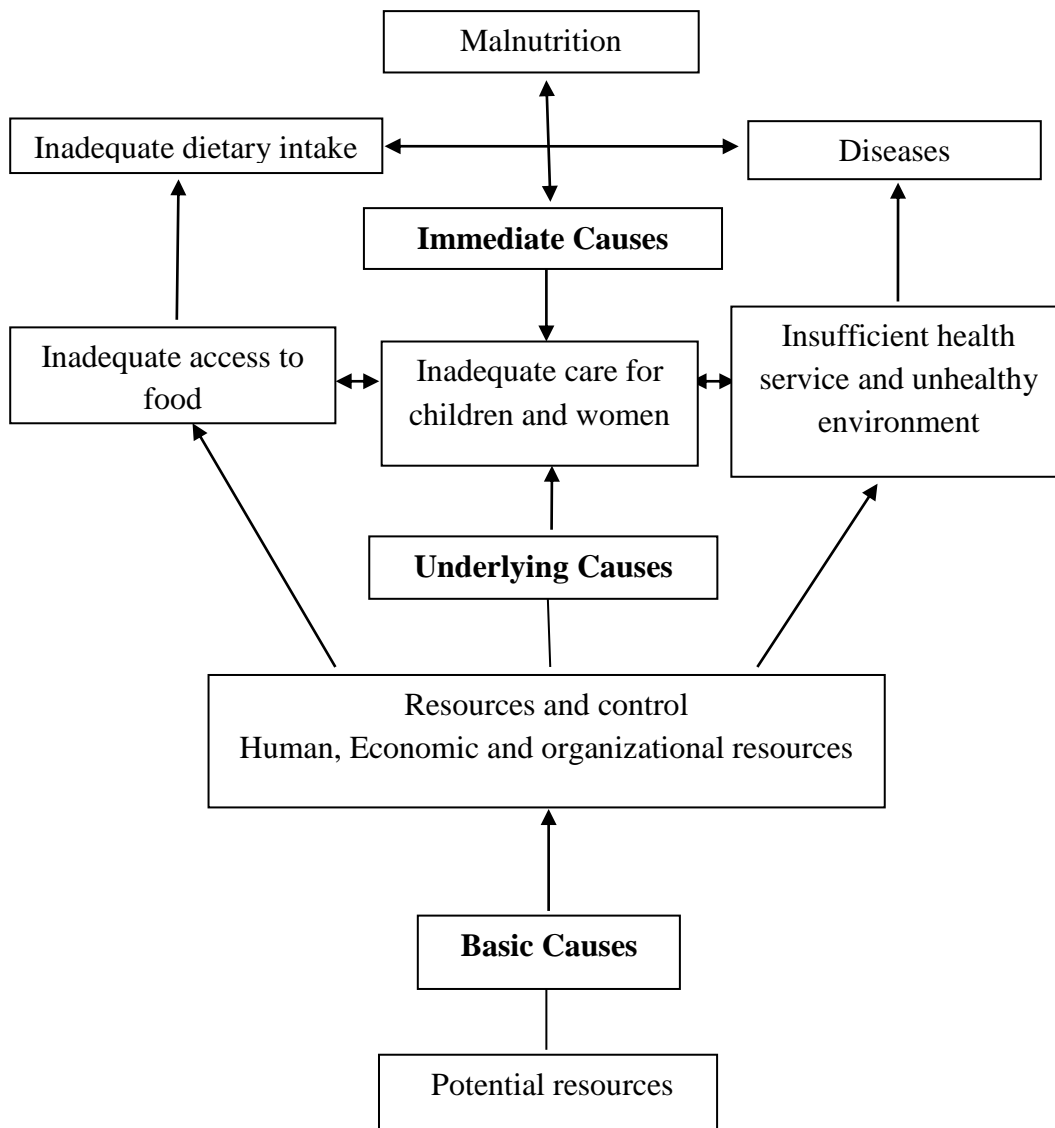
viii) Food availability and nutrition status: - Good health depends on adequate food supply and consumption. The food distribution determines the state of health and the incidence of disease among population. If the food supply is inadequate than the physiological needs, malnutrition and under nutrition 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 nutrients, adverse consequences manifest. 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 these deficiencies diet rich in these nutrients should be consumed (Katwal, 1992). 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).

## **2.2 Conceptual Framework**

The literature repeatedly shows that malnutrition is caused by a combination of above mentioned factors, such as low income, illiteracy, an unhealthy environment, unsatisfactory health services, inadequate food habits, low agricultural productivity, etc., and that all these affect each other differently according to the particular situation (FAO, 2005).

i) Immediate causes: The very first immediate cause of nutritional deficiency is inadequate dietary intake in terms of quality and quantity. The usual Nepalese diet usually consists chiefly of carbohydrates but not enough protein and other micro nutrients. Not all Nepalese are privileged to have meat, eggs, milk, legumes, fruits, vegetables. Even if they do, they do not consume regularly. Recurrent infection like acute respiratory infections, gastroenteritis, worm infestations further aggravates the problem. Figure 2.1 illustrates the relationship between malnutrition and infection. This relationship is cyclic; nutritional deficiency can make an individual more susceptible to disease, while disease contributes to nutritional deficiency. All of this adds up to an increased risk of death (Devkota *et al.*, 2015).



**Fig. 2.1** UNICEF Conceptual Framework of Malnutrition (Hartog *et al.*, 2006)

ii) Underlying causes of under nutrition: The underlying cause of nutritional deficiency disorders are lack of household food security, lack of proper social and care environment and lack of health care and healthy environment. Seventy percent of the population of Nepal are involved in agriculture but still not growing enough food grains. Average household food production can meet their food needs for only about four months. Likewise, ineffective and insufficient health care services, improper care practices, inadequate or delayed treatment of childhood illnesses, lack of proper environmental sanitation, lack of proper care of vulnerable group of population, lack of proper nutrition education are other contributing factors for the problems. These underlying causes are

not discrete causes but interact in important ways, as shown in the above Figure 2.1 (Devkota *et al.*, 2015).

iii) Basic causes: The other factors contributing to under nutrition identified by the conceptual framework are considered basic causes. These refer to what resources are available (human, structural, financial) and how they are used (political, legal and cultural factors). These can be thought as the real reason behind the underlying causes (FAO, 2005).

Political, legal and cultural factors may defeat the best efforts of household to attain good nutrition. These include the degree to which the right to women and girls are protected by law and customs; the political and economic system that determines how income and assets are distributed and the ideologies and political that governs the social sectors. Overcoming poverty and under development requires resources and inputs (UNICEF, 2012).

### **2.3 Nutritional requirement**

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(Black *et al.*, 2010).

The energy supplies are most insufficient, it seems to occur in those developing countries where the staple commodities are either very low in protein content or the protein is of very low quality. Most of the people in developing countries depend on the starchy food and derive their 80% of total calories from them (Schmitt, 1979).

The recommended daily allowance (RDA) of nutrients for 6-59 months of children according to ICMR 2020 are shown in table below:

**Table 2.1.** RDA for 6-59 months of children according to ICMR 2020 (ICMR, 2020)

<b>Nutrients</b>	<b>6-12 months</b>	<b>1-3 years</b>	<b>4-5 years</b>
<b>Protein(gm/day)</b>	10.5	12.5	16
<b>Calcium(mg/day)</b>	300	500	550
<b>Iron(mg/day)</b>	3	8	11
<b>Vitamin A (µg /day)</b>	350	390	510
<b>Vitamin D (IU/ day)</b>	400	600	600
<b>Thiamine(mg/day)</b>	0.4	0.7	0.9
<b>Riboflavin(mg/day)</b>	0.6	1.1	1.3
<b>Niacin (mg/day)</b>	5	7	9
<b>Pyridoxine(mg/day)</b>	0.6	0.9	1.2
<b>Vitamin C (mg/day)</b>	30	30	35
<b>Dietary folate(µg/day)</b>	85	120	135
<b>Vit B-12(µg/day)</b>	1.2	1.2	1.2
<b>Magnesium(mg/day)</b>	75	90	125
<b>Zinc(mg/day)</b>	2.5	3.3	4.5

## **2.4 Malnutrition**

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, 1966). Malnutrition is a broad term commonly used as an alternative to under nutrition but technically it also refers to over nutrition. People are malnourished if their diet does not provide adequate calories and protein for growth and maintenance or they are unable to fully utilize the food they eat due to illness (under nutrition). People are also malnourished if they consume too many calories (over nutrition) (UNICEF, 2008).

Malnutrition is thus a health outcome as well as a risk factor for disease and exacerbated malnutrition. It can increase the risk both of morbidity and mortality (Adhikari and Krantz, 2013).

### **2.4.1 Forms of malnutrition**

There are different forms of malnutrition. As defined by World health organization (WHO, 1966) there are four forms of malnutrition which are described as follows.

#### **i) Under nutrition**

Under nutrition is defined as the condition which results when insufficient food is eaten over an extended period of time. In extreme cases, it is called starvation (Jelliffe, 1966). It includes acute and chronic malnutrition:

#### **a) Acute malnutrition**

Acute malnutrition is a devastating disease of epidemic proportions. Worldwide, some 55 million children age 5 or younger suffer from acute malnutrition. It is estimated that productivity losses alone exceed 10% of a person's lifetime income, and up to 3% of a country's GDP (ACF, 2009). Acute malnutrition is categorized into Moderate Acute Malnutrition (MAM) and Severe Acute Malnutrition (SAM), determined by the patient's degree of wasting. SAM is further classified into two categories: Marasmus and Kwashiorkor. Patients may present with a combination, known as Marasmic Kwashiorkor. Patients diagnosed with Kwashiorkor are extremely malnourished and great risk of death. All cases of bi-lateral edema are categorized as SAM. These guidelines address management and treatment of acute malnutrition (Collins, 2006).

An anthropometric measure frequently used during emergencies is the measurement of child's middle upper arm circumference or MUAC. Arm circumference less than 12.5 cm indicates a child is at the risk of acute malnutrition (ACF, 2009). Children with Z- scores below minus two standard deviations (-2SD) are considered thin (wasted) or acutely malnourished. Children with Z- scores below minus three standard deviations (-3SD) are considered severely wasted (WHO, 2015).

Acute malnutrition in children under five years of age increases their risk of death, inhibits their physiological and mental development, has life-long implications for the health, and heavy mortgages the opportunity available to future generations. Acute malnutrition may come out at any lifetime and can be recovered (ACF, 2009).



## **b) Chronic malnutrition**

Chronic malnutrition is defined as stunting and differs from acute malnutrition. It can be determined by a patient's degree of stunting, i.e. when a child has not reached his or her expected height for a given age. To treat a patient with chronic malnutrition requires a long-term focus that considers household food insecurity, home care practices (feeding and hygiene practices) and issues related to public health (Collins, 2006).

Chronic malnutrition results from failure to treat acute malnutrition during the period between conception and the first two years of life. Because it is a key development stage of a child's body, resulting harm cannot be treated after the first two year of a child's life. The length of a child and foetus between conception and the first two years of life is determined by two factors (UN, 2010)

- a) Sequence of a foetus growth, which is greatly defined during the first six months of pregnancy and
- b) Child's nutrition status during the first two years of life.

## **ii) Over nutrition**

This is the pathological state resulting from the consumption of excessive quantity of food over an extended period of time. Over nutrition is often related to obese and overweight (Jelliffe, 1966).

## **iii) Imbalance**

It is the pathological state resulting from a disproportion among essential nutrient with or without the absolute deficiency of any nutrient (Jelliffe, 1966).

## **iv) Specific deficiency**

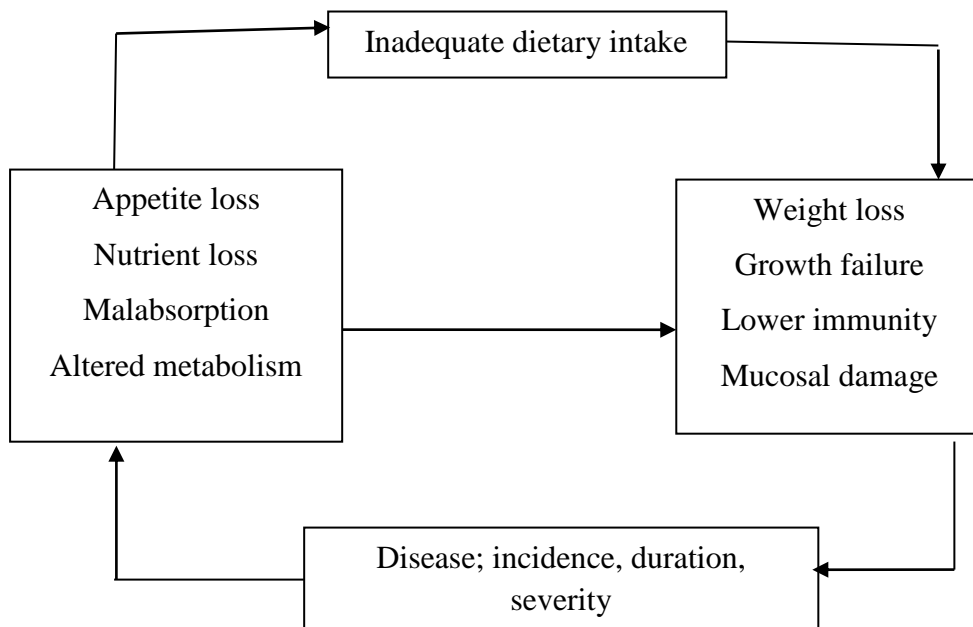
It is defined as the pathological state resulting from a relative or absolute lack of an individual nutrient. Micronutrient deficiencies such as Vitamin A deficiency, Iodine deficiency disorders, Iron deficiency disorders are some examples of specific deficiency (Jelliffe, 1966).

