NUTRITIONAL ASSESSMENT OF 6-59 MONTHS CHILDREN OF DHARAN-6, PANBARI, SUNSARI NEPAL

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Nutritional assessment of 6-59 months children of Dharan-6, Panbari, Sunsari Nepal

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Approval Letter

This ***dissertation*** entitled ***"Nutritional assessment of 6-59 months children of Panbari, Sunsari Nepal"*** presented by **Milan Rai** has been accepted as the partial fulfillment of the requirements for the Bachelor of Science in Nutrition and Dietetics.

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If I have forgotten anyone, I apologize.

Regards,

Date of submission: ……/……., 2019

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Milan Rai

Abstract

The study was conducted to assess factors associated with nutritional status of 6 – 59 months children in Dharan-6, Panbari, Sunsari.

A community based cross-sectional study was conducted among 126 children aged 6-59 months in Dharan-6, Panbari, Sunsari. Children were selected by simple random sampling technique. Anthropometric measurements and semi-structured questionnaire were used. Anthropometric measurement was then used to determine if children were underweight (weight-for-age), wasted (weight-for-height) and stunted (height-for-age) based on WHO reference. Statistical Package for the Social Science (SPSS) version 20 and World Health Organization (WHO) Anthro. version 3.2.2 were used for analyzing the data. Fisher's exact test were used to identify the associated factors of malnutrition.

The study revealed that 19.8%, 11.1% and 8.7% of children were stunted, underweight and wasted respectively. The main associating factors with stunting ($P<0.005$) were age of child. Underweight was found associated ($P<0.05$) with Home garden. Similarly, wasting was found statistically significant ($P<0.05$) with family size, milk and milk product consumption and birth weight.

Result of this study indicates that under nutrition is still an important problem among 6 to 59 months children of Dharan-6, Panbari, Sunsari. So, the nutrition intervention programs focusing above risk factors should be launched immediately to overcome the problems.

Content

List of Table

List of figures

List of symbols and abbreviation

Abbreviation	Full forms
VDC	Village Development Committee
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
IDD	Iron Deficiency Disorder
SAM	Severe Acute Malnutrition
PEM	Protein Energy Malnutrition
FAO	Food and Agriculture Organization
MNDS	Micro-Nutrient Deficiency Symptoms
HIV	Human Immuno Deficiency Virus
AIDS	Acquired Immuno Deficiency Syndrome
UN	United Nations International Child Emergency Fund
WFP	World Food Program
MUAC	Mid-Upper Arm Circumference
CB-IMCI	Community Based- Integrated Management of Childhood Illness
WHZ	Weight for Height
HAZ	Height for Age

Part I

Introduction

1.1 General Introduction

Nutrition, is the science that deals with digestion, absorption and metabolism of food, i.e., the utilization of food in the body. It may be defined as "the science that interprets the relationship of food to the functioning of living organism. It includes the uptake of food, liberation of energy, elimination of wastes and all the processes of synthesis essential for maintenance, growth and reproduction. These fundamental activities are characteristic of all living organisms from the simplest to the most complex plants and animals" (Khanna *et al.,* 2005).

The importance of nutrition education as a means for improving the nutrition of the community in the developing countries has been increasingly realized during recent years. Lack of knowledge of the dietary requirements and the nutritive value of different foods is the main contributory cause for the widespread occurrence of malnutrition among preschool children and other vulnerable groups of the population in the developing countries. Nutrition education should be practiced and adopted to suit the socio-economic conditions, food habits and local food resources. It should include effective demonstration feeding in which mothers take active part (Swaminathan, 2008).

NDHS (2016) reported that, 36% of children under five years of age are stunted, 10% are wasted and 27% are underweight (MoHP., 2016). Adequate nutrition is critical to children's growth and development. The period from birth to age two is especially important for optimal physical, mental and cognitive growth, health and development. Unfortunately, this period is often marked by protein-energy and micronutrient deficiencies that interfere with optimal growth. Childhood illnesses such as diarrhea and acute respiratory infections (ARIs) also are common (MoHP., 2016).

Malnutrition continues to be a primary cause of ill health and mortality among children in developing countries. It is one of the major public health problems and accounts for about half of all child deaths worldwide. Malnutrition commonly affects all groups in a community, but infants and young children are the most vulnerable

because of their high nutritional requirements for growth and development. Women and young children bear the brunt of the disease burden associated with malnutrition (WHO., 2005).

WHO estimates that malnutrition is associated with about half of the 10.7 million child deaths among under-five children occurring each year in the developing world (Gharti, 2005). It is estimated that about 30% of all the world's children under five years accounting to about 150 million children are malnourished in terms of weight for age. It is estimated that the majority of them live in Asia and especially Southern Asia and the risk of being underweight is about 1.5 times higher in Asia than in Africa. The effects of childhood malnutrition leads to physical and psychological effect, continue through adulthood, cause intergenerational impact, loss of human potential leading to loss of social productivity (Gharti, 2005).

Dharan is a sub-metropolitan city in Sunsari District of Nepal and is situated on the foothills of the Mahabharat Range in the north with its southern tip touching the edge of the Terai region at an altitude of 1148 ft. It serves as a trading post between the hilly region and the plains of Terai region. A dense forest which is a part of famous Charkoshe jhadi lies in the south. Panbari is located about 6.5 km from Bhanu Chowk and is situated on south-eastern region of Dharan Sub-Metropolatan. Panbari consists of people of different ethnic groups and different economic status. Mostly Rai, Dalit, Brahmin, Chhetri etc. The major occupation of this place is agriculture. But nowadays most of the people are dependent on remittance and labour in construction. There are 1685 household, 8282 total population and 580 children 6-59 months of age.

1.2 Statement of problem and justification

The nutritional status of people of the developing countries is very poor. Malnutrition continues to be a major public health problem in developing countries. It is the most important risk factor for the burden of disease causing about 300,000 deaths per year directly and indirectly responsible for more than half of all deaths in children (Muller and Michael 2005). Major types of nutritional problems in developing countries are under-nutrition and nutritional disorders which are resulting from inadequate food intake both in quality and quantity, particularly of calories, proteins, vitamins and minerals; and parasitic infection and disease (Burk, 1984) .

Children under five years of age are very vulnerable to the malnutrition. These children from higher rank family are mostly provided with optimum nutrient and are well breastfed from their parents and they often become overweight. The children from the low-income family are not breastfed properly and complementary foods are also not provided sufficiently so there is high chance of malnutrition. A study carried out in Inaruwa showed 8.9% wasting, 28.1% stunting and 13.5% underweight (Shrestha, 2017).

The prevalence of malnutrition imposes significant costs on the Nepalese economy as well as society. The high mortality due to malnutrition leads to the loss of the economic potential of the child. It affects children in many ways, predisposing them to different infectious diseases, psychosocial mal-development, and cognitive deficiencies (MoHP, 2011).

The prevalence of under nutrition is still high in Eastern Terai i.e. 31.4% stunting, 24% underweight and 10.3% wasting (MoHP, 2011). In Dharan-6, Panbari no studies were conducted before to assess the nutritional status. 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 Dharan-6, Panbari.

1.3 Objectives

1.3.1 General Objectives

The main objective of this study is to assess the nutritional status and associated factors of 6-59 months old children from Dharan-6, Panbari, Sunsari district.

1.3.2 Specific Objectives

i) To assess the socioeconomic condition, feeding practices, environment and sanitation condition and immunization status of the children.

ii) To find out the relationship with nutritional status and socioeconomic condition, feeding practices, environment and sanitation and immunization status of the children.

1.4 Significance of the study

The nutritional status of children is important as it determines their health, physical growth and development and progress in life. All children have right to adequate nutrition, which is essential for attainment of the highest standard of health. This study will be helpful in designing better nutritional intervention for malnutrition problem prevalent in the community and will be used as baseline data for other programs. The study will make people aware of the real situation of nutrition among their children and help to aware in the improvement of their existing nutritional status. The study will act as a representative of the nutritional well-being of an entire population because this age group suffers the effects of malnutrition more severely.