### 2.4.2 Effects of malnutrition

The effect of malnutrition on the community is both direct and indirect. Direct effects are the occurrence of visible signs and subclinical nutrition deficiency diseases such as kwashiorkor, marasmus, and vitamin and minerals deficiency disease. Indirect are, high morbidity and mortality among young children (nearly 50% of total death in the developing countries occur among children five years of age as compare to less than 5 percent in developed countries), retarded physical and mental growth and development (which may be permanent), lowered vitality of the people leading to lowered productivity and reduced life expectancy (Amruth, 2012).

### 2.4.3 Malnutrition and infection cycle

Malnutrition is frequently part of a vicious cycle that includes poverty and disease. These three factors are interlinked in such a way that each contributes to the presence and permanence of the others. Socioeconomic and political changes that improve health and nutrition can break the cycle; as can specific nutrition and health interventions (WHO, 2017).



**Fig. 2.2** The Vicious Cycle of Malnutrition (Caballero and Maqboal, 2003)

The vicious cycle of malnutrition, impaired immune response, increased infection and diseased food intake is well recognized (Caballero and Maqboal, 2003). Malnutrition (both macro and micronutrients) affected epithelial mucosal integrity, mucociliary clearance,

immunoglobulin synthesis, lymphocyte differentiation and thus lead to impaired immunity which leads to recurrent infection (Chandra and Kumari, 1994) .

Inadequate dietary intake leads to malnutrition in the form of wasting, stunting and underweight with characteristics symptoms like weight loss, growth failure and lower immunity. Severe and repeated infectious diseases leads to appetite loss, nutrient loss, mal absorption and also altered metabolism which finally leads to malnutrition and results in poverty (WHO, 2017).

#### **2.4.4 Common prevalent forms of malnutrition**

##### **i) Protein-energy malnutrition**

PEM is one of the major public health problems. As the name suggests, this condition is a deficiency of protein and calories in the diet. Although, it affects people of all ages, the results are more drastic in childhood due to the highest nutrients requirement in that period. Primarily due to a deficiency of total dietary energy; the protein deficiency being increased cases of kwashiorkor, the shriveled cases of marasmus; and the other, cases of nutritional dwarfing (Joshi, 2016).

##### **Classification of PEM**

###### **a) Kwashiorkor:**

It is derived from African word meaning ‘the sickness the older child gets when the next baby is born’. It refers to the observation that the first child develops PEM when the second child is born and replaces the first child through breastfeeding (Joshi, 2016).

Symptoms of Kwashiorkor are growth failure, edema, muscle wasting, moon face, apathy and peevishness, crazy pavement dermatitis and fatty liver. Symptoms of Kwashiorkor include (Joshi, 2016):

- 1) Fine, reddish-brown, lusterless hair with loose curls,
- 2) Apathy: growth failure
- 3) Blotchy
- 4) Prominent stomach
- 5) With weight usually below 60% of expected weight for age, but this depends on the degree of edema

- 6) Edema (excess fluid under the skin, causing puffiness)
- 7) Diarrhea
- 8) Wasted muscles

Kwashiorkor usually occurs later than marasmus and is uncommon under one year of age (Joshi, 2016).

#### **b) Marasmus**

The term derived from the Greek word meaning ‘to waste’. It occurs due to the deficiency of protein. It is most predominant form of PEM in developing countries. Marasmus is commonly seen in babies whose mothers had inadequate breast milk and occurs mostly during the child’s first year. It may also occur when there is too long a reliance on breast milk without complementary solid foods. Improper use of bottle-feeding is closely associated with marasmus, especially in urban areas (FAO, 1997).

Symptoms of marasmus include (Joshi, 2016):

- 1) Apathy, growth failure.
- 2) With weight below 60 percent of expected weight for age.
- 3) Wasted muscles (muscles that are visibly thinner and less developed than normal) and very little fat under the skin.
- 4) Diarrhea.

#### **c) Marasmic kwashiorkor**

As the name implies, this is a combination in varying degrees of the features of the two conditions marasmus and kwashiorkor, and is found in places where PEM is prevalent. Children suffering from this type of PEM exhibit a mixture of some features of both marasmus and kwashiorkor (Joshi, 2016).

#### **d) Nutritional dwarfing**

Retardation of growth is observed in the children who are deprived of food for prolonged period of time. Weight and height are both reduced resembling children a year and more younger (Sandberg *et al.*, 1991).

#### **e) Underweight child**

These children are growing up smaller than their genetic potential and of greater importance as they are at risk of gastroenteritis, respiratory and other infection, which can precipitate malnutrition (Srilakshmi, 2014).

Infants and young children are the most severely affected by PEM because of their high energy and protein needs relative to body weight and their particular vulnerability to infection. Children's health is in risk from about three months of age until they can feed themselves, perhaps at about three years of age. During this period several weaning practices can have an adverse effect on child nutrition. One factor is the age at which food supplements are introduced into the child's diet; others include the method of food preparation, the frequency of feeding and the energy density of weaning foods. In all circumstances, especially during illness, young children need to be fed frequently during the day. Mothers may have difficulty in feeding children often if they are working in the fields; thus limited time available to mothers may be an important factor on children's food intake (FAO, 1997).

#### **2.4.5 Micronutrient deficiencies**

Micronutrient deficiency is a global challenge to health as in Nepal. In Nepal, the targeted beneficiaries are less aware about importance of micronutrients (MNs), which has resulted in low intake of foods rich in MNs. Micronutrient deficiencies (MNDs) have huge impact on health of vulnerable population like women and children and have jeopardized the national economy and prosperity of developing countries including Nepal. However, less attention has been paid towards MNDs, which can be prevented. The major causes of MNDs were poor diet, diseases and infestations, and poor health caring practices. The results of MNDs were unwanted child and maternal mortality, impairments of lives, and reduction in productivity and intellectual capacity. School health and nutrition education and supplementation and fortification of essential MNs proved to be effective while dietary diversification and economic growth and poverty eradication seemed promising. Control and prevention of MNDs can help to achieve Millennium Development Goals as well, so studies in this sector should be emphasized (Bhandari and Banjara, 2015). Some major micronutrient deficiencies are mentioned as follows:

### **i) Vitamin A deficiency**

Vitamin A is an essential micronutrient for the immune system that plays an important role in maintaining the epithelial tissue in the body. Severe vitamin A deficiency (VAD) can cause eye damage. VAD can also increase the severity of infections, such as measles and diarrheal diseases in children, and slow recovery from illness. Vitamin A is found in breast milk, other milk, liver, eggs, fish, butter, mangoes, papayas, carrots, pumpkins, and dark green leafy vegetables. The liver can store an adequate amount of the vitamin for four to six months (MoHP, 2011).

VAD occurs when people do not eat enough foods containing vitamin A or fat. VAD not only causes night blindness, permanent damage to the eyes and even blindness, but also increase risk to and severity of infections. Pregnant and breastfeeding mothers and children are most at risk of VAD. Vitamin A deficiency (VAD) is found sub-clinically in 32% of pre-school children; 5% of mothers suffer night blindness, an indicator of severe VAD (Gorstein *et al.*, 2003).

The prevalence of both Bitot's spots and night blindness among preschool children decreased from levels observed in surveys conducted in the previous twenty years. However, the prevalence of night-blindness was found to be 5% among women, and over 1% among school-aged children, which indicates that the entire population is vulnerable to VAD. These observations support findings from other surveys that have noted a high prevalence of maternal night-blindness in Nepal (Gorstein *et al.*, 2003).

### **ii) Iron deficiency**

Iron deficiency is the most common and widespread nutritional disorder in the world. As well as affecting a large number of children and women in developing countries, it is the only nutrient deficiency which is also significantly prevalent in industrialized countries. The numbers are staggering: 2 billion people – over 30% of the world's population are anemic, many due to iron deficiency, and in resource-poor areas, this is frequently exacerbated by infectious diseases. Malaria, HIV/AIDS, hookworm infestation, schistosomiasis, and other infections such as tuberculosis are particularly important factors contributing to the high prevalence of anemia in some areas. In developing countries every second pregnant women and about 40% of pre-school children are estimated to be anemic (MoHP, 2011).

In Nepal, 78% women are anemic due to iron deficiency of which 50% of women are in childbearing age. In total 78% of any anemia, mild, moderate and severe are 34.7, 28.7%, 5.6% and 0.3% respectively. And in children anemic condition data shows 46.2%, 27.2%, 18.5% and 0.5% as any anemia, mild, moderate and severe respectively (MoHP, 2011).

### **iii) Iodine deficiency**

Globally iodine deficiency affects 780 million people. The most common symptom is a swelling of the thyroid gland called a goiter. But the most serious impact is on the brain, which cannot develop properly without iodine. According to UN research, some 20 million children are born mentally impaired because their mothers did not consume enough iodine (UNICEF, 2010). Iodine deficiency is estimated to have lowered the intellectual capacity of almost all of the nations reviewed by as much as 10 to 15 percentage points (UNICEF, 2010). The worst-hit suffer cretinism, associated with severe mental retardation and physical stunting (WFP, 2016).

## **2.5 Weaning and complementary feeding status**

After six months, complementary food should be introduced and it is important to continue breastfeeding the children at least up to the age of two years (UNICEF, 2016). Overall, 74 percent of infants aged 6-8 months had received solid, semi-solid or soft foods at least once during the previous day. The minimum frequency of complementary feeding of 6-8 and 9-23 months breastfed children were 2 and 3 times respectively, while for the non-breastfed is 4 times (USAID, 2007). Boys were more likely to receive solid, semi-solid or soft foods than girls. Of children aged 6-23 months, 74 percent had adequate meal frequency and 37 percent had adequate dietary diversity. Overall, 32 percent received a minimum acceptable diet (CBS, 2015). Undesirable cultural practices such as giving pre lacteal feeds, late initiation of breastfeeding after birth, delay in introduction of weaning foods and avoiding exclusive breastfeeding are still prevalent among the mothers. The maternal knowledge towards breast feeding was inadequate and there was a big gap between actual and desired practices (Chaudhary *et al.*, 2011). Some of them are listed below:

i) **Formula milk:** Formula milk is a manufactured food designed and marketed for feeding to babies and infants less than 12 months of age. The composition of infant formula is designed to be roughly based on a human mother's milk. The most commonly used infant formulas contains purified cow's milk whey and casein as a protein source, as

blend of vegetable oils as a fat source, lactose as a carbohydrate source and vitamin-mineral mix. There are infant formulas using soya bean as a protein source in place of cow's milk.

Formula milk should contain proteins, fat, linoleic acid, vitamin (A,C,D,E,K), thiamin (B<sub>1</sub>), riboflavin (B<sub>2</sub>), B<sub>6</sub>, B<sub>12</sub>, Niacin, folic acid, pantothenic acid, calcium, minerals (magnesium, iron, zinc, manganese, copper), phosphorus, iodine, sodium chloride and potassium chloride. Ex. Lactogen. The commonly used formula milk (lactogen), is the product of Nestle.

ii) Cerelac: Cerelac is a brand of instant cereal made by Nestle. The brand is promoted for infants 6 months and older as a supplement to breast milk.

iii) Multiple Micro-nutrient Powder (MNP): MNP is distributed as brand name *bal – vita* by government of Nepal. It is mixture of 15 types of micro-nutrients (Vitamin A, Vitamin B<sub>1</sub>, Vitamin B<sub>2</sub>, Vitamin B<sub>6</sub>, Vitamin B<sub>12</sub>, Vitamin C, Vitamin D, Vitamin E, Niacin, Folic acid, Copper, Iodine, Iron, Zinc and Selenium). It is given to the children of age group 6-24 months. It should be fed by mixing with the usual food eaten by child (GoN, 2012).

## **2.6 Nutritional status of children below 5 years in Nepal**

Stunting is an indication of chronic under nutrition. More than one-third (36%) of children under five in Nepal are stunted, or too short for their age. Stunting is more common in rural children (40%), compared to urban children (32%). By province, stunting ranges from 29% in Provinces 3 and 4 to 55% in Province 6. Children from the poorest households (49%) and whose mothers have no education (46%) are more likely to be stunted (NDHS, 2016).

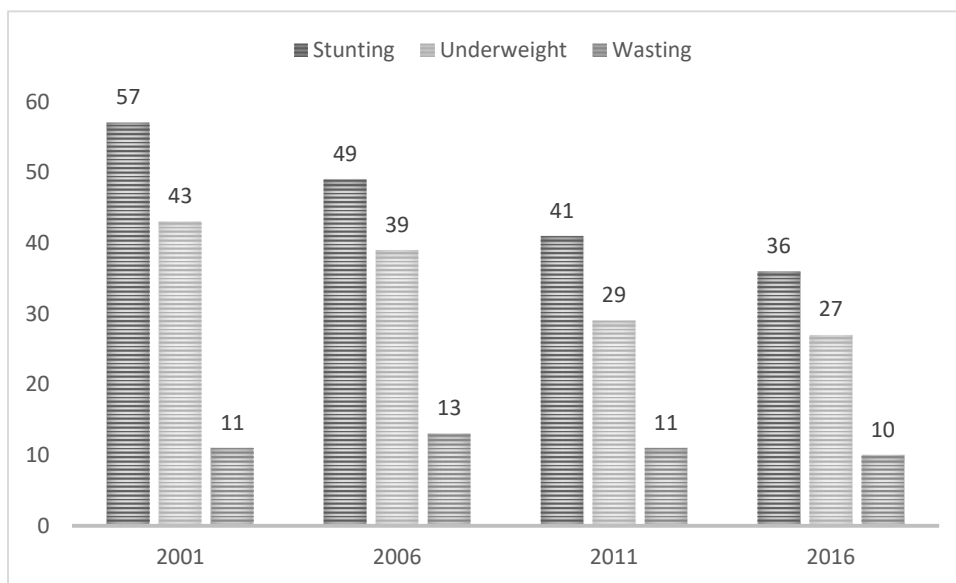
Overall, 10% of children are wasted (too thin for height), a sign of acute malnutrition. In addition, 27% of children are underweight, or too thin for their age. The nutritional status of children in Nepal has improved since 2001. More than half (57%) of children under five were stunted in 2001 compared to 36% in 2016 (NDHS, 2016).

According to the WHO, 45% of under five deaths are due to presence of malnutrition (Bharati and Mehta, 2018). Nationally, the percentage of stunting among under five children is 36% in 2016 and was 41% in 2011; 49% in 2006 and 57% in 2001. The percentage of severe stunting among under five children is 12% in 2016, and was 16% in 2011; 20% in 2006 and 21% in 2001. Similarly, the percentage of underweight is 27% in 2016 and was 29% in 2011; 39% in 2006 and 43% in 2001. The percentage of severely underweight among under five children is 5.4% in 2016 and was 8% in 2011; 11% in 2006;



and 13% in 2001. Overall, the percentage of under five children wasted is 10% in 2016; and was 11% in 2011; 13% in 2006 and 11% in 2001. The percentage of severely wasted among under five children is 2% in 2016 and was 3% in 2011 & in 2006(Bharati and Mehta, 2018).

The results indicate that the nutritional status of children in Nepal has improved over the 2 decades. The percentage of stunted children declined by 14% between 2001 and 2006, declined by an additional 16% between 2006 and 2011, and dropped by 12% between 2011 and 2016. A similar trend downwards is observed for underweight children. This decline has been in line with the Millennium Development Goal (MDG) target. However, there is still a long way to go meet the SDG target of reducing stunting to 31% and underweight to 25% among children under 5 by 2017 (National Planning Commission 2015) (NDHS, 2016).



**Figure 2.3** Trends in nutritional status of children under five years in Nepal Source: (NDHS, 2016)

## 2.7 Assessment of nutritional status

Assessment of nutritional status of community is one of the first steps in the formulation of any public health strategy to combat malnutrition. The principle aim of such an assessment is to determine the type, magnitude and distribution if malnutrition in different geographic areas to identify at risk groups and to determine the contributory factors. In addition

fractural evidence of the exact magnitude of malnutrition is essential to sensitize administrators and politicians to obtain allocation of materials and human resources and to plan appropriately (Srilakshmi, 2002).

The nutritional assessment may require encompassing nations, communities, vulnerable segments of communities or individuals. It may be done as a part of an exercise to document current status as compared with past status or as specific attempt to evaluate the impact of an intervention program (Ramchandran, 1987).

### **Direct method of nutritional survey**

The method is summarized as ABCD steps as (Rashed, 2009):

- a) Anthropometric method
- b) Biochemical and laboratory method
- c) Clinical examination
- d) Dietary evaluation method

### **Indirect method**

The indirect methods of nutritional survey are (Rashed, 2009):

- a) Ecological variables including agricultural crop production, food balance, health and educational services.
- b) Socio economic factors e. g. Family size, occupation, per capita income, population density, education, customs and social habits.
- c) Vital health statistics particularly infant (under 5) mortality and morbidity related to PEM, school age child stunting and wasting, anemia, goiter, diarrhea, measles and parasitic infestation.

## **2.8 Anthropometric measurement**

Anthropometric assessment means physical measurements of body weight and dimensions. The measurements vary with age and degree of nutrition and as a result are useful in assessing imbalances of protein and energy. They can be used to detect moderate as well as severe degree of malnutrition in children as well as in adults. The technique also provides information on past nutritional history, which cannot be obtained in other assessment techniques. Anthropometric indices can be derived directly from a single one

measurement, i.e. weight for age, height for age, from combination of raw measurements, such as weight and height. Mid upper arm circumference has been one of the most widely used indicators for the assessment of nutritional status (Joshi, 2008) .

It is necessary to select those methods of anthropometry depending on the purpose and objective of the survey. It is necessary for the nutritionist to keep in mind that this tool is of great value in the assessment of growth failure and malnutrition (Joshi, 2016).

Advantages of anthropometry (Joshi, 2008) :

- a) Simple, non-invasive and safe
- b) Some equipment is inexpensive, portable.
- c) Relatively unskilled personnel can perform measurements
- d) Quickly identifies mild to moderate malnutrition
- e) Methods are reproducible
- f) Measures with long term nutritional history
- g) Measure many variable of nutritional significance like height, weight, skin fold thickness, head circumference waist-hip ratio and BMI

Limitation of Anthropometry (Joshi, 2008) :

- a) Relative insensitive to short term nutrition status
- b) Cannot identifies specific nutrient deficiencies
- c) Measurements like skin-fold are difficult to carry out in obese people
- d) There may be ethnic differences in fat deposition

## **2.9 Indicators in nutritional status**

A variety of indicators, which can be used for the purpose of assessing nutritional status, are currently available. Among many possible indicators only few are suitable for the evaluation of field program. The only indicator of nutritional status that are applicable in a large scale and for a suitable experience if available are those based on anthropometric indicators (Keller, 1982) . WHO, listed indicators based on body dimensions, birth weight, weight for height, height for age, weight for age, arm circumference, reported in 1976. The measurement of weight and height is relatively simple and reliable and their changes and distribution over ages are well documented for healthy well-nourished reference populations. The simplest of these indicators are weight– for age. It is widely used for both

the assessment of child population and the monitoring of individual development (Keller, 1982).

Weight is the measure of total body mass but gives no indication of its structure; a tall thin child may have same mass as a short, well-proportioned one, a fact that introduces considerable error in to the classification of malnutrition by weight for age particularly in the categories of mild and moderate malnutrition. Therefore, a refinement that has long been used by anthropologist was introduced into the nutritional anthropometry of children (Scoane and Lathan, 1971) . By relating the weight to the attained height, a distinction was made between chronic and acute malnutrition (Scoane and Lathan, 1971) or between; “stunting” (low-height-for-age), and “wasting” (low-weight-for-height), (Waterlow and Ruthishaue, 1974). Three indicators weight-for-age, height-for-age, and weight-for-height have since found wide acceptance and application and probably more known today about these indicators in different population and different health situations than any of other indicators that have been prepared in the past (Keller, 1982).

An essential component of these indicators and their use is the reference population. It provides the indicator value of the population that are considered normal i.e., healthy and without significant deficiencies, and against which measured indicator value are compared, while the indicator weight-for-height is apparently independent of age during childhood (Waterlow and Ruthishaue, 1974).

### **2.9.1 Height-for-age (H/A)**

Height for age is used as an indicator of nutritional status of groups of population for estimating past and chronic malnutrition but not present nutritional status (Joshi, 2008).

Children whose height for age Z – score is below minus two standard deviations (-2SD) from the median of the WHO reference population are considered short for age (stunted), or chronically malnourished. Children who are below minus three standard deviations (3SD) are considered severely stunted (WHO, 2015).

Stunted growth reflects a process of failure to reach linear growth potential as a result of suboptimal health and/or nutritional conditions. On a population basis, high levels of stunting are associated with poor socioeconomic conditions and increased risk of frequent

and early exposure to adverse conditions such as illness and/or inappropriate feeding practices (Onis and Blossner, 2003).

Stunting starts from pre-conception when an adolescent girl and who later becomes mother is undernourished and anemic; it worsens when infants' diets are poor, and when sanitation and hygiene is inadequate. It is irreversible by the age of two. Child survival and health is inseparably connected to reproductive and, maternal health (UNICEF, 2013).

### **2.9.2 Weight-for-height (W/H)**

Weight-for-Height (W/H) helps to identify children suffering from current or acute malnutrition. It is used to examine short term effects, i.e. recent rapid weight loss associated with a period of starvation and/or severe disease (Gomez *et al.*, 2000).

Children with Z – scores below minus two standard deviations (-2SD) are considered thin (wasted) or acutely malnourished. Children with weight for height index below minus three standard deviations (-3SD) are considered severely wasted and children with more than two standard deviations (+2SD) above the median weight for height are considered overweight or obese (WHO, 2015).

Wasting results from weight falling significantly below the weight expected of a child of the same length or height. Wasting indicates current/acute malnutrition resulting from feeding practices, diseases and infection, or, more frequently, a combination of these factors. Wasting in individual children and population groups can change rapidly and shows marked seasonal patterns associated with change in food availability or disease prevalence (Smith and Haddad, 2000).

### **2.9.3 Weight-for-age (W/A)**

Low weight-for-age identifies the condition of being underweight at a specific age. W/A may reflect both chronic and acute under nutrition; however, it is unable to distinguish between the two (Smith and Haddad, 2000).

Children whose weight for age Z – score is below minus two standard deviations (2SD) are classified as underweight while children whose weight for age Z – score is below minus three standard deviation (-3SD) are considered severely underweight (WHO, 2015).

W/A is used to identify the nutritional condition underweight, which is a composite measure of stunting and wasting. Just over 15% of the study children were severely malnourished, having a Z- score  $\leq -3$  standard deviations (SD) for any index (Hommes, 2005).

#### **2.9.4 Mid-upper-arm circumference (MUAC)**

Measurement of the mid-upper arm appears to be most useful in practice. Children whose MUAC is less than 11.5 cm are considered as severely malnourished, similarly MUAC between more than or equals to 11.5 to less than 12.5 cm are considered moderately malnourished likewise MUAC more than or equal to 12.5 are considered normal (WHO, 1966).

## **Part III**

### **Materials and methods**

The materials and methods used during this study were described below:

#### **3.1 Research instruments**

Equipment needed for performing the surveys were:

- i) Digital weighing machines: Child weighing machines made by microlife having capacity of 180kg (1 piece). The minimum capacity of weighing balance was 0.1 kg.
- ii) Height measuring stand (Stadiometer): The height measuring stand of 2m capacity (1 piece). The minimum measurement capacity was 0.1 cm.
- iii) Mid Upper Arm Circumference (MUAC) tape: MUAC tape was used to measure the MUAC reading. The tape was flexible, non-stretchable and made of fiber glass and used to measure to the nearest 0.1 cm.
- iv) Questionnaire: A well designed set of questionnaire was administered to collect information on household characteristics, food availability and its consumption, health status health facility etc.

#### **3.2 Research method**

Descriptive cross-sectional study was carried out. The area of prevalence of malnutrition in children of 6-59 months old was Kerabari Rural Municipality which consisted of two approaches which are:

- i) Anthropometric measurements of 6–59 months children that include height, weight and MUAC.
- ii) Household survey of the children under study with the help of questionnaire.

#### **3.3 Study variables**

Study variables were categorized into two groups: dependent variable and independent variable. Dependent variable of this study was nutritional status of 6-59 months children as

indicated by wasting, stunting and underweight. Whereas, independent variables of the study were:

- i) Socio-economic and demographic variables: family size, income, occupation, education.
- ii) Child characteristics: age, sex, birth order, breastfeeding status
- iii) Child care practices: feeding, hygiene
- iv) Maternal characteristics: age, iron intake, vitamin A intake, number of children born,
- v) Environmental health condition: water supply, hygiene and sanitation

### **3.4 Study area**

Household situated in various wards of Kerabari Rural Municipality, Morang district.

### **3.5 Target population**

Children under five years of age (above six months) were considered as target population of the study. Mothers or caretaker of the children under study were considered as respondents.

#### **Inclusion and exclusion criteria**

**Inclusion criteria:** Children of age (6-59) month who live in Kerabari Rural Municipality of Morang district were included in the study.

**Exclusion criteria:** Participants who were seriously ill or who were not available at the period of survey were excluded in the study.

### **3.6 Sampling technique**

There are ten wards in Kerabari rural municipality. Out of 10 wards 4 wards were selected for sample selection by using lottery method. Number of household to be surveyed from each ward was calculated on the basis of probability proportionate sampling technique to improve precision of sampling strategy. Random households were chosen for sample selection. In households with more than one children of age between 6-59 months, one child was chosen by lottery method.



### 3.7 Sample size

The sample size was determined using a single proportion formula.

$$N = Z^2 P (1-P) / d^2$$

Where,

N=required sample size

Z=confidence interval at 95% (standard value of 1.96)

P=estimated prevalence of malnutrition in projected area

d=margin of error 8%

Here, P was not known for this area because none of the nutritional research was conducted in this municipality for particular age group (6-59months). So that we have taken 41.5% (prevalence rate of Morang district) Prevalence of under nutrition in this place.

The sample size was obtained as below

$$N = Z^2 P (1-P) / d^2$$

$$= (1.96)^2 * 0.415(1-0.415) / (0.08)^2$$

$$= 0.93264 / 0.08^2$$

$$= 146$$

From the information obtained from the municipality, we found that the total number of 6-59 months children in Kerabari rural municipality was 3105. Thus, we apply finite population sample formula to obtain new sample size i.e.

$$\text{New SS} = N_o / [1 + \{(N_o - 1) / \text{POP}\}]$$

Where,

New SS = New sample size for finite population

$N_o$  = Sample size in infinite population

POP = Total population (in this case total population is the population of 6-59 months children in Kerabari)

$$\begin{aligned}\text{New sample size obtained} &= N_o / [1 + \{(N_o - 1) / \text{POP}\}] \\ &= 146 / [1 + \{(145 - 1) / 3105\}] \\ &= 140\end{aligned}$$

Thus calculated sample size is adjusted for non-response. Considering non-response rate as 10%, the adjusted sample size is calculated to be 155.

### **3.8 Pre – testing**

The study was pre-tested below five year children from a selected area under sampling procedure. The pre-testing was conducted to establish accuracy of questionnaire and to check for consistency in the interpretation of questions and to identify ambiguous items. After review of questionnaire all suggested change were made before being administered in the actual study.