1.5 Limitation of the study

- This study was conducted with limited resources and time.

PART II

Literature review

2.1 Nutritional Status

Nutrition plays a vital role in growth and development of children. Inadequate nutrition may lead to malnutrition, growth retardation, reduced work capacity and poor mental and social development. The World Health Organization considers that poor nutrition is the single most important threat to the world's health. Overall undernutrition represents the single largest killer of under-five children, being responsible for 3.1 million child deaths each year (45% of the total under 5 years' deaths) In 2013, 52 million children under age 5 (10% of the global population) were wasted, meaning that, due to acute malnourishment, they had low weight for their height. Other 165 million children in the world, a quarter of the world's under-5 population, were too short for their age, or stunted, which can impact the child's physical and mental development (Harmeet, 2018).

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 and nutritious food supply, are not exposed to repeated illness, and are well cared for, they reach their growth potential and are considered well nourished. Malnutrition is associated with more than half of all child deaths worldwide. Under-nourished children are more likely to die from common childhood ailments, and for those who survive, have recurring sicknesses and faltering growth. Three-quarters of children who die from causes related to malnutrition were only mildly or moderately malnourished—showing no outward sign of their vulnerability. The MDG target is to reduce by half the proportion of people who suffer from hunger between 1990 and 2015. A reduction in the prevalence of malnutrition will also assist in the goal to reduce child mortality (CBS. and UNICEF, 2014).

The principal aim of assessing the nutritional status of a community is to map out the magnitude and geographical distribution of malnutrition as a public health problem, to discover and analyze the ecological factors that are directly or indirectly responsible, and, where possible to suggest appropriate corrective measures, preferably capable of being applied with continuing public participation (Jellife, 1966).

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., 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 eats 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., 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).

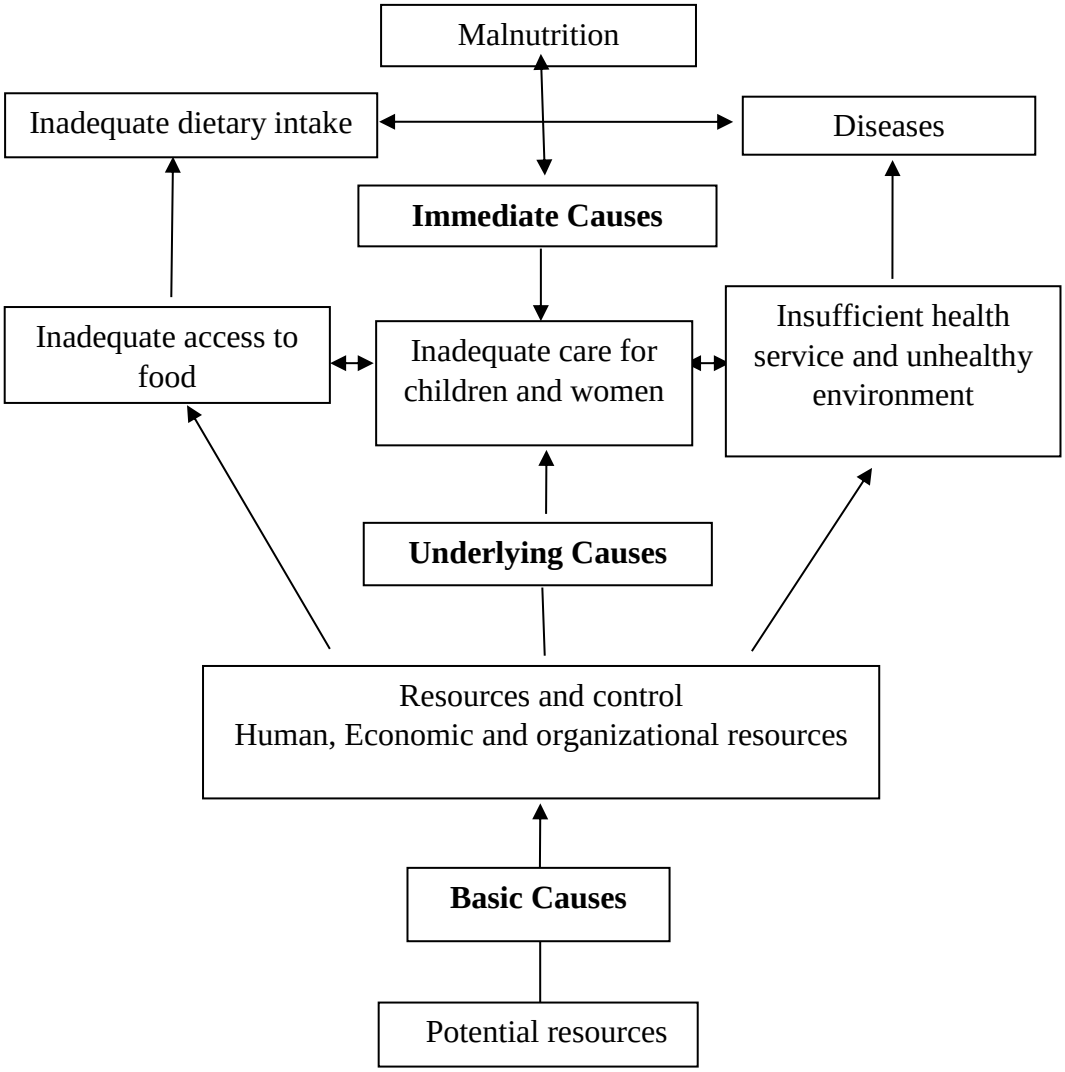


Fig. 2.1 UNICEF conceptual framework of malnutrition (Hartog *et al.*, 2006)

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 55 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., 2016).

2.3 Nutritional Requirement

Nutrient requirement can be defined as the minimum amount of the absorbed nutrient that is necessary for maintaining the normal physiological functions of the body. There are different dietary standards which are recommended dietary allowances, recommended nutrient intakes, recommended daily amounts of nutrient, or safe intakes of nutrients- are the average daily amounts of essential nutrients estimated, on the basis of available scientific knowledge, to be sufficiently high to be meet the physiological needs of practically all healthy persons in a groups with specified characteristics (Srilakshmi, 2014).

The nutritional requirements are based on the requirements for different population groups specified by age, sex, weight and physical activity. The average requirements are a weighted average by using the size of each age-sex group as weights. This includes specific needs for pregnant and lactating women. These requirements are not the

individual requirements of a particular individual, but an average for a group that is representative of the population in a developing country. Food aid programming guidelines usually give specific suggestions for adjustments based on climate, abnormal demographic distributions and specific nutritional needs of the beneficiary population (WFP, 2011).

Table 2.1: Recommended daily allowance (RDA) of nutrients for infants and pre-school children (6-59 months)

Nutrients	**Months**		
	6-12	**12-36**	**48-72**
Calories (Kcal)	80	1240	1690
Protein (g)	1.69	22	30
Fat (g)	19	25	25
Calcium (mg)	500	400	400
Iron (mg)	5	12	18
Vitamin A (µg)	350	400	400
Thiamine (mg)	0.3	0.6	0.9
Riboflavin (mg)	0.4	0.7	1
Nicotinic acid (µg)	650	8	11
Pyridoxine (mg)	0.4	0.9	0.9
Ascorbic acid	25	40	40
Folic acid (µg)	25	30	40
Vitamin B_{12} (µg)	0.2	0.2	0.2-1

Source: (Srilakshmi, 2014).

Recommendation of dietary intake of macronutrients and micronutrients differs with ages and it depends on body requirements. It is the recommended daily macronutrients,

vitamins and mineral intake considered adequate for healthy people (WHO/FAO., 2004).