### **3.9 Validity and reliability**

To ascertain the degree to which the data collection instruments measure what they purposed to measure, the instruments were validated. Validity of instruments was tested by group of professionals of Central Campus of Technology, Department of Nutrition and Dietetics. For questionnaire too various aspects were tested through preliminary pre testing and also through available literature in nutrition education for young children.

Reliability means absence of errors of measurement in a measuring instrument. It implies the accuracy of the scale. Reliability of the instruments (stadiometer and weighing scale) was tested by the test retest method. Questionnaire was checked daily for completeness, consistency and clarity as mentioned earlier.

### **3.10 Data collection techniques**

Data obtained from the respondents was collected with the help of structured questionnaire. The questionnaire was prepared in English language, and then it was translated into Nepali

language. Interview was conducted with mothers of the children to fill the questionnaire. In which each questionnaire were given a unique identity number for each child.

Data collection was carried out on standardized procedures for obtaining informed consent, conducting interviews and performing anthropometry from guide teacher. We also learnt how to tackle the local problem that may arise in the field while conducting survey. The questionnaire comprised mainly of details on household profiles like age, sex, educational level, occupation of household members, etc.

### **3.10.1 Date of birth**

This date of birth of the child was asked and its reliability was checked with supportive questions like age of mother at pregnancy, birth order of child and age of mother at marriage.

According to Gibson (1993), anthropometric measurements taken for children aged 6-59 months were given below:

### **3.10.2 Length/height**

Stadiometer was used to measure the height of children. The length of children below 2 years was measured by recombinant method here the length of each child aged 6 – 24 months was measured lying flat and centrally on measuring boards placed on a hard flat 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). 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 the head was held erect and hands were hung closely at the sides. The child's height was measured to the nearest one decimal place (Gibson, 1993).

### **3.10.3 Weight**

Firstly, the clothes and shoes worn by child were removed and weight was measured by electronic digital weighing scale and read to the nearest 0.1 Kg. Calibration was done before and after weighing every child by setting it to zero. For the children age below two

years and if were unable to stand by them, their weight was obtained from the difference between weights of mother as she held the child and the weight of the mother alone (Gibson, 1993).

#### **3.10.4 MUAC**

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. Standard MUAC tape given by ACF was used for measuring MUAC (Gibson, 1993).

#### **3.11 Data Analysis**

Collected data was first organized, coded and entered into Microsoft excel 2010 and then into statistical package for social science (SPSS) 20 and into WHO Anthro 3.2.2. Data was analyzed by using descriptive and inferential statistics. Descriptive analysis was used to describe the percentage and number distributions of the respondents by socio-demographic characteristics and other relevant variables in the study.

The verified test parameters were used to establish the relationships between the variables and nutritional status of children. In this case various statistical tests were employed for reliable results.

#### **3.12 Logistical and ethical consideration:**

Permission was taken to carry out the study from Kerabari Rural Municipality. Verbal and written consent from mothers of study subjects was obtained. Respondents were assured that the data collected will be used for the purpose of the study and will be treated with the uttermost confidentiality.

## Part IV

### Results and discussion

A study was conducted to find the nutritional status of 6-59 months children in Kerabari rural municipality. On this study, 155 children aged 6-59 months were taken as sample for anthropometry and a semi structured questionnaire was set for interviewing the mothers or caretakers to obtain information. Among 155 respondents, all the respondents responded to the study with 100% response rate. The results and findings of the study are expressed into several following headings rate.

#### 4.1 Socio economic and demographic factors

As shown in Table 4.1, 76.1% (118) were found to be Hindu, 19.4% (30) Christian and 4.5% (7) Buddhist respectively. Among 155 households, 15.5% (24) were Brahmin, 17.4% (27) Chhetri, 43.2% (67) Janjati, 14.2% (22) Dalit, 9.7% (15) Madhesi.

**Table 4.1** Religion and caste distribution of study population (n=155)

Variables	Frequency	Percent
<b>Religion</b>		
Hindu	118	76.1
Christian	30	19.4
Buddhist	7	4.5
<b>Caste</b>		
Brahmin	24	15.5
Chhetri	27	17.4
Janjati	67	43.2
Dalit	22	14.2
Madhesi	15	9.7

As shown in the Table 4.2, 64.5% (100) had nuclear family and remaining 35.5% (55) had joint family. All the study households were permanent residents. The major occupations in Kerabari rural municipality were agriculture 31.6% (49) and foreign employment 28.4% (44) and other were engaged in labor 16.8% (26), business 9% (14) and service 14.2%

(22). In Nepal, the agricultural sector remains the main employer, with 75% of women and 35% of men engaged in agricultural occupation (MoHP, 2011). The study shows that among the survey children, the occupation of fathers were foreign employment 38.7% (60), labor 16.8% (26), agriculture 20% (31), business 10.3% (16) and service 14.2% (22). This might be due to increasing attraction towards foreign employment (good salary). In the study, it was found that most of the mothers were housewives and only few of the wherein service.

Most of the fathers under study, 76.1% (118) had secondary level of education while 1.9% (3), 6.5% (10), and 15.5% (24) were illiterate, had basic level of education and bachelor degree respectively as categorized by the education act (MoLJP, 2073). Thus the finding shows that least percentage of fathers of children under study was up to secondary level of education. As shown in the Table 4.2, monthly income of 42.6% (66) families was ‘Between’ twenty-five thousand to thirty-five thousand, 18.7% (29) were above thirty-five thousand and remaining 38.7% (60) were below twenty-five thousand.

**Table 4.2** Socio-economic and demographic characteristics (n=155)

<b>Variable</b>	<b>Frequency</b>	<b>Percent</b>
<b>Type of family</b>		
Nuclear	100	64.5
Joint	55	35.5
<b>Main occupation of family</b>		
Service	22	14.2
Business	14	9.0
Labor	26	16.8
Agriculture	49	31.6
Foreign employment	44	28.4
<b>Father occupation</b>		
Service	22	14.2
Business	16	10.3
Labor	26	16.8
Agriculture	31	20.0
Foreign employment	60	38.7

<b>Father Educational Level</b>		
Bachelor degree	24	15.5
Secondary level ( up to12 )	118	76.1
Basic level ( up to 8)	10	6.5
Illiterate	3	1.9
<b>Monthly Income</b>		
15000 to 25000	60	38.7
25000 to 35000	66	42.6
More than 35000	29	18.7

---

## **4.2 Child characteristics**

Among 155 respondents included in this study 49.7% (77) were females and 50.3% (78) were males. Out of 155 selected children, 58.1% (90) were first child, 33.5% (52) second child, 4.5% (7) third child and 3.9% (6) fourth child of their parents. As mentioned in the Table 4.3, 58.7% (91) of children had more than 2.5 Kg birth weight, 27.7% (43) child had less than 2.5 Kg birth weight while 13.5% (21) of mother cannot remember their children's weight. Children whose birth weight is less than average are considered to have a higher risk of early childhood death (MoHP, 2011). NDHS 2011 shows 16.4% of children in Eastern Terai were born less than 2.5 kg. Birth weight less than 2.5 Kg is considered as low birth weight (MoHP, 2011). It might be due to under nutrition in women before and during pregnancy (Srilakshmi, 2014).

As shown in the Table 4.3 below, 93.5% (145) families under the survey had only one child below 5 years of age and on the other hand 6.5% (10) had 2 children under 5 years of age. Majority of surveyed children age group were in 36 – 47 months 47.7% (74) followed by 25.2% (39) in 24 – 35 months, 48 – 60 months 16.1% (25), 12 – 23 months 8.4% (13) and 6-11 months 2.6% (4) respectively.

**Table 4.3** Child characteristics of study population (n=155)

<b>Variables</b>	<b>Frequency</b>	<b>Percent</b>
<b>Sex of child</b>		
Female	77	49.7
Male	78	50.3
<b>Birth order of child</b>		
1	90	58.1
2	52	33.5
3	7	4.5
4	6	3.9
<b>Birth weight</b>		
less than 2.5 kg	46	29.7
More than 2.5 kg	109	70.3
<b>No. of under 5 children</b>		
1	145	93.5
2	10	6.5
<b>Age group</b>		
6 – 11	4	2.6
12 – 23	13	8.4
24 – 35	39	25.2
36 – 47	74	47.7
48 – 59	25	16.1

### 4.3 Child caring practices

All child, were breastfed. NDHS, 2011 had also concluded breast feeding is almost universal in Nepal (MoHP, 2011). All the children were breast fed within one hour may be due to the absence of food fads or taboos and due to the mass coverage media (radio and TV) as well as active participation of FCHV inside the Kerabari. All children were fed colostrum. They did not feed any kind of pre lacteals.

Among the study sample, 65.2% (101) were exclusively breastfed for first six months while 34.8% (54) were not exclusively breastfed for six months which is less than the



national data 70% of children less than six months of age (MoHP, 2011). Thus not following exclusive breastfeeding was seen as a problem in the study area. The age at which complementary diet given was 3 months 18.7% (29), 4 months in 14.2% (22), 5 months in 9.0% (14), 6 months in 27.1% (42) and 7 months in 31% (48). The type of complementary food given to children was 45.8% (71) homemade *lito*, 3.2% (5) *dal*, *bhat* and *tarkari*, 18.7% (29) *jaulo*, 9.7% (15) *dal* and *bhat*, and the remaining 22.6% (39) were given food like milk powder and commercial complementary food.

Out of 155 samples, 40.6% (63) children were not fed formula milk while 59.4% (92) were fed. All the survey household use packaged iodized salt. Regarding Vitamin A supplementation, all children were given Vitamin A capsule and deworming tablet. Similarly the effectiveness of National Vitamin A supplementation program was similar to that of the country as the national data on Vitamin A supplementation showed nine in ten children aged 6-59 months received vitamin supplementation (MoHP, 2011). Over the past decade, the country has had success in reducing under-five mortality, largely due to the implementation of the CB-IMCI program with vitamin A supplementation and the immunization program (MoHP, 2011). This may be due to increasing awareness of people regarding child vaccination and availability of health facilities or increment of governmental coverage.

As shown in the Table 4.4, the priority of health services for the treatment of children during illness was highest 98.7% (153) to nearby hospital center followed by, 1.3% (2) to traditional healer. This may be due to establishment of many medical centers, increase in the knowledge of the people and many treatments which were free of cost in health center provided by the government.

**Table 4.4** Child caring characteristics (n=155)

<b>Variables</b>	<b>Frequency</b>	<b>Percent</b>
<b>Exclusive breast feeding</b>		
Yes	101	65.2
No	54	34.8
<b>Introduction of weaning food</b>		
Three month	29	18.7
Four month	22	14.2

Five month	14	9.0
Six month	42	27.1
Seven month	48	31.0
<b>Types of complementary food</b>		
Jaulo	29	18.7
Home made lito	71	45.8
Dal and Bhat	15	9.7
Dal, Bhat and Tarkari	5	3.2
Commercial Food	35	22.6
<b>Feeding of formula milk</b>		
Yes	92	59.4
No	63	40.6
<b>First place of treatment</b>		
Nearby hospital center	153	98.7
Tradition healer	2	1.3

---

#### 4.4 Maternal characteristics

Among the survey household, most of the mothers under study were housewife and only few of them were in any kind of services. Under study sample, 4.5% were found to have a bachelor degree, 66.5% mothers were found to have secondary educational level, 20.6% had some basic educational level, 3.2% got some informal educational level and remaining 5.2% were illiterate. Mothers who got married at the age 20 or below 20 were 60.6% (94) while rest of 39.4% (61) had married at above 20. Out of all mother 37.4% (58) had their first pregnancy at 20 or below 20 years of age while 97% (62.6) had their first pregnancy for the first time above 20 years of age. This shows that majority of women were pregnant at the recommended age for less pregnancy complication.

**Table 4.5** Maternal characteristics (n=155)

<b>Variables</b>	<b>Frequency</b>	<b>Percent</b>
<b>Mother education level</b>		
Bachelor degree	7	4.5
Secondary level ( up to 12)	103	66.5
Basic level ( up to 8)	32	20.6
Informal education	5	3.2
Illiterate	8	5.2
<b>Marriage age</b>		
20 or under	94	60.6
above 20	61	39.4
<b>First pregnancy age</b>		
20 and below	58	37.4
above 20	97	62.6
<b>Knowledge about malnutrition</b>		
Yes	129	83.2
No	26	16.8
<b>Knowledge about marasmus</b>		
Yes	96	61.9
No	59	38.1
<b>Knowledge about bal-vita</b>		
Yes	137	88.4
No	18	11.6
<b>Feeding Pattern during pregnancy</b>		
More than usual	36	23.2
less than usual	51	32.9
Usual	68	43.9
<b>Preparation of super flour porridge</b>		
Yes	139	89.7
No	16	10.3

As shown in the Table 4.5 above, 83.2% (129) mothers had some knowledge about malnutrition and the remaining 16.8% (26) had no knowledge. However, 51.9% (96) of the

mothers had knowledge about marasmus and 38.1% (59) has no knowledge. Out of the study household, 88.4% (137) mothers had knowledge about the importance of *bal-vita* while 11.6% (18) had no knowledge. The mothers of the study area have less knowledge about health. Most of the women 43.9% (68) consume as usual amount of food during pregnancy, 32.9% (51) consume less than as usual and remaining 23.2% (36) consume more than usual. These data shows that the women in study area are still lacking in health and nutrition related information.

As shown in the Table 4.5, mothers who told that they knew to prepare super flour porridge themselves were 89.7% (139) while 10.3% (16) did not know. None of the mothers had knowledge about the appropriate proportion. All the mothers were vaccinated according to the schedule during pregnancy. All of them had iron and folate supplements. They all knew methods to prepare ORS solution. It may be due to different awareness related interventions and procedure written over the packet. Also most of the mothers of the children were literate which positively affected their nutritional knowledge.

#### **4.5 Environment and sanitation characteristics**

The main source of drinking water of the households was tap water. According to the national population and housing census 2011 in Kerabari rural municipality 88.71% of the household used drinking water through Tap water (CBS, 2011). In the study percentage of using tap water was found hundred percent because municipality modern facilities by governmental and private organizations. Every household treated water before drinking. It may be due to awareness about the benefits of drinking purified water. All households had toilet facility.

Table 4.6 shows that the mothers who washed their hand before cooking was hundred percentage. All the household use purified water about 86.5% purify by using filter and remaining 13.5% by boiling. Almost half i.e. 63.9% (99) households managed their waste product through incineration, 21.3% (33) throwing in the kitchen garden, and 14.8 (23) % by burial method.

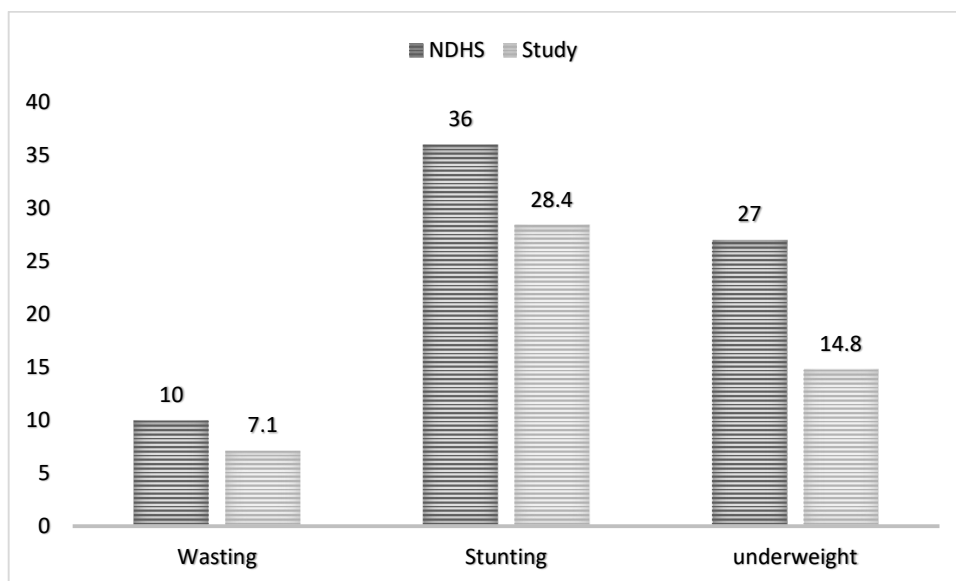
**Table 4.6** Environment and sanitation characteristics (n=155)

Variable	Frequency	Percent
<b>Hand washing before cooking</b>		
Yes	155	100
<b>Water purification</b>		
Boiling	21	13.5
Filter	134	86.5
<b>Household waste management</b>		
By burial method	23	14.8
Incineration	99	63.9
Throw in kitchen garden	33	21.3

#### 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, wasting, stunting and underweight are widely used indicators of malnutrition. (Shrestha, 2017).

**Figure 4.1** Prevalence of under nutrition in the study are in compared to NDHS 2016



In survey, among 155 children, the overall magnitude of malnutrition among 6-59 months children of Kerabari rural municipality were 28.4%, 7.1% and 14.8% for stunting, wasting, and underweight, respectively.

wasting and underweight respectively as shown in Figure 4.6. NDHS 2016 showed the prevalence of stunting, underweight and wasting to be 36%, 27% and 10% respectively. The prevalence of stunting, wasting and underweight in the study area was found to be lower than the national data.

#### 4.6.1 Distribution of malnutrition based on gender

The prevalence of malnutrition of children was higher among the boys than in girls in Kerabari rural municipality. Study shows that about 30.8% of males and 26% of females were stunted, similarly 9.1% of females and 5.1% of males were wasted and 15.4% of males and 14.3% females were underweight as shown in Fig 4.2 and Table 4.7

**Fig 4.2** Gender wise distribution of wasting, stunting and underweight



**Table 4.7** Sex wise distribution of wasting, stunting and underweight (n=155)

Characteristics		Male (%)	Female (%)	All (%)
<b>WHZ</b>	Severely wasted(<-3)	Nil	Nil	Nil
	Moderately wasted(>-3 and <-2)	5.1	9.1	7.1
	Normal	94.9	90.9	92.9
<b>HAZ</b>	Severely stunted(<-3)	10.3	13.0	11.6
	Moderately Stunted(>-3 and <-2)	20.5	13.0	16.8
	Normal	69.2	74.0	71.6

	Severely Underweight(<-3)	Nil	Nil	Nil
<b>WAZ</b>	Moderately Underweight(>-3 and <-2)	15.4	14.3	14.8
	Normal	84.6	85.7	85.2

#### 4.6.2 Distribution of malnutrition based on age

In the age group 24-35 months and 36-47, 5.1% and 12.2% were found to be in moderately underweight and there was no severely underweight children. Similarly, moderate underweight was found to be higher in the age group 36-47 months.

In the age group 24-35 months the prevalence of severely stunted was higher than other groups i.e. 17.9% while in age group 12-23, 36-47 and 48-59 months 7.7 %, 10.8% and 8.0% children were severely stunted respectively while no children were severely stunted in other age group. In age group 6-11 months the prevalence of moderately stunted was higher than other groups (25%). While in age groups 12-23, 24-35, 36-47 and 48-60 months 23.1%, 5.1%, 20.3% and 20% were moderately stunted respectively.

There were no severely wasted children. The prevalence of moderately wasted children was higher in age group 6-11 months. It was 25 %. In the age group 12-23, 24-35, 36-47 and 48-59 months, 7.7%, 7.7%, 20.3% and 12 % were moderately wasted respectively. Table 4.8 shows the distribution of wasting, stunting and underweight among different age groups.

**Table 4.8** Distribution of wasting, stunting and underweight among different age group (n=155)

Age groups	N	WHZ (%)		HAZ (%)		WAZ (%)	
		< -3	< -2	< -3	< -2	< -3	< -2
(6-11)	4	Nil	0	0	25	Nil	25
(12-23)	13	Nil	0	7.7	23.1	Nil	7.7
(24-35)	39	Nil	5.1	17.9	5.1	Nil	7.7
(36-47)	74	Nil	12.2	10.8	20.3	Nil	20.3
(48-59)	25	Nil	0	8.0	20	Nil	12.0

### 4.6.3 Distribution of malnutrition based on MUAC

The prevalence of wasting based on MUAC measurement is shown in Table 4.9 On the basis of MUAC Out of 155 children, 3 (1.9%) of the children fall into moderate acute malnutrition criteria (MUAC: 115 mm - 125 mm). The remaining 152 (98.1%) children fall in the normal criteria (MUAC: >125mm).

**Table 4.9** Distribution of Malnutrition based on MUAC (n=155)

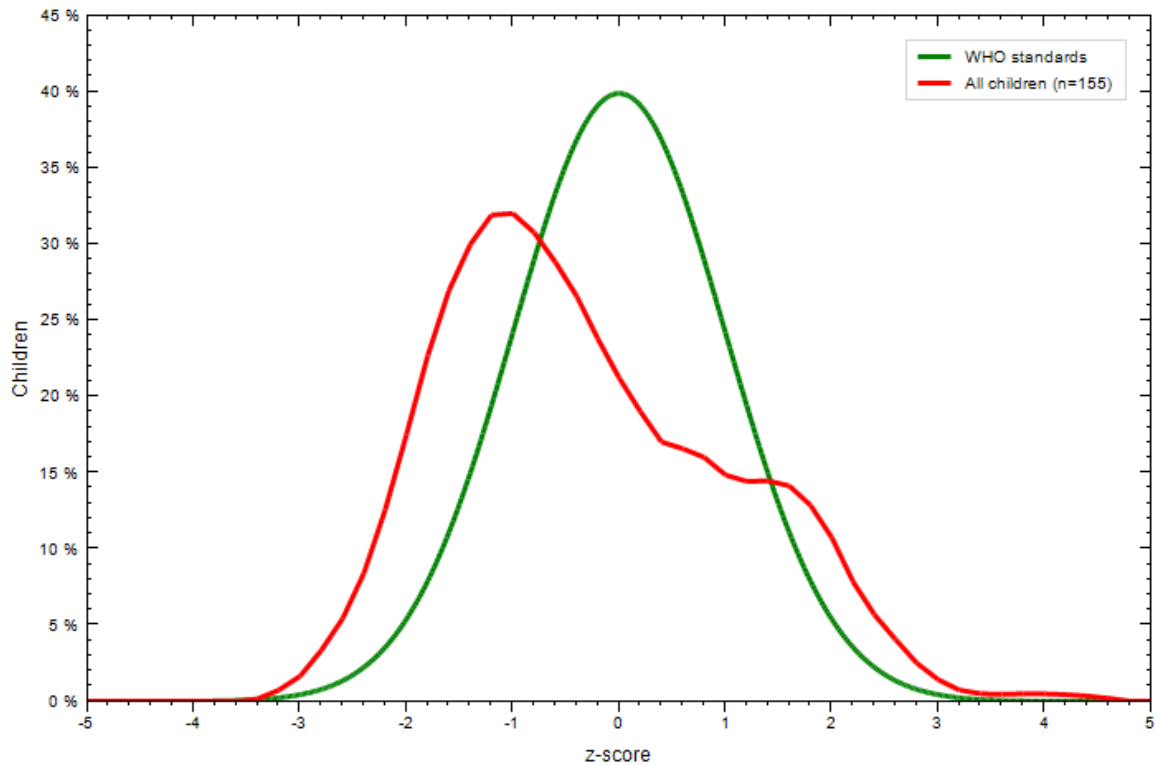
Class	Frequency	Percentage
Severe Acute Malnutrition	Nil	Nil
Moderate Acute Malnutrition	3	1.9
Normal	152	98.1

Since no any child had MUAC less than 115 mm, no any child was severely malnourished. The proper arrangement of complementary foods and good dietary pattern is the key role in preventing the severe malnutrition.

### 4.6.4 Nutrition status comparison with WHO standard

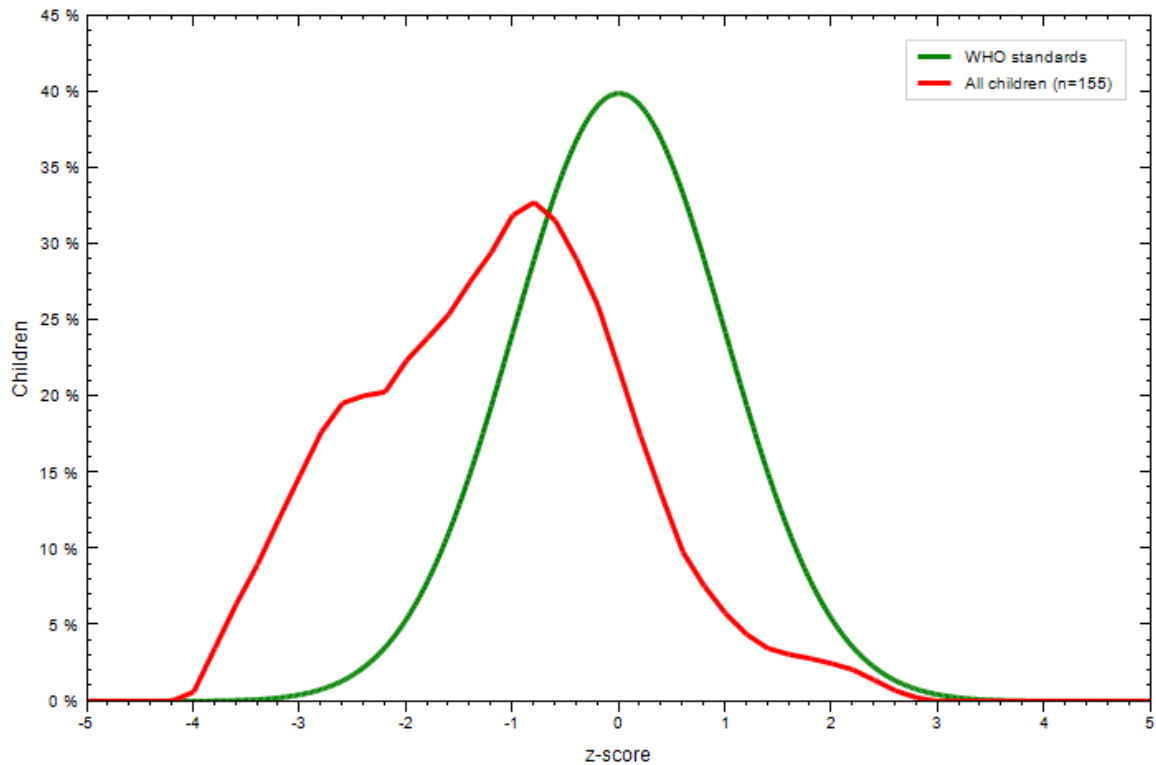
Distribution of wasting, stunting and underweight among under five children of Kerabari rural municipality based on WHO standard are shown in the Figure 4.3, 4.4 and 4.5 respectively.