Otten *et al.* (2006) also reported the Recommended daily allowances for macro and micronutrients for children at various age groups shown in table.

Table 2.2: Recommended daily allowances for macro and micronutrients for children at various age groups

Nutrient	**6-12 months**	**13-36 months**	**37-59 months**
Carbohydrate g	95	130	130
Protein g	11	13	19
Fats g	30	30	30
Iron mg	11	7	10
Calcium mg	260	700	1000
Zinc mg	3	3	3
Vitamin A µg	500	300	400

Source: (Otten *et al.*, 2006)

2.4 Malnutrition

Malnutrition is defined as a pathological condition of varying degree of security and disease clinical manifestations, resulting from the deficient assimilation of component of nutrient complex. The disease affect the physiological patterns of tissue, reduce the defensive capabilities to withstand different environmental condition and lower both the efficiency and ability in work shortens life (Gomez. *et al.*, 1955).

The term malnutrition covers a range of short and long-term conditions that result in physiological impairment caused by lack of (or excess of) nutrients in the body. These conditions may be experienced over a scale of severity and are usually classified into moderate and severe forms. They may occur in isolation within an individual or in combination (UNICEF. and Valid International., 2015).

When the person is not getting enough food or not getting the right sort of food, malnutrition is just around the corner. Even if people get enough to eat, they will become malnourished if the food they eat does not provide the proper amount of

micronutrient vitamins and minerals-to meet the daily nutritional requirement (UNWFP., 2008).

2.4.1 Forms of Malnutrition

According to (WHO, 1966) there are four forms of malnutrition. They are as follows: -

2.4.1.1 Undernutrition

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 (Jellife, 1966). It includes acute and chronic malnutrition. Malnutrition can be further divided into two categories: Acute Malnutrition and Chronic Malnutrition.

a) Acute malnutrition

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 *et al.*, 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. *et al.*, 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. *et al.*, 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 *et al.*, 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 fetus between conception and the first two years of life is determined by two factors (UN., 2010).

a) Sequence of a fetus 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.

2.4.1.2 Overnutrition

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 (Jellife, 1966).

2.4.1.3 Imbalance

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

2.4.1.3 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 (Jellife, 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).

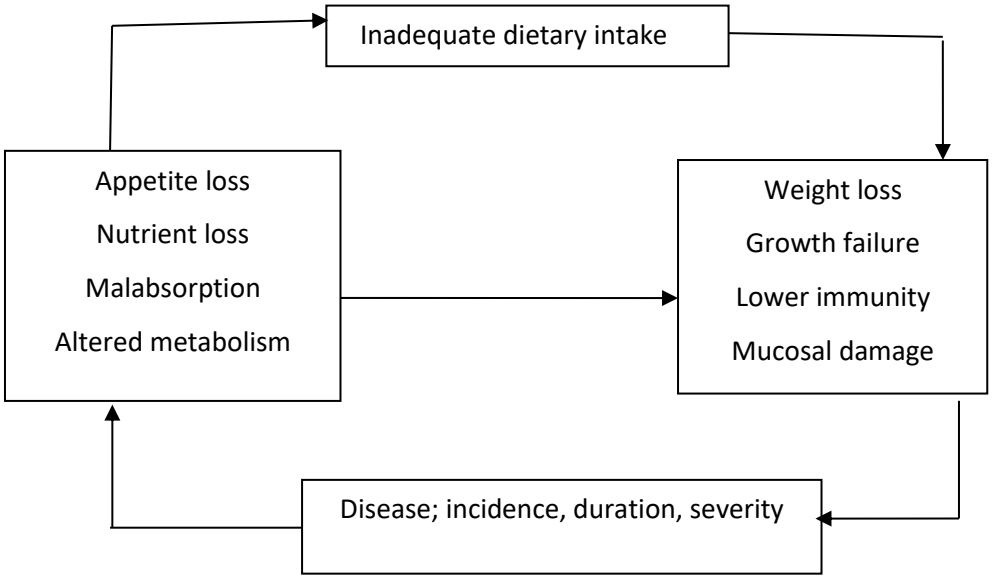


Fig. 2.2: The vicious cycle of malnutrition (Caballero. *et al.*, 2003)

The vicious cycle of malnutrition, impaired immune response, increased infection and diseased food intake is well recognized (Caballero. *et al.*, 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, 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 Types of malnutrition

The World Food Program, a United Nations agency, has identified five main types of malnutrition as the most deadly forms: protein energy malnutrition, in which the body lacks sufficient quantities of all major macronutrients, and deficiencies in iron, vitamin A, iodine and zinc (WFP, 2011).

2.4.4.1 PEM (Protein Energy Malnutrition)

Protein energy malnutrition, also known as starvation, is defined as a diet with insufficient amounts of all the major macronutrients: proteins, carbohydrates and fats. A starving person becomes skeletally thin and weak and is in danger of death. Protein energy malnutrition usually is seen during famines in Third-World countries and in eating disorders in Western societies (WFP, 2011). PEM is a range of pathological condition arising out of coincident lack of protein and energy in varying proportion, most frequently seen in infants and young children and usually associated with infection (WHO., 1996).

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).

2.4.4.1.1 Classification of PEM

a) Kwashiorkor

Dr. Ciley Millons (1935) first introduce the word Kwashiorkor, given to the disease by people of gold coast in Africa in 1935. The term Kwashiorkor means, disease which the child gets when the next baby born i.e. sickness of the disposal child. (Jellife, 1966).

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

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

Nutritional marasmus is principally due to the consumption of diet markedly deficient in both protein and calories and is usually participated by diarrheal diseases (Swaminathan, 1991).

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).

Marasmus child has the following symptoms (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).

When the incidence of PEM is high, a large number of cases show some of the feature of both marasmus and kwashiorkor (Passimore, 1986).

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

The World Health Organization (WHO) estimates that of the roughly two billion people suffering from micronutrient deficiencies, 85% live in resource poor settings and these often occur as multiple rather than single micronutrient deficiencies. The prevalence is especially high in Southeast Asia and sub-Saharan Africa. Micronutrients play a critical role in cellular and humoral immune responses, cellular signaling and function, learning and cognitive functions, work capacity, reproductive health and even in the evolution of microbial virulence. Infants, children and pregnant women have high demands for vitamins and minerals because of increased growth and metabolic requirements and yet their dietary intake often fails to meet these requirements. In children these micronutrient deficiencies can cause anemia restrict growth and hamper motor and cognitive development and also effect the immune function (Salam *et al.*, 2013).

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:

2.4.5.1 Vitamin-A deficiency

Vitamin-A deficiency, as defined by eye damage, has been identified as a widespread public health problem in the developing countries. Each year it is estimated that between 250000 and 500,000 preschool children go blind from vitamin A deficiency, and that within months of going blind, two-third of these children die. The peak prevalence seems to fall in the age range of two to four year (Scrimshaw, 1997).

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, (Gorstein *et al.*, 2003)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).

Fourty percentage of women receive a vitamin A dose during the postpartum. The 2016 NDHS collected data on vitamin A supplements for children under age 5 shows that 86 % of children age 6-59 months were given vitamin A supplements in the six months before the survey. The proportion of children receiving a vitamin A supplement increases with age from 51.5 % at 6-8 months to 90.2 % at 36-47months before declining to 85.7 % at 48-59 months. Similarly, mother 's education and wealth do not have an impact on use of vitamin A supplementation (MoHP., 2016).

2.4.5.2 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).

Nutritional anemia may be defined as the condition that results from the inability of the erythropoietic tissue to maintain normal hemoglobin concentration on accounting of inadequate supply of one or more nutrients leading to reduction in total circulating hemoglobin. Nutritional anemia is caused by the absence of any dietary essential that is involved in hemoglobin formation or by poor absorption of these dietary essentials. Some anemia's are caused by lack of either dietary iron or high quality protein; by lack of pyridoxine (vitamin B6) which catalyzes the synthesis of the haem portion of the hemoglobin molecules; by lack of vitamin C which influences the rate of iron absorption into the tissues; or by a lack of vitamin E which affects the stability of the red blood cell membrane. Copper is not part of the haemoglobin molecules but aids in its synthesis by influencing the absorption of iron, its release from the liver or its incorporation into haemoglobin molecules (Srilakshmi, 2014).

The most common cause of anemia is inadequate dietary intake of nutrients necessary for synthesis of hemoglobin, such as iron, folic acid, and vitamin B_{12}. NDHS (2016) has shown that 53 % of children in Nepal are anemic; 26 % are mildly anemic, 26 % are moderately anemic, and less than 1 % are severely anemic. The prevalence of anemia among children under age 5 has increased from 46% to 53% since 2011 to 2016 (MoHP., 2016).

2.4.5.3 Iodine deficiency

Iodine deficiency disorders (IDD) is the world's leading cause of preventable mental retardation and impaired psychomotor development in young children. In its most extreme form, iodine deficiency causes cretinism. It also increases the risks of stillbirth and miscarriage in pregnant women. Iodine deficiency is most commonly and visibly associated with goiter. IDD takes its greatest toll in impaired mental growth and development, contributing in turn to poor school performance, reduced intellectual ability, and impaired work performance. The indicator is the percentage of households consuming adequately iodized salt (MoHP., 2016).

NDHS (2016) result shows that in less than 1 percent of households, there was no salt available. These households are included in the denominator of the indicator. In 82 percent of households, salt was found to contain 15 parts per million (ppm) or more of iodine. Use of iodized salt was lowest in the Far Western hills (54 percent) and highest in the Central hills (92 percent). Almost all (96 percent) of urban households were found to be using adequately iodized salt as compared to only 78 percent in rural areas. Interestingly, the difference between the richest and poorest households in terms of iodized salt consumption is much greater than expected, varying from 64 percent for the poorest households to 98 percent for the richest households (MoHP., 2016).

2.5 Infant and young child feeding practices

2.5.1 Breastfeeding practice

Breastfeeding in the first years of life protects children from infection, provides an ideal source of nutrients, and is economical and safe. However, many mothers stop breastfeeding too soon and there are often pressures to switch to infant formula, which can contribute to growth faltering and micronutrient malnutrition and is unsafe if clean water is not readily available. WHO/UNICEF provide the following feeding recommendations (CBS., 2012).

a) Exclusive breastfeeding for first six months of life.

b) Continued breastfeeding for two years or more. Safe, appropriate and adequate complementary foods beginning at six months of age.

c) Frequency of complementary feeding: two times per day for 6–8-month-olds; three times per day for 9–11-month-olds.

d) It is also recommended that breastfeeding be initiated within one hour of birth.

Breastfeeding decreases the incidence or severity of diarrhea (Dewey *et al.*, 1995), lower respiratory infection (Wright *et al.*, 1989), bacterial meningitis (Cochi *et al.*, 1986) botulism (Arnon, 1984), and urinary tract infections (Pisacane, 1992). Other studies suggest that breastfeeding may protect against sudden infant death syndrome (Ford *et al.*, 1993), insulin dependent diabetes mellitus (Gerestein, 1994), Crohn's disease (Koletzko *et al.*, 1989), ulcerative colitis (Rigas *et al.*, 1993), lymphoma (Davis *et al.*, 1988), allergic disease and other chronic digestive diseases (Sveger, 1985). According to AAP, breastfeeding also enhances cognitive development. A number of studies indicate possible health benefits for mothers as well, specifically, a reduction in hip fractures after menopause (Cumming, 1993), less postpartum bleeding (Chua *et al.*, 1994), reduced risk of ovarian cancer and premenopausal breast cancer (Newcomb *et al.*, 1994).

According to NDHS (2016), 66% of children under age 6 months are exclusively breastfed, and 83% of children 6-8 months (breastfed and non-breastfed) are introduced to complementary foods at an appropriate time. 95% of all children are still breastfeeding at age 1, and 90% are still breastfeeding at age 2. This includes exclusive breastfeeding for children age 0-5 months and continued breastfeeding along with complementary foods for children age 6-23 months. Four-fifths of children under 6 months are predominantly breastfed. This percentage includes children who are exclusively breastfed and those who receive breast milk and only plain water or non-milk liquids such as juice (MoHP., 2016).

2.5.2 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). Weaning pattern is the process of providing other nutritive food to the child besides mother's milk. Appropriate infant and young child feeding (IYCF) practices include exclusive breastfeeding in the first six months of life, continued breastfeeding through

age two years, introduction of solid and semisolid foods at age six months, and gradual increases in the amount of food given and frequency of feeding as the child gets older. It is important for young children to receive a diverse and adequate diet, that is, to eat foods from different food groups and to satisfy growing micronutrient needs. After the first 6 months, breast milk alone is no longer enough to meet the nutritional needs of the infant; therefore, complementary foods should be added to the diet. Feeding family foods to the child while breastfeeding is referred to as complementary feeding. Overall, 84% of children were introduced to complementary foods at 6-8 months (MoHP., 2016).

The period of childhood especially the second year of life is notoriously fraught with risk. The young child is transitional as regard diet immunity to infection and psychologically dependence. This is a period of rapid growth with high nutrients needs, particularly of proteins for swiftly increasing muscle tissue. It is a time when several meals a day required and when foods should be easily mistakable and digestible (Jellife, 1966). If the baby is to maintain the expected rate of growth, remain healthy and well nourished, supplementary feeding has to be restored to a round 6^{th} months (Srilakshmi, 2014).

During the weaning period good food source of energy, protein calcium and iron are particularly important. In many traditional societies, the weaning child seldom receives especially formulated food rather they are gradually introduced to adult food. Some of the weaning foods given to child in different regions of Nepal are *dalbhat, dhindo, sarbottampitho, sattu,* etc. (Vaidya, 1987).

Common traditional weaning foods include:

a) Porridge (*lito*), made from roasted rice flour (occasionally maize or millet), ghee (clarified butter) and sugar.

b) *jaulo*, made from rice and turmeric or rice and salt.

c) *dhiro*, made from maize flour (or millet or wheat).

d) *maar*, made in lowland areas by cooking rice, cracked maize and soybeans together.

e) *Khichari*, a mix of rice, pulses and vegetables.

Some of these traditional foods are high in energy and nutrients and should be encouraged. These include *maar* and *khichari*. Others are poor weaning foods with little protein or nutrients, such as *jaulo*, so adding pulses, green leafy vegetables or fruit to these foods is encouraged (Nidhi, 2002) In an under developed country like Nepal the average family food, *Dal Bhat* in small quantities and in diluted form is given to the infants child, especially in the hills among low income group families, is *Dhindo*‘. Roasted soybean or corn, flattened rice (*chiura*) and puffed rice are also given as snacks food.

As mentioned earlier, after pasni the child can take supplementary food and the infants are fed with Litto‘. Litto is a traditional blend rice porridge made with green vegetables is also given to infants, but it is specially given to convalescing young children. Sattu‘. An infant food particularly made from roasted maize is used especially in the Terai (Vaidya, 1987).