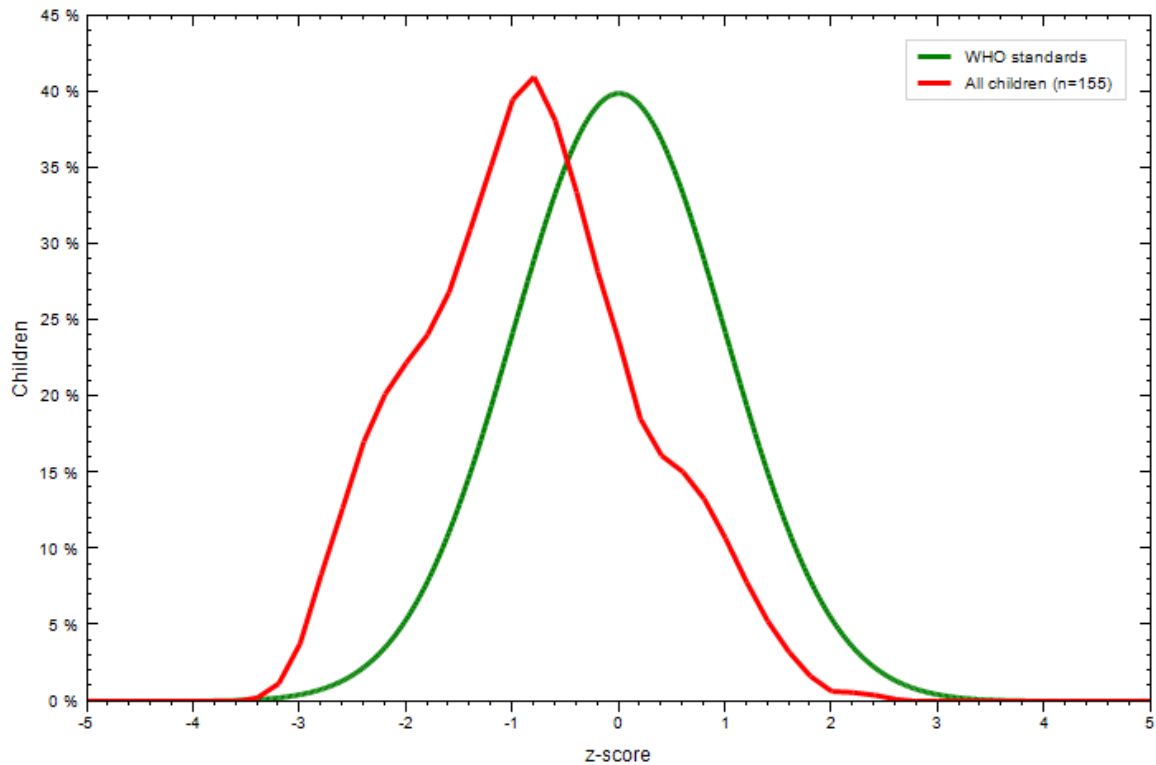
**Figure 4.3 : Distribution of Weight for Height among 6 to 59 months children of Kerabari rural Municipality based on WHO standard (n=155)**

The WHZ curve compared with WHO standards for combined sex is shown in figure 4.3. Reading Weight for Height, 7.1% children were below -2 S.D and 92.9% of children were found to be normal. This curve is skewed to the left side of WHO standard curve showing prevalence of underweight among study population. The prevalence of wasting was found high among the age group of 36-47 months. The result of the study revealed that the prevalence of wasting was lower than NDHS (2016). Acute malnutrition is affected by the person's state of living condition and environment. Wasting in an individual children and population groups can change rapidly and shows marked seasonal patterns associated with change in food availability or disease prevalence.



**Figure 4.4: Distribution of Height for Age, among 6 to 59 months children of Kerabari rural Municipality based on WHO standard (n=155)**

The WHZ curve compared with WHO standards for combined sex is shown in figure 4.4. Reading Height/Length for age, 16.8% children were below -2 S.D, 11.6% children were below -3 S.D and 71.6% of children were found to be normal. This curve is skewed to the left side of WHO standard curve showing prevalence of underweight among study population. Stunting in early stages of one's life is associated with adverse functional effects, including cognition deficiencies, educational performance, low adult incomes, loss of productivity and, when accompanied by too much weight increase later in childhood, increased risk of nutrition-related chronic diseases (Cousens *et al.*, 2010). The prevalence of stunting was found highest among the age group of 12-23 months in the survey area. As a child's age increases, the process of weaning, the introduction to new types of feeding, make him or her to be more exposed to the risks of stunting.



**Figure 4.5 Distribution of Weight for Age among 6 to 59 months children of Kerabari rural Municipality based on WHO standard (n=155)**

The WHZ curve compared with WHO standards for combined sex is shown in figure 4.5. Reading Weight for Age, 14.8% children were below -2 S.D and 85.2% were found to be normal. This curve is skewed to the left side of WHO standard curve showing prevalence of underweight among study population. Underweight was found highest among the age group of 36-47 months and least among the age group of 12-23 months and 24-35 months of children. According to NDHS 2016, 27% of children under five years of age group are underweight. The result of this study is somewhat lower than the national average. This may be different because of the study period, socioeconomic characteristics, health service delivery and geographical characteristics of the study area.

#### **4.6.5 Edema**

No cases with nutritional edema were found.

## 4.7 Factors associated with under nutrition of Children

Under nutrition was assessed by wasting, stunting and underweight. Chi – square test was used to identify the variables that were related to nutritional status of children.

### 4.7.1 Factors associated with wasting

Different possible factors were analyzed using Chi – square to find the association with wasting (Table 4.10). Mother education status (p=0.422), family monthly income (p=0.868), birth order (p=0.098), birth weight (p=0.235), type of family (p=0.473), age of child (p=0.227), gender (p=0.337), knowledge about malnutrition (p=0.897) exclusively breastfeeding (p=0.443), was not associated with wasting. This may be due to low prevalence of wasting among the children of the Kerabari and seasonal variation may be other cause as the season when this study was conducted was after crops harvesting. Greater coverage of health facilities may be another reason for prevalence of wasting among the children of the community.

**Table 4.10** Factors associated with wasting (n=155)

Factors		WHZ		$\chi^2$	P-value
		Wasted	Normal		
<b>Mother educational status</b>	Literate	11 (7.5%)	136 (92.5%)	0.644	0.422
	Illiterate	0 (0%)	8 (100%)		
<b>Family Monthly Income</b>	less than 25000	4 (6.7%)	56 (93.3%)	0.027	0.868
	More than 25000	7 (7.4%)	88 (92.6%)		
<b>Birth Order</b>	First Child	9 (10%)	81 (90%)	2.744	0.098
	Other Child	2 (3.1%)	63 (96.9%)		
<b>Birth Weight</b>	Less than 2.5 Kg	5 (10.9%)	41 (89.1%)	1.412	0.235
	More than 2.5 Kg	6 (5.5%)	103 (94.5%)		
<b>Type Of Family</b>	Nuclear	6 (6%)	94 (94%)	0.514	0.473
	Joint	5 (9.1%)	50 (90.9%)		
<b>Age Of Child</b>	< 24	0 (0%)	17 (100%)	1.459	0.227
	> 24	11 (8%)	127 (92%)		
<b>Gander</b>	Male	4 (5.1%)	74 (94.9%)	0.923	0.337
	Female	7 (9.1%)	70 (90.9%)		

<b>Knowledge about Malnutrition Exclusively Breastfeeding</b>	Yes No Yes No	9 (7%) 2 (7.7) 6 (5.9%) 5 (9.3%)	120 (93%) 24 (92.3%) 95 (94.1%) 49 (90.7%)	0.017  0.588  0.897  0.443
---	------------------------	---	---	--

\* Statistically Significant (P <0.05)

#### 4.7.2 Factors associated with stunting

**Table 4.11** Factors associated with stunting (n=155)

Factors	HAZ		$\chi^2$	P-value	
	Stunted	Normal			
<b>Mother educational Status</b>	Literate	39 (26.5%)	108 (73.5%)	4.829	0.028*
	Illiterate	5 (62.5%)	3 (37.5%)		
<b>Family Monthly Income</b>	less than 25000	16 (26.7%)	44 (73.3%)	0.143	0.706
	More than 25000	28 (29.5%)	67 (70.5%)		
<b>Birth Order</b>	First Child	25 (27.8%)	65 (72.2%)	0.039	0.843
	Other Child	19 (29.2%)	46 (70.8%)		
<b>Birth Weight</b>	Less than 2.5 Kg	10 (21.7%)	36 (78.3%)	1.422	0.233
	More than 2.5 Kg	34 (31.2%)	75 (68.8%)		
<b>Type of Family</b>	Nuclear	23 (23%)	77 (77%)	4.023	0.045*
	Joint	21 (38.2%)	34 (61.8%)		
<b>Age Of Child</b>	< 24	5 (29.4%)	12 (70.6%)	0.010	0.921
	> 24	39 (28.3%)	99 (71.7%)		
<b>Gander</b>	Male	24 (30.8%)	54 (69.2%)	0.438	0.508
	Female	20 (26%)	57 (74%)		
<b>Knowledge about Malnutrition Exclusively Breastfeeding</b>	Yes No Yes No	39 (30.2%) 5 (19.2%) 35 (34.7%) 9 (16.7%)	90 (69.8%) 21 (80.8%) 66 (65.3%) 45 (83.3%)	1.288  5.600  0.256  0.018*	

\* Statistically Significant (P <0.05)

Above Table 4.11 shows, that here was significant association of stunting with mother education status (p=0.028), type of family (p=0.45), knowledge about malnutrition

( $p=0.256$ ) and exclusively breastfeeding ( $p=0.018$ ). The result also shows that there was no significant association of stunting with family monthly income ( $p=0.706$ ), birth order ( $p=0.843$ ), birth weight ( $p=0.233$ ), age of child ( $p=0.921$ ) and gender ( $p=0.508$ ).

The factors mother educational status ( $p=0.028$ ), was significantly associated with stunting. The study done in Cambodia, mother's education was strongly associated with both small birth size and stunting (Miller and Rodgers, 2009). The pattern of declining incidence of stunting by mother's education was consistent with patterns observed in many other developing countries (Mukuria *et al.*, 2005). Recovery from stunting was also associated with mother's education (Vella *et al.*, 1994).

Statistically significant association was found between type of family ( $p=0.045$ ) and stunting. This result is in contradiction with the finding of study conducted in Ethiopia by Mekides *et al.* which revealed that family size was statistically significant with stunting and children from larger families were at greater risk of getting stunted than nuclear families (Mekides *et al.*, 2015). This might be due to uneven distribution of food among the members of the family.

There was significant association between exclusively breastfeeding ( $p=0.018$ ) and stunting. Education status of mothers was very good but they have no nutritional knowledge so they were not completely breastfeed the child up to 6 months. A research study conducted in Kenya (Ayisi, R. K. & Wakoli, A. B. (2014) were found significant ( $p=0.047$ ) association of stunting with exclusive breastfeeding in under five children.

#### **4.7.3 Factors associated with underweight**

This study showed that mother educational status ( $p=0.848$ ), family monthly income ( $p=0.070$ ), birth order ( $p=0.871$ ), birth weight ( $p=0.683$ ), age of child ( $p=0.706$ ) and gender ( $p=0.847$ ), knowledge about malnutrition ( $p=0.932$ ) and exclusively breast feeding ( $p=0.631$ ) had no significant association with underweight.

In this study though significant association was found with prevalence of under-nutrition with the type of family ( $p=0.022$ ). Similar result was found in the study done in Qazvin, Iran where it was found that underweight and family size are associated (Mahyar *et al.*, 2010). Positive association was also shown in the study done in Mumbai, India. Non-nuclear families were less likely to house children who are underweight. Even after

inclusion of maternal characteristics such as age and education, the non-nuclear family was positively associated with the nutritional status of children. Such a relationship may be because the non-nuclear family offers better social care for its members and therefore was more likely to provide necessary resources, such as food and health care by protecting a child from infectious diseases may be positively associated with child nutritional status, as had been supported by previous studies.

**Table 4.12** Factors associated with underweight (n=155)

Factors		WAZ		$\chi^2$	P- value
		Underweight	Normal		
<b>Mother</b>	Literate	22 (15%)	125 (85%)	0.037	0.848
<b>Educational Status</b>	Illiterate	1 (12.5%)	7 (87.5%)		
<b>Family</b>	less than 25000	5 (8.3%)	55 (91.7%)	3.278	0.070
<b>Monthly Income</b>	More than 25000	18 (18.9%)	77 (81.1%)		
<b>Birth Order</b>	First Child	13 (14.4%)	77 (85.6%)	0.026	0.871
	Other Child	10 (15.4%)	55 (84.6%)		
<b>Birth Weight</b>	Less than 2.5 Kg	6 (13%)	40 (87%)	0.167	0.683
	More than 2.5 Kg	17 (15.6%)	92 (84.6%)		
<b>Type of family</b>	Nuclear	10 (10%)	90 (90%)	5.221	0.022*
	Joint	13 (23.6%)	42 (76.4%)		
<b>Age Of Child</b>	< 24	2 (11.8%)	15 (88.2%)	0.143	0.706
	> 24	21 (15.2%)	117 (88.8%)		
<b>Gander</b>	Male	12 (15.4%)	66 (84.6%)	0.037	0.847
	Female	11 (14.3%)	66 (85.7%)		
<b>Knowledge about</b>	Yes	19 (14.7%)	110 (85.3%)	0.007	0.932
<b>Malnutrition</b>	No	4 (15.4%)	22 (84.6%)		
<b>Exclusively</b>	Yes	16 (15.8%)	85 (84.2%)	0.231	0.631
<b>Breastfeeding</b>	No	7 (13%)	47 (87%)		

\* Statistically Significant (P <0.05)

## Part V

### Conclusion and recommendations

#### 5.1 Conclusion

Conclusively, this study has generally assessed the nutritional status of 6-59 months children of Kerabari rural municipality and findings are important to understand prevalence and determinants of nutritional status among 6-59 months children in Kerabari rural municipality. The results of the study indicate that malnutrition is still an important problem among children of 6-59 months in Kerabari rural municipality.