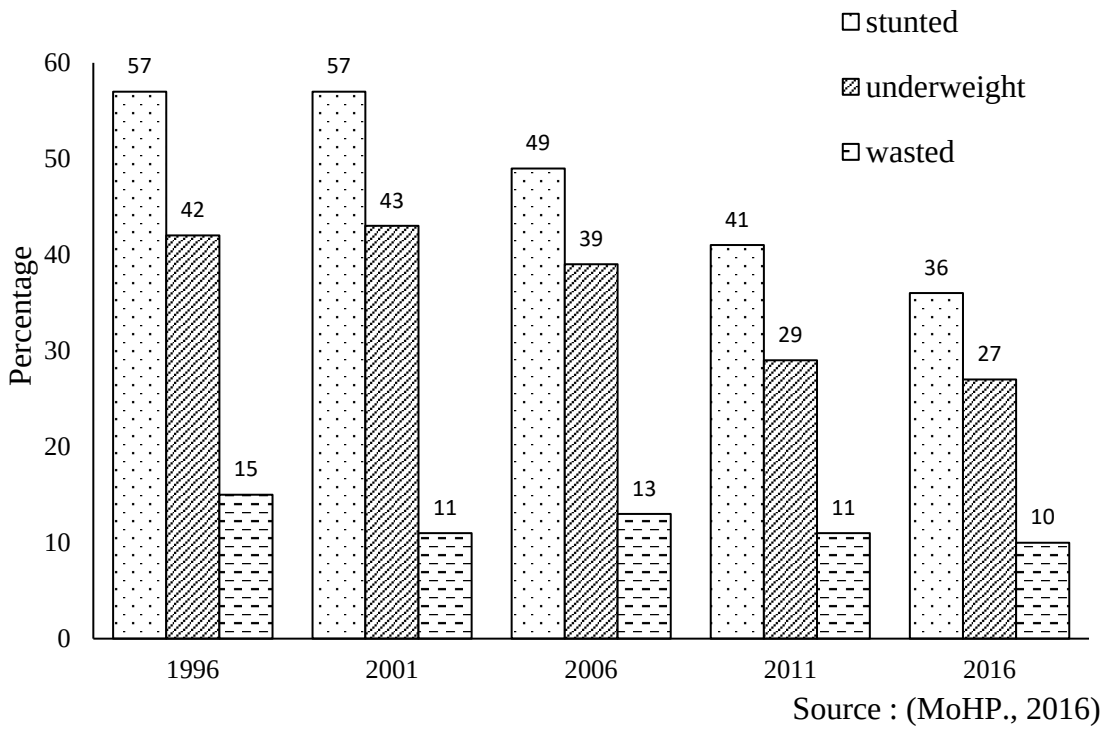
2.6. Nutritional situation

2.6.1 Nutritional Status of children in Nepal

Under nutrition is defined as the outcome of insufficient food intake and repeated infectious diseases. It includes being underweight for one’s age, too short for one’s age (stunted), dangerously thin for one’s height (wasted) and deficient in vitamins and minerals (micronutrient malnutrition) (UNICEF, 2006). Malnutrition is a major public health & nutrition problem in Nepal. It is associated with many risk factors like low birth weight, multiple birth, short spaced birth, extra diet, and iron supplementation in pregnancy etc. (Niraula *et al.*, 2013).

Good nutrition is the fundamental requirement for positive health, functional efficiency and productivity. Nutritional status is the condition of health of the individual as influenced by the utilization of nutrients. It can be determined only by the correlation of information obtained through a medical and dietary history, taking physical measurements of the body, clinical examination and appropriate laboratory investigation (Srilakshmi, 2016).

Overall, 36% of children under age 5 are stunted, with 12% being severely stunted, 10% are wasted, with 2% severely wasted and 27% are underweight, with 5% severely underweight, while around 1% of the children are overweight (MoHP., 2016). NDHS 2016 also shows that 53 % of children in Nepal are anemic; 26 % are mildly anemic, 26 % are moderately anemic, and less than 1 % are severely anemic. The prevalence of anemia among children under age 5 has increased from 46% to 53% since 2011 (MoHP., 2016)



Source : (MoHP., 2016)

Figure 2.3: Trends in nutritional status of children in Nepal

NDHS 2016 shows that prevalence of stunting and of underweight among children under age 5 have markedly decreased, from 57% to 36%, and from 42% to 27%, respectively, in the last 20 years (1996-2016). This indicates stunting in children declined by 14% between 2001 and 2006, declined by an additional 16% between 2006 and 2011, and dropped by 12% between 2011 and 2016. A similar downward trend is observed for underweight children. However, in the same time period, changes in wasting were minimal (MoHP., 2016).

2.6.2 Infant mortality, life expectancy and birth-weight

Infant mortality rates are important indicators of a country's socio-economic development and quality of life, as well as health status. Measures of childhood mortality also contribute to a better understanding of the progress of population and health programs and policies. From 2011 to 2016, in the 5-year period preceding the survey, neonatal mortality was 21 deaths per 1,000 live births, infant mortality was 32 deaths per 1,000 live births, and under-5 mortality was 39 deaths per 1,000 live births. These rates imply that nearly one in 30 children die before reaching their first birthday and that one in 25 die before reaching their fifth birthday. Slightly more than one-half (54%) of all deaths in the first 5 years of life occur in the first month of life, an increase from 42% in 1996. As childhood mortality rates have declined, the burden of neonatal deaths has increased (MoHP., 2016).

Information on a baby's birth weight is important because birth weight is an indirect indicator of maternal nutrition as well as a predictive indicator of potential neonatal death and of malnutrition if the child survives. Among children with a reported birth weight (61%), 12% were of low birth weight (less than 2.5 kg). The survey also provided information on mothers' estimates of their baby's size at birth. Although mothers' estimates of size are subjective, they can be a useful proxy for the baby's birth weight. Five percent of births are reported as very small, 12% as smaller than average, and 83% as average or larger than average (MoHP., 2016). The average life expectance of Nepalese men and women is around 60.1 and 60.7 respectively (MoHP., 2006).

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 status reflects the degree to which physiologic needs for nutrients are being met. Appropriate techniques of assessment can detect nutritional deficiency in the early stages of development so that dietary intake can be improved through proper counseling and nutritional support before more severe condition appears (Joshi., 2008).

Nutritional assessment is essential in order to:

a) Identify the undernourished or over-nourished state of an individual or a community and estimating the optimum energy and nutrient intake to promote growth and wellbeing. b) To gauge the prevalence of malnutrition in the clinical setting, this is found to be high, in the range of 48% to 50%. Also, it is associated with suboptimal surgical outcome, increased rate of infection, longer hospital stay, impaired wound healing, frequent hospital stay, impaired wound healing, frequent hospital readmission for the elderly, more frequent post-operative complication and increased risk of death.
c) To plan health programs.

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c) To plan health programs.

A number of public health problems afflict a large population of the world. In order to improve the situation, several numeric measurements are required in order to act as a baseline (Joshi., 2016).

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 post status or as specific attempt to evaluate the, impact of an intervention programs (Ramchandran, 1987).

There are three main aims of nutritional assessment of a community. They are:
1. To judge the magnitude and geographical distribution of malnutrition.
2. To know the effect of ecological factors that may directly or indirectly be responsible.
3. To suggest corrective measures especially with the participation of the affected community.

The assessment of nutritional status of an individual member of a community is accomplished by carrying out clinical, biochemical, anthropometric and biophysical examinations. To determine the nutritional status of any given community or section of community, it is necessary to apply such techniques to all its various members (WHO, 1962). The assessment of nutritional status can be done by using the following information:

2.7.1 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

2.7.2 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:

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 variables 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 Ruthishause, 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.

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 Ruthishause, 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

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 questionnaires was administered to collect information on household characteristics, food availability and its consumption, health status health facility etc.

3.2 Research method

A semiquantitative cross-sectional study was carried out. The area of the study was Dharan-6, Panbari. The study was mainly consisted of two approaches:

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 (Appendix B).

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

The household situated in Panbari of Dharan sub-metropolitan Sunsari, Nepal. Panbari is located about 6.5 km from Bhanu Chowk and is situated on south-eastern region of Dharan sub-metropolatan.