Following points were concluded from the study:

- i) The overall magnitude of malnutrition among the children of Kerabari rural municipality was 7.1%, 28.4% and 14.8% for wasting, stunting and underweight respectively. Among them severe stunted was found to be 11.6%.
- ii) The highest percentage of wasting was found in the age group 36-47 months (12.2%). Stunting was found high in the age group 6 -11 months (25%) and underweight in the age group 36-47 months (20.3%). Male children were more affected by the under nutrition than female children.
- iii) There was significant association of stunting with mother education status ( $P=0.028$ ), type of family ( $P=0.045$ ) and exclusively breastfeeding ( $P=0.018$ ).
- iv) There was significant association of underweight with type of the family ( $P=0.022$ ).
- v) There was no factor with which wasting was significantly associated.
- vi) Based on MUAC, moderate wasting and normal wasting was found to be 1.9% and 90.4% respectively.
- vii) This study point out the need of making a comprehensive, integrated and multi-sectorial plan for addressing the problem of malnutrition in long term.



## 5.2 Recommendations

- i) Different nutritional related education through health workers and mobilization of FCHVs like exclusive feeding practices, timely introduction of complementary and feeding food behavior should be advocated to uplift the feeding practices.
- ii) Consumption of homemade food product should be encouraged through different nutrition and food related intervention.
- iii) Knowledge about purification of drinking water as well as method of purification and management of household waste, they should come in practice.
- iv) Detailed study should be done to find the out other unexplored factors and those of which were not significantly associated with malnutrition according to present study but considered as important ones.
- v) Similarly, cross-sectional, descriptive or longitudinal survey can be further conducted to determine the magnitude and distribution of malnutrition and other probable causes of malnutrition in children. Several biochemical parameters could be done to find out the behavior change.

## **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. A community based cross-sectional study was conducted to assess the factors associated with nutritional status of 6 – 59 months children in Kerabari rural municipality of Morang district, Nepal. One hundred fifty five children were selected using lottery method and anthropometric measurements (weight, height, MUAC) were performed to find the nutritional status of children. The data collected was analyzed by using the SPSS version 20 and WHO Anthro 3.2.2 version and chi-square test was used to identify the associated factors of malnutrition.

Out of the 155 children, 50.3% were males and 49.7 % were females. The main religion was Hindu and most of the people were Chhetri followed by Brahmin and others were Madhesi, Janjati and Dalit's. Major occupation of the family's was agriculture. Most of the mother studied up to secondary level while very few i.e. 3.2% of mother had only informal education. In the family type, 64.5% were from single type family and 35.5% were from joint family. All of the household are permanent residents of respective municipality. Mainly mothers were housewives.

About 42.6% of the household had monthly income twenty five thousand to thirty five thousand, 18.7% had more than thirty five thousand and 38.7% had less than twenty five thousand. All the children taken in survey were colostrum's fed, breast fed within one hour but only 65.2% of children were exclusively breastfed. 93.5% of household had only one child under five years of age and 6.5% had two under five children. 60.6% female had married below 20 and 39.4% married above 20 years of age. 37.4% of female had their first pregnancy below 20 and 62.6% got married above 20 years of age. 70.3% percent of children had birth weight more than 2.5 Kg and 29.7% of children had weight less than 2.5 Kg. All the family used iodized salt. All mothers and children got vaccinated and supplement timely. Overall household had toilet facility.

It was found that 98.7% of children got treatment at the nearby hospital center and 1.3% had traditional healing. It was found that all of mother washed their hand before preparing

food. 63.9% managed their waste by incineration, 21.3 %throwing in the kitchen garden, and 14.8% by burial method.

The prevalence of wasting, stunting and underweight was found to be 7.1%, 28.4% and 14.8%. Based on MUAC, the prevalence of malnutrition was found to be 1.9%. The survey shows that under nutrition was found higher in males than in females. Chi-square test analysis showed that there was significant association of stunting with mother education status ( $P=0.028$ ), type of family ( $P=0.045$ ) and exclusively breastfeeding ( $P=0.018$ ) and underweight with type of the family ( $P=0.022$ ), while in wasting no significant association was found.

The result of the study revealed that under-nutrition is still an important problem in Kerabari rural municipality. Similarly, mother education status, type of family exclusively breastfeeding were found to be risk factors associated with under nutrition. Since, this type of study is done for the first time in Kerabari rural municipality, thus this findings might be helpful in designing better nutritional intervention for management and prevention of the malnutrition problem prevalent in the community.

## References

- ACF, I., Network. (2009). *Acute Malnutrition: A Preventable Pandemic*.
- Acharya, D., & et al. (2013). *Factors Associated with Nutritional Status of Under Five Years Children in Rupandehi District of Nepal*. Pokhara University,
- Adhikari, K. R. and Krantz, E. M. (2013). "Child Nutrition And Health" (Fourth ed.). Educational Publishing House. Kantipath, Kathmandu, Nepal.
- Alsobaihi, S., Keiko, N. and Masashi, k. (2016).  
Undernutrition among children under 5 years of age in Yemen: Role of adequate childcare provided by adults under conditions of food insecurity. 47-57.
- Amruth, M. (2012). *A study on nutritional status and risk factors for malnutrition among primary school children in sullia, Karnataka*. M. D. Rajiv Gandhi University of Health Science,
- Ayisi, R. K. & Wakoli, A. B. (2014) *School of Public Health, University of Nairobi, Kenya Department of Family and Consumer Sciences University of Eastern Africa, Baraton, Kenya*.
- Bhandari, T. and Chhetri, M. (2013). *Nutritional Status of Under Five Children and Factors Associated in Kapilvastu District, Nepal*. **1** (1), 5.
- Bhatta, K., Mishra, S. and Gurung, G. (1998a). *Nutritional Status of Bishanku Narayan Village*. **37**, 614-619.
- Bhatta, K., Mishra, S. and Gurung, G. (1998b). *Nutritional status of Bishanku Narayan Village (pp. 614-619): J. Nep. Med. Assoc.*
- Bharati, M., & Mehta, R. (2018). *Nutrition and Dietary management" (2nd ed.)*. Jamal, Jyatha, Kathmandu. [978-9937-8815-3-1].: Medhavi publication. .
- Black, R., Morris, S. and Bryce, J. (2003). *Where and why are 10 million children are dying every year?* , 2226-2234.
- Burk, M. (1984). *Brief introduction for food economics to nutrition Integration Nutrition into Agriculture and Rural Development: FAO*.
- Caballero, B. and Maqbool, A. (2003). *International Nutrition*. In W. Walker, Watkins, J. & Duggan, C. (Ed.), *Nutrition in Pediatrics* (pp. 195-204). London: BC Decker Inc.
- CBS. (2011). *National population and housing census [Report]*. Central bureau of statistics. Kathmandu, Nepal,

- CBS. (2015). Nepal Multiple Indicator Cluster Survey 2014 [Report]. UNICEF. Kathmandu, Nepal,
- Central Statistical Agency, E. (2011). Demographic and Health Survey [Report]. Ethiopia, Retrieved from <http://dhsprogram.com/pubs/pdf/FR255/FR255.pdf>.
- Chandra, R. and Kumari, S. (1994). Nutrition and Immunity: An Overview. **124** (18), 1433-1435.
- Chaudhary, R., Shah, T. and Raja, S. (2011). Knowledge and Practice of Mothers regarding Breastfeeding: A Hospital Based Study. **9** (3), 7.
- Collins, S. (2006). "Management of Severe Acute Malnutrition in Children". 9551.
- Cousens, S., Black, R. E., Johnson, H. L., Lawn, J. E., Rudan, I., Bassani, D. G. and Cibulskis, R. (2010). Global, regional, and national causes of child mortality in 2008: a systematic analysis. *The Lancet*. 375(9730), 1969–1987.
- Development, A. A. A. T. A. N. S. (2015). Global Nutrition Report [Report]. Retrieved from <http://www.globalnutritionreport.org/the-report/the-report-2015/>.
- Devkota, C. S., De, A. and Sathian, B. (2015). Nutritional Deficiencies: Major Public Health Problem in Nepal. **3**.
- FAO. (1997). "Malnutrition and micronutrient deficiencies. In: "Agriculture food and nutrition for africa- A resource book for teachers of agriculture"". Vol. 1. Publishing Management Group and F.I. Division, Eds Rome, Italy.
- FAO. (2005). Nutrition :A Guide to Data Collection, Analysis, Interpretation and Use.
- Gartaula, R. (1998). Improving Nutrition Education, Messages and Strategies in Nepal. *Khoj-bin*. 2(1).
- Gharti Chhetri, P. (2005). Factors Associated with Malnutrition Among Children in Rural Terai Eastern Nepal. Master's Sree Chitra Tirunal Institute for Medical Sciences and Technology,
- Gibson, R. S. (1993). "Nutritional Assessment". Oxford University Press. New York.
- Gomez, F., Ramos Galvan, R., Frenk, S., Cravioto Munoz, J. and Vazquez, J. (2000). Mortality in Second and third degree malnutrition. **78** (10), 1275-1280.
- GoN. (2012). "Akrikrit Sishu Tatha Balya-kalin Poshan ra Bal-vita Samudaya Prawdhan Karyakram, Samudaya Straiya Talim Nirdeshika". Health and Population Ministry (GoN)

- Gorstein, J., Shrestha, R., Pandey, S., Adhikari, R. and Pradhan, A. (2003). Current status of vitamin A deficiency and the National Vitamin A Control Program in Nepal: results of the 1998 National Micronutrient Status Survey. **12** (1), 96-103.
- Hartog, A. P. d., Staveren, W. A. v. and Brouwer, I. D. (2006). "Food habits and consumption in developing countries". Wageningen Academic. The Netherlands.
- Hommel. (2005). Nutritional Status of Children Victims of the Armed Conflict in Nepal. A Survey report of IDP Children in Banke Children. Retrieved from [https://www.ecoi.net/file\\_upload/babsi3\\_1129628269\\_nutrition\\_assessment\\_sept.pdf](https://www.ecoi.net/file_upload/babsi3_1129628269_nutrition_assessment_sept.pdf).
- ICMR. (2020). ICMR- NIN Expert Group on Nutrient Requirements for Indians, Recommended Dietary Allowances (RDA) and Estimated Average Requirements (EAR). Hyderabad, India.
- Jawaregowda, S., k. and Angadi, M., M. (2015). Gender differences in nutritional status among under five children in rural areas of Bijapur district, Karnataka, India.
- Jelliffe, D. (1966). "The assessment of the Nutritional Status of the community". World Health Organization. Geneva, Switzerland.
- Joshi, A. (2016). "Nutrition And Dietetics" (Fourth Edition ed.). McGraw Hill Education (India) Private limited. Chennai, India.
- Joshi, Y., K. (2008). "Basics of Clinical Nutrition" (Second ed.). Jaypee Brothers Medical Publishers (P) LTD. Ansari Road, Daryanganj.
- Katwal, H. (1992). An Area Nutritional Survey. Central Campus of Technology, Tribhuvan University,
- Katwal, S. (1989). Livestock Production and its Impacts on the Nutritional Status of the People in Developing Countries.
- Keller, W. (1982). Choices of Indicator of Nutritional Status
- Khatriwada, G. (2015). Nutrition Status Of Children Aged 6-59 Months Of Topgachhi VDC Of Jhapa District. Nutritional Survey. Tribhuvan University, English.
- Mekides Wondemeneh, T., Belachew, T. E. and Semaw, A. F. (2015). Under Nutrition and Association Factors Among Under-Five Age Children of Kunama Ethnic Groups In Tahtay Adiyabo Woreda, Tigray regional State, Ethiopia: Community based study. *International Journal os Nutrition and Food Science*.
- Miller, J. and Rodgers, Y. (2009). Mother's education and children's nutritional status: new evidence from Cambodia. **26** (1), 131-165.

- MoHP. (2001). Nepal Demographic and Health Survey [Report]. New ERA, Ministry of Health and Population. Kathmandu, Nepal,
- MoHP. (2011). Nepal Demographic and Health Survey [Report]. Ministry of Health and Population, New ERA, Nepal and ICF International Calverton Maryland, USA. Kathmandu, Nepal,
- MoLJP. (2073). "Education Act.". Nepal Government
- Mukuria, A. G., Cushing, J. and Sangha, J. (2005). "Nutritional Status of Children: Results from the Demographic and Health Surveys, 1994-2001". ORC Macro.
- NMICS. (2012). Breastfeeding and Infant and Young child Feeding in Nepal [Report]. Kathmandu; NMICS,
- NDHS (2016). Kathmandu, Nepal: NDHS key indicator [Report]. New ERA.
- Onis, M. and Blossner, M. (2003). Global Database on Child Growth and Malnutrition. **32**.
- Pokhrel, R. (2015). ASSESSMENT OF THE CONTRIBUTING FACTORS ON NUTRITIONAL STATUS OF 6-59 MONTHS CHILDREN IN ITAHARA VDC, MORANG. Tribhuvan, University, English.
- Ramchandran, P. (1987). "In Nutrition:Monitoring and Assessment". Oxford University Press. India.
- Rashed, S. (2009). ASSESSMENT OF NUTRITIONAL STATUS: Alexandria Faculty of Medicine.
- Robinson, C. (1972). "Normal and Therapeutic Nutrition" (14th ed.). Willy Eastern P. Ltd. New Delhi.
- Ruwali, D. (2010). Nutritional Status of Children Under Five Years of Age and Factors Associated in Padampur VDC, Chitwan.
- Sandberg, D., Smith, M., Fornari, V., Godstein, M. and Lifshitz, F. (1991). Nutritional dwarfing: is it a consequence of disturbed psychosocial functioning?
- Schmitt, B. (1979). "Nutrition Source and Their Relative Importance in Economics of Developing Countries". West View Press. London.
- Scoane, N. and Lathan, N. (1971). Nutritional Anthropometry in identification of Malnutrition in Childhood.
- Shah, S., Shetty, S., Singh, D., Mathias, J., Upadhaya, A. and Pandit, R. (2016). Prevalence of Undernutrition among Musahar Children Aged Between 12 To 59 Months in Urban Siraha District, Nepal. **4** (5).
- Sharma, K., R. (2012). Malnutrition in Children Aged 6-59 Months in MuguDistrict. **10**.