Source: (Google map., 2018)

Figure 3.1 Map of Dharan-6, Panbari

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.

3.5.1 Inclusion and exclusion criteria

Inclusion criteria*:* Children of age (6-59) month who live in Dharan-6, Panbari of Sunsari 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

A cross – sectional study followed by simple random sampling was used to select children from households. The basic criterion for the selection of household sample was that the household with at least one child of 6-59 months of age was included in the sample. In households with more than one child 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 by assuming 50% of prevalence of malnutrition in Dharan-6, Panbari, 95% confidence interval (CI), 8 % desired precisions, some children may be unavailable so 5% non-response rate is added to the total sample size. A Z-value 1.96 is used at 95% CI and d of 8 %. (N= sample size, P= prevalence, d= margin of error).

Calculation of sample size for infinite population: -

Sample Size $n_0=Z^2\times p(1-p)/d^2$

$= (1.96)^2\times 0.5(1-0.5)/ (0.08)^2$

$= 150.0625$

≈ 150

From the ward office of Dharan-6, Panbari, we found that the total no. of children of 6-59 months are 580. Thus, we apply finite population sample formula to obtain new sample size to conduct survey in this particular community.

Therefore,

New SS = n0 / [1+{(n0-1) / POP}]

Where,

New SS = New sample size for finite population

no = Sample size in infinite population

POP = Total number of population (in this case total number of populations is number of 6-59 months age children in this area)

New sample size obtains as

= n0 / [1+ {(n0-1) / POP}]

= 150 / [1+ {(150-1) / 580}]

= 119.426

i.e., 120

Thus, calculated sample size was adjusted for non-response. Considering non-response rate as 5%, the adjusted sample size was calculated to be 126.

3.8 Pre – testing

The study was pre-tested below five years 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 Nepali language. Interview was conducted with mothers of the children to fill the questionnaire. In which each questionnaire was 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 2016 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 Dharan-6, Panbari. 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

The cross- sectional semiquantitative study with 126 sample size was conducted in Dharan-6, Panbari in order to determine the nutritional status of 6-59 months children. The important findings of the study are listed below.

4.1 Socio economic and demographic factors

The sociodemographic characteristic of studied household and population is presented in Table 4.1. Table 4.1 shows that 97.6% (123) were found to be Hindu, 0.8% (1) Bouddha ,0.8% (1) Christian and 0.8% (1). Other While according to the census 2011, in Sunsari district 73% of populations were Hindu and 1.5% Christian (CBS., 2014, March). Among 126 households, 27.8% (35) were Brahmin, 31% (39) Chhetri, 24.6% (31) Janjati, 14.3% (18) Dalit and 2.4% (3) were of other caste like Chaudhary.

Table 4.1 Religion and caste distribution of study population (n=126)

Variables	Frequency	Percent %
Religion		
Hindu	123	97.6
Bouddha	1	0.8
Christian	1	0.8
Others	1	0.8
Total	126	100
Caste		
Brahmin	35	27.8
Chettri	39	31
Janajati	31	24.6
Dalit	18	14.3
Others	3	2.4
Total	126	100

Table 4.2 Socio-economic and demographic characteristics (n=126)

Variables	Frequency	Percent %
No of member		
Less than 5	43	34.1
5	28	22.2
More than 5	55	43.7
Total	126	100
Father occupation		
Agriculture	16	12.7
Business	13	10.3
Foreign employment	58	46
Labour	12	9.5
Service job	12	9.5
Driver	12	9.5
Other	3	2.4
Total	126	100
Father education		
Illiterate	7	5.6
primary level (up to 8)	28	22.2
secondary level (up to 12)	80	63.5
higher secondary or above	11	8.7
Total	126	100
Annual income		
<1 lakh	3	2.4
1 lakh-3 lakh	78	61.9
>3 lakh	45	35.7
Total	126	100

As shown in the above Table 4.2, From the survey conducted among 126 children most of them were from the family whose family size was more than five i.e. 43.7% (55) followed by 34.1% (43) whose family size was less to five. In the family whose family size was equal to five, 22.2% (28).

According to the survey, major occupations of father in Dharan-6, Panbari were foreign employment 46% (58) and agriculture 12.7% (16) and others were engaged in business 10.3% (13), labour 9.5% (12), service job 9.5% (12), driver 9.5% (12) and other 2.4% (3). This might be due to increasing attraction towards foreign employment (good salary).

Most of the fathers under study, 63.5% (80) had secondary level of education while 5.6% (7), 22.2% (28), 8.7% (11) were illiterate, had primary level, higher secondary or above respectively. Thus, the finding shows that least percentage of fathers of children under study was illiterate. As shown in the Table 4.2, annual income of 61.9% (78) families was between one lakh to three lakhs, 35.7% (45) were above three lakh and remaining 2.4% (3) were below one lakh.

4.2 Child characteristics

Table 4.3 Child characteristics of study population (n=126)

Variables	**Frequency**	**Percent** %
Sex		
Male	67	53.2
Female	59	46.8
Total	126	100
Birth order of child		
1st	75	59.5
2nd	41	32.5
3rd	6	4.8
4th	1	0.8
5th	3	2.4
Total	126	100
Birthweight		
Less than 2.5	21	16.7
More than 2.5	98	77.8
Don’t know	7	5.6
Total	126	100

Number of children below five years		
1	93	73.8
2	32	25.4
3	1	0.8
Total	126	100
Age group		
6-11	9	7.1
12-23	16	12.7
24-35	23	18.3
36-47	35	27.8
48-59	43	34.1
Total	126	100

Among 126 respondents, 53.2% (67) were males and 46.8% (59) were females. Out of 126 selected children, 59.5% (75) were first child, 32.5% (41) second child, 4.8% (6) third child, 0.8% (1) fourth child and 2.4% (3) fifth child of their parents. As mentioned in the Table 4.3, 77.8% (98) of children had more than 2.5 Kg birth weight, 16.7% (21) child had less than 2.5 Kg birth weight while 5.6% (7) 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 2016 shows 12.3 % of children in province 1 were born less than 2.5 kg (MoHP., 2016). 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).

Table 4.3 shows that 73.8% (93) families under the survey had only one child below 5 years of age, 25.4% (32) had 2 children below 5 years of age and 0.8% (1) had 3 children below 5 years of age. The mean age of children was 38.86 ± 15.7 months. Majority of them were in 48-59 months 34.1% (43) followed by 27.8% (35) in 36-47 months, 24 – 35 months 18.3% (23), 12 – 23 months 12.7% (16) and 6-11 months 7.1% (9) respectively.

4.3 Child caring practices

The child caring practices of the study population is shown in table 4.4.

Table 4.4 Child caring practices of study population (n=126)

Variables	Frequency	Percent %
Mode of delivery		
Vaginal	94	74.6
Caesarian section	32	25.4
Total	126	100
Time of initiation of breastfeeding		
Within 1 hour of birth	112	88.9
After 1 hour of birth	14	11.1
Total	126	100
Continue breastfeeding till two years		
Yes	94	74.6
No	7	5.6
Total	101	80.2
Types of Complementary Food		
dal vaat	14	11.1
Lito	68	54
Jaulo	25	19.8
Other	19	15.1
Total	126	100
First place of treatment		
Health Post	54	42.9
Dhami Jhakri	2	1.6
Both	69	54.8
Other	1	0.8
Total	126	100

Consumption of meat/fish/egg per week		
<2 times	43	34.1
2-4 times	65	51.6
>4 times	13	10.3
Don't consume	5	4
Total	126	100
Consumption of pulses per week		
<2 times	14	11.1
2-4 times	66	52.4
>4 times	46	36.5
Total	126	100
Consumption of vegetables per week		
<2 times	19	15.1
2-4 times	49	38.9
>4 times	58	46
Total	126	100
Consumption of milk and milk products per week		
<2 times	19	15.1
2-4 times	45	35.7
>4 times	58	46
Don't consume	4	3.2
Total	126	100
Immunization		
Yes	121	96
No	5	4
Total	126	100
Received Vit. A and deworming capsule		
Yes	124	98.4

No	2	1.6
Total	126	100
Recent disease of children		
Allergy	1	0.8
Diarrhea	1	0.8
Fever	1	0.8
Jaundice	2	1.6
Leg and hand pain	1	0.8
Pneumonia	1	0.8
Tonsil	1	0.8
No	118	93.7
Total	126	100
Death of Previous children		
Kidney failure	2	1.6
Miscarriage	2	1.6
Pneumonia	1	0.8
still birth	2	1.6
Total	7	100

74.6% (94) children were born vaginal delivery and 25.4% (32) were born by caesarian section. Access to cesarean sections can reduce maternal and neonatal mortality and complications of labor. According to NDHS (2016) proportion of births delivered by cesarean section has almost doubled, from 5% in 2011 to 9% in 2016. 88.9% (112) were fed Colostrum milk within one hour of birth and all the children were exclusively breastfed. 74.6% of the children were breastfed till two years. Iodized salt was consumed by all household of the survey. Among the study sample type of complementary food given to children was 11.1% (14) *dal vaat*, 54% (68) lito, 19.8% (25) *jaulo* and the remaining 15.1% (19) were given other food such as commercial complementary food.

The majority of ill treatment was highest 54.8% (69) to both (health post and *dhami jhakri*) followed by 42.9% (54) to health post only, 1.6% (2) is recorded to visit *dhami jhakri* only and 0.8 % (1) is recorded to visit other (Church).

Consumption of meat/fish/egg was highest 51.6% (65) 2-4 times per week followed by 34.1% (43) <2 times per week, 10.3% (13) >4 times per week and 4% (5) don't consume. Consumption of pulses per week was highest 52.4% (66) 2-4 times per week and lowest 11.1% (14) <2 times per week. Consumption of vegetables was highest 46% (58) >4 times per week and lowest 15.1% (19) <2 times per week. Consumption of milk and milk products was highest 46% (58) >4 times per week followed by 35.7% (45) 2-4 times per week, 15.1% (19) <2times per week and 3.2% (4) doesn't consume.

All the survey households use packaged iodized salt. This finding is similar to that of NDHS 2011 which revealed that more than 95% of households were using iodized salt (MoHP., 2011). Majority of children i.e. 96% (121) were immunized according to schedule. Regarding Vitamin A supplementation, 98.4% (124) children were given Vitamin A capsule and deworming tablet during the last Vitamin A campaign. The NDHS (2016) collected data on vitamin A supplements for children under age 5 shows that 86 % of children age 6-59 months were given vitamin A supplements. 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.

Among the survey household, mother's educational status, almost 65.9% (83) had secondary level of education followed by 20.6% (26) had primary level of education, 7.9% (10) were completely illiterate and 5.6% (7) had higher education or above. On the survey, most of the mother's occupation 90.5% (114) were housewife. Almost 61.9% (78) got married in early age of less or equal to twenty while 38.1% (48) got married after twenty. Survey shows that maximum women become pregnant at the age of more than twenty year with 65.1% (82) followed by age group less or equal to twenty with 34.9% (44).

4.4 Maternal characteristics

Table 4.5 Maternal characteristics of study population (n=126)

Variable	Frequency	Percent %
Mother education		
Illiterate	10	7.9
primary level	26	20.6
secondary level	83	65.9
Higher secondary or above	7	5.6
Total	126	100
Mother occupation		
Agriculture	4	3.2
Business	1	0.8
Housewife	114	90.5
Labour	3	2.4
Service Job	3	2.4
foreign employment	1	0.8
Total	126	100
Age of marriage		
< 20 or 20 years	78	61.9
>20 year	48	38.1
Total	126	100
First pregnancy		
<20 year	44	34.9
>20 year	82	65.1
Total	126	100
Vaccination during pregnancy		
Yes	123	97.6
No	3	2.4
Total	126	100
Iron folate supplement during pregnancy		
Yes	123	97.6

No	3	2.4
Total	126	100
Deworming tablet during pregnancy		
Yes	122	96.8
No	4	3.2
Total	126	100
Smoking habit of mother		
Yes	3	2.4
No	123	97.6
Total	126	100
Alcohol consumption		
Yes	5	4
No	121	96
Recent disease of mother		
Cancer on back bone	1	0.8
Chest pain	1	0.8
circulatory system	1	0.8
Diabetes	2	1.6
Gastritis	1	0.8
Headache	2	1.6
irregular menstruation	1	0.8
Sinusitis	1	0.8
Tonsil	2	1.6
urinary tract infection	1	0.8
No	112	88.9

From the survey higher proportion of mothers mentioned that they had taken iron and folate tablets during pregnancy i.e.97.6% (123). Among 108 respondents, 97.6% (123) mothers had taken vaccination during pregnancy. Almost 96.8% (122) mothers had taken deworming tablet during pregnancy. The survey study shows that 2.4% (3) mothers are smoker and 4% (5) mothers consume alcohol.

4.5 Environment and sanitation characteristics

Table 4.6 Environment and sanitation characteristics (n=126)

Variables	Frequency	Percent %
Source of drinking water		
Tap water	115	91.3
River	1	0.8
Boring water	10	7.9
Total	126	100
Purification of drinking water		
Yes	103	81.7
No	23	18.3
Total	126	100
Source of fuel		
Lpg gas	61	48.4
Wood	19	15.1
Both	45	35.7
Other	1	0.8
Total	126	100
Household waste management		
Yes	97	77
No	29	23
Total	126	100

Most of the surveyed families used tap water as a source of drinking water i.e. 91.3% (115) followed by use of boring water with 7.9% (10) and only 0.8% (1) use river water. According to this survey most of the families purify water i.e. 81.7% (103) while 18.3% (23) families doesn't drink purified water. In most of the respondent's major source of fuel was found to be cylindrical gas i.e. 48.4% (61), followed by 35.7% (45) respondent using both (LPG gas and wood) and 15.1% (19) respondent using wood as the major source of fuel. NDHS (2016) survey findings show that the prevalence of diarrhea

among children under age 5 is 8% (MoHP., 2016). 77% (97) households managed their waste product while 23% (29) don't manage household waste products.

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.

In survey among 126 children, the overall magnitude of malnutrition among 6 – 59 months children in Dharan-6, Panbari was 8.7%, 19.8% and 11.1% for wasting, stunting and underweight respectively as shown in Figure 4.1 below. Moreover, severe and moderate wasting was found to be 2.4% and 6.3% respectively. Severe and moderate stunting was found to be % 9.5 and 10.3% respectively and on the other hand prevalence of severe and moderate underweight was found 1.6% and 9.5%.

NDHS 2016 showed the prevalence of wasting, stunting and underweight to be 10%, 36% and 27% respectively. The prevalence of wasting is similar to the national wasting data but nutrition status regarding to stunting was low as compared to the national data. Underweight was also found to be lower when compared to national data.

A study conducted in Nirajan basti, Dharan-15 revealed that children 9% wasted, 42% stunted and 18% underweight. The prevalence of wasting (8.7%) was lower than this study as well as the prevalence of stunting (19.8%) and underweight (11.1%) was also lower in this study (Adhikari, 2015).