- Shrestha, B. (2017). Study on nutritional status of 6-59 month children in Inaruwa-7, Sunsari. Bachelor Nutrition survey. Tribhuvan University, English.
- Smith, L. and Haddad, L. (2000). Overcoming Child Malnutrition in Developing Countries: Past Achievements and Future Choices.2020. Retrieved from <http://cdm15738.contentdm.oclc.org/utis/getfile/collection/p15738coll2/id/125413/filename/125414.pdf>.
- Srilakshmi, B. (2002). "Nutrition Science". New Age International (p) Ltd. Delhi, India.
- Srilakshmi, B. (2011). "Dietetics" (7th ed.). New Age International (P) limited. New Delhi.
- Srilakshmi, B. (2014). "Dietetics". Vol. 7. New Age International (P) Ltd. New Delhi.
- Suri, S. and Kumar, D. (2015). Nutritional Status and the Factors Associated withit among Children Aged 1-5 Years in a Rural Area of Jammu.
- Tesfaye, M. (2009). *Bayesian Approach to Identify Predictors of Children Nutritional Status in Ehopia*.
- Thapa, M. (2015). "Nutritional status of children aged 6-59 months of Hasandaha VDC, Morang Nepal".
- UN. (2010). Multisectoral Plan for Chronic Malnutrition Reduction in Mozambique 2011-2014 (2020) [Report]. Mozambique,
- UNICEF. (1996). Nepal Multiple Indicator Surveillance, Health and Nutrition, Cycle 1 [Report].
- UNICEF. (2008). The State of World Children. [Report]. United Nations Children's Emergency Fund. New York, USA,
- UNICEF. (2012). "Program for children. Defination of Undernutrition".Geneva, Switzerland: UNICEF.
- UNICEF. (2013). Stunting [Report]. India, india., Retrieved from <http://unicef.in/Whatwedo/10/Stunting>.
- UNICEF. (2016). Breastfeeding Week Promotes Better Nutrtrition and Child Health in Nepal.
- USAID. (2007). Indicators for assessing infant and young child feeding practices 21.
- Waterlow, J. and Ruthishause, I. (1974). "Malnutrition in man -in choice of indicator of nutrritional status". Vol. 3. Hans Huber Publisher. Vienna.
- WHO. (1966). Forms of malnutrition [Report]. New York,
- WHO. (2015). Global Database on Child Growth and Malnutrition. Retrieved from <http://www.who.int/nutgrowthdb/about/introduction/en/index6.html>.



WHO. (2017). Global Database on Child Growth and Malnutrition.

Yadav, D. (1994). Nutrition Survey of Bhutnese refugee camp Beldangi ext-2, Damak Municipality, Jhapa. Central Campus of Technology, Tribhuvan University.,

Vella V (1994), Determinants of stunting and recovery from stunting in Northwest Uganda. International Journal of Epidemiology. Retrieved from <http://www.researchgate.net/publication/15197436.pdf>.

## Appendices

### Appendix-A

#### Consent letter

Namaste!

I, Mr. Samir Karki, 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 Assessment of 6-59 Months Children of Kerabari rural municipality, Morang".

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 mentioned participant /his/her relative.

Investigator's sign:

Date:

## Appendix- B

### Survey Questionnaire

Sample code number 

--	--	--

Date of interview 

Year	Month	Day

#### a. General Information

1. Name of the child: \_\_\_\_\_

2. Date of birth

Year	Month	Day

3. Age: \_\_\_\_\_ (in years)

4. Sex:

1. Male
2. Female

5. Mother's name: \_\_\_\_\_

6. Mother's age: \_\_\_\_\_ (in years)

7. Address: केराबारी गाउँपालिका

Ward number: \_\_\_\_\_

8. Respondent relation to the child

1. Mother
2. Father
3. Other (\_\_\_\_\_)

#### b. Family Description

9. What is your caste/ethnicity?

- |            |  |
|------------|--|
| 1. Brahmin | 3. Janjati (Rai, limbu, Magar, Tamang) |
| 2. Chhetri | 4. Dalit                               |

5. Madhesi

6. Others (\_\_\_\_\_)

10. What is your religion?

1. Hindu

4. Buddhist

2. Muslim

5. Others (\_\_\_\_\_)

3. Christian

11. No. of total family members: \_\_\_\_\_

12. No. of total male member: \_\_\_\_\_

13. No of total female member: \_\_\_\_\_

14. No. of children below 5 years: \_\_\_\_\_

15. Type of family?

1. Single

2. Joint

16. Type of house

1. Permanent

2. Temporary

17. What is the main income source of your family?

1. Service

4. Agriculture

2. Business

5. Foreign employment

3. Labor

6. Others \_\_\_\_\_

18. What is the occupation of child's father?

- |             |                       |
|-------------|-----------------------|
| 1. Service  | 4. Agriculture        |
| 2. Business | 5. Foreign employment |
| 3. Labor    | 6. Others_____        |

19. What is the occupation of child's mother?

- |             |                       |
|-------------|-----------------------|
| 1. Service  | 4. Agriculture        |
| 2. Business | 5. Foreign employment |
| 3. Labor    | 6. Others_____        |

20. Monthly income of your family

- |                   |                |
|-------------------|----------------|
| 1. 15000 to 25000 | 3. Above 35000 |
| 2. 25000 to 35000 |                |

21. Is your income enough for food consumption

- |        |       |
|--------|-------|
| 1. Yes | 2. No |
|--------|-------|

22. Mother's educational qualification

- |                      |                       |
|----------------------|-----------------------|
| 1. Bachelor          | 4. Informal education |
| 2. Secondary (8-12)  | 5. Illiterate         |
| 3. Basic level (1-7) |                       |

23. Father's educational qualification

- |                           |                       |
|---------------------------|-----------------------|
| 1. Bachelor and above     | 4. Informal education |
| 2. Secondary level (8-12) | 5. Illiterate         |
| 3. Basic level (1-7)      |                       |

**c. Nutrition and breastfeeding related information**

24. Did you breastfeed your child?

- |       |        |
|-------|--------|
| 1. No | 2. Yes |
|-------|--------|

25. If Yes then when did you initiate breast feeding?

- |                             |                    |
|-----------------------------|--------------------|
| 1. Within 1 hour of birth   | 4. Cannot remember |
| 2. Within 8 hours of birth  | 5. Other (_____)   |
| 3. Within 24 hours of birth |                    |

26. If not, what is the reason?

- |                      |                         |
|----------------------|-------------------------|
| 1. Lack of tradition | 4. Child cannot swallow |
|----------------------|-------------------------|

2. Because it is harmful
3. It is unhygienic
5. Others (\_\_\_\_\_)
27. Did you feed colostrum to your baby?
1. Yes
2. No
3. Cannot remember
28. If NO, then what is the reason behind it? \_\_\_\_\_
29. Did you feed any of the following before feeding colostrum milk to your baby?
1. None
2. Honey and Ghee
3. Cow's milk
4. Others
30. Did you exclusively breast fed your baby for first six months?
1. Yes
2. No
31. If NO, then till when did you breastfeed exclusively? \_\_\_\_\_ months
32. What was the reason behind not exclusively breastfeeding?
1. I/Other family members thought milk was not sufficient.
2. Medical complications.
3. Child cried a lot when only breastfed.
4. Child didn't sleep properly at night.
5. Others\_\_\_\_\_
33. When did you start giving complementary food?
1. 4 months
2. 5 months
3. 6 months
4. 7 months
34. Which complementary food did/do you give to your baby?
1. Jaulo
2. Locally made lito
3. Dal/bhat
4. Dal/bhat/tarkari
5. Processed food (cerelac, lito, Powder milk)
6. Others\_\_\_\_\_
35. Do you know how to prepare lito at home?
1. Yes
2. No
36. If yes, then what proportion of cereals and pulses do you use?
1. 1:1
2. 1:2
3. 2:1
4. Randomly

37. Did you ever feed commercial or formula milk to your baby?  
 1. Yes 2. No
38. Do you know about Baal- Vita?  
 1. Yes 2. No
39. Have you given it your baby?  
 1. Yes 2. No
40. What type of salt do you use in your home?  
 1. Iodized salt 2. Non- Iodized salt

**d. Health and immunization information**

41. Have you vaccinated your child according to the schedule?  
 1. Yes 2. No
42. If NO why did you miss it?  
 1. Thought it is not necessary.  
 2. There was shortage of that vaccine in the center.  
 3. Child had cried a lot/ had fever after getting the previous one.  
 4. Other (\_\_\_\_\_)
43. If NO which one did you miss?  
 1. Polio 3. DPT  
 2. BCG 4. PCV
44. Did you get vaccination during pregnancy?  
 1. Yes 2. No
45. Did you take iron and folate tablet during pregnancy?  
 1. Yes 2. No
46. Do you know how to prepare ORS at home?  
 1. Yes 2. No
47. Did you give “Vit.A” capsule and “De-worming” tablet to your baby?  
 1. Yes 2. No
48. Where do you take your children for treatment during illness?  
 1. Nearby health post 4. Traditional healer  
 2. Pharmacy 5. Don’t take  
 anywhere

3. FCHV

6. Others \_\_\_\_\_

**e. Other information about Mother and child**

49. Which child is this (from the eldest) \_\_\_\_\_

50. Weight at the time of birth

1. Less than 2.5 Kg

3. Don't know

2. More than 2.5 Kg

51. Mother's age when she got married? ..... Years

52. Mother's age during first pregnant? .....years

53. Death of any child under five? If yes, how many .....

54. Cause of death.....

55. How much food did you take during pregnancy?

1. More than usual

3. As usual

2. Less than usual

56. Do you know about malnutrition?

1. Yes

2. No

57. If yes, what is the main cause of malnutrition?

1. Inadequate balanced diet

4. Others

2. Witch craft

5. Don't know

3. Curse of god

58. Do you know about marasmus?

1. Yes

2. No

**f. Environment and sanitation information**

59. What is your source of drinking water?

1. Drinking water tap

3. Well

2. River

4. Hand pump

60. Do you give purified water to your child?

1. Yes

2. No

61. How do you purify drinking water?

1. Boiling

3. Sunlight-UV

2. Filter

4. Other (\_\_\_\_\_)



62. Do you have toilet facility in your house?

1. Yes

2. No

63. Do you wash your hands before preparing food for your child?

1. Yes

2. No

64. Do you wash your hands before feeding food to your child?

1. Yes

2. No

65. How do you manage household waste and its disposal?

1. Digging

2. Incineration

3. Throw in kitchen garden

4. Others\_\_\_\_\_

**g. Anthropometric Measurements:**

	Weight (Kg)	Height (cm)	MUAC (mm)
Reading 1			
Reading 2			
Reading 3			
Mean			

**h. Clinical findings:**

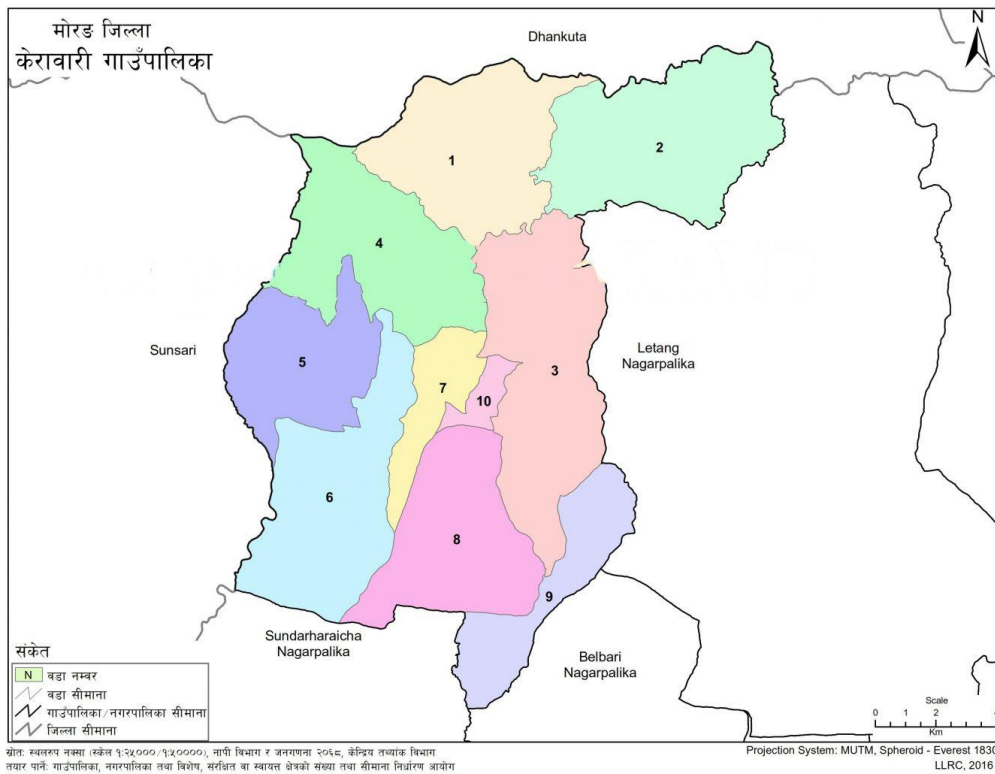
1. Edema

1. Yes

2. No

## Appendix- C

### Map of Survey Site (Kerabari Rural Municipality)



**Photo Gallery (Glimpse of Data Collection)**