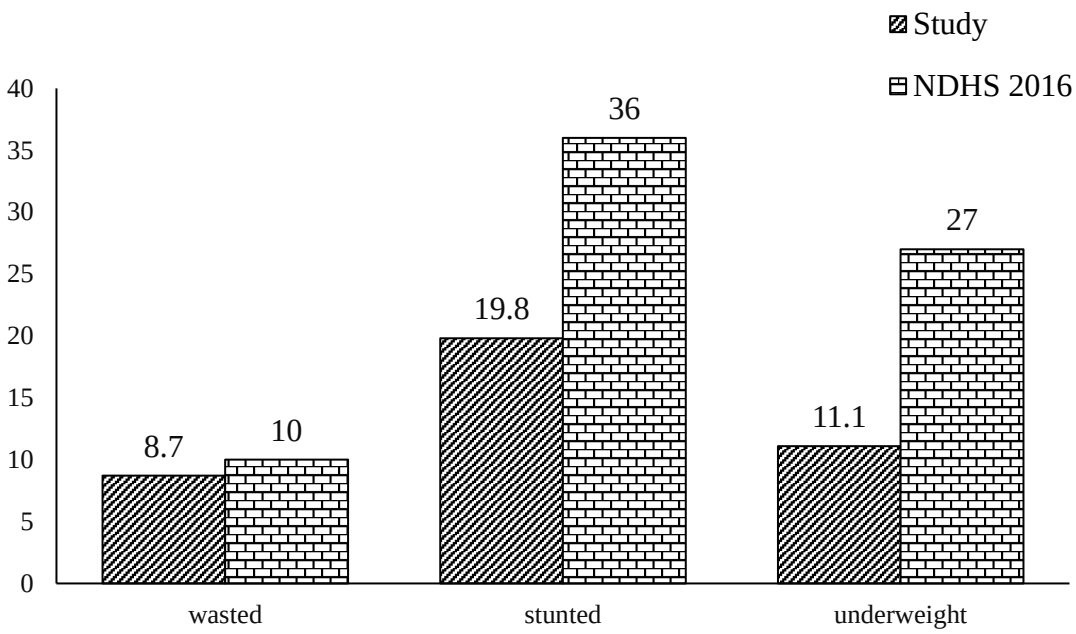

Figure 4.1 Prevalence of under nutrition in Dharan-6, Panbari in compared to NDHS

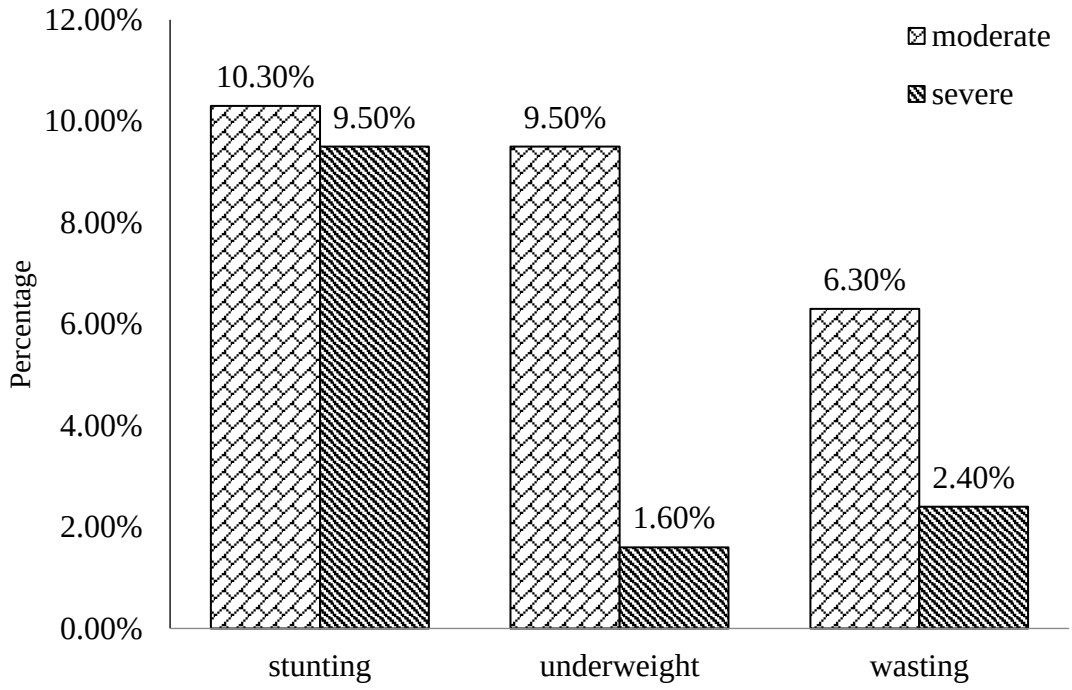

Figure 4.2 Prevalence of stunting, underweight and wasting among survey population

4.6.1 Distribution of malnutrition based on age

As shown in the Table 4.7, the highest percentage of wasting (22.2%) in the age group 6-12 months. In age groups 48 -59 months the prevalence of wasting was 4.7%. In age group 24-35 months was found more severely wasted 8.7% and age groups 6-11, 36-47, 48-59 months were found to be nil.

Table 4.7 Distribution of wasting, stunting and underweight among different age group (n=126)

Age groups	**N**	**WHZ (%)**		**HAZ (%)**		**WAZ(%)**	
		< -3	**< -2**	**< -3**	**< -2**	**< -3**	**< -2**
(6-11)	9	Nil	22.2	22.2	22.2	11.1	11.1
(12-23)	16	6.2.	6.2	31.2	43.8	Nil	25
(24-35)	23	8.7	8.7	13	17.4	4.3	4.3
(36-47)	35	Nil	11.4	Nil	17.1	Nil	5.7
(48-59)	43	Nil	4.7	4.7	14	Nil	14
Total:	126	2.4	8.7	9.5	19.8	1.6	11.1

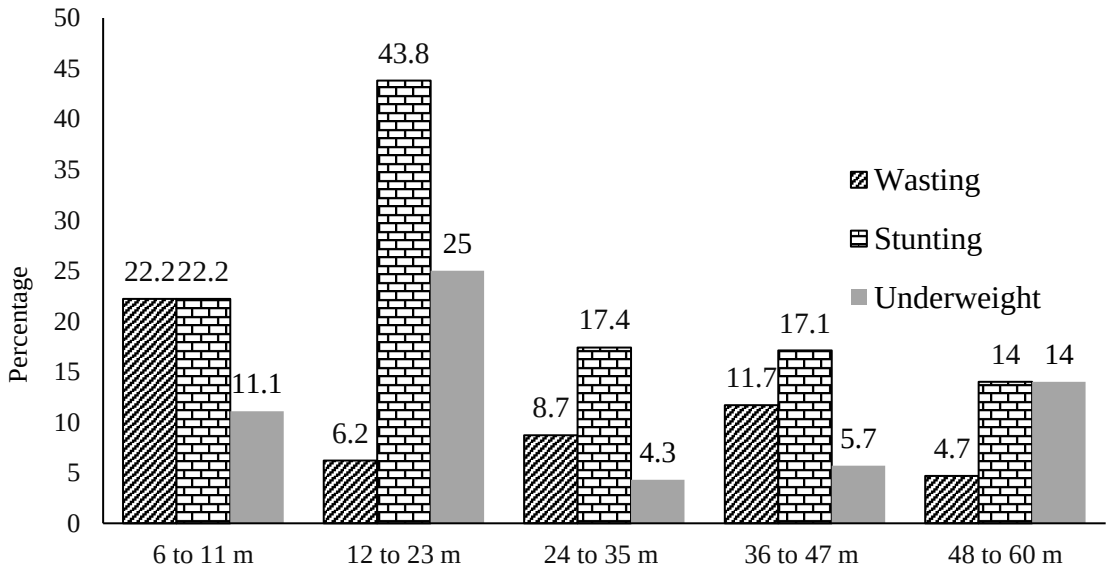

Figure 4.3 Distribution of stunting, underweight and wasting among different age groups.

The highest stunted is found in age group 12 -23 months (43.8%) followed by 22.2% in 6 -11 months, (17.4%) 24-35 months, (17.1%) 36-47 months, (14%) 48-59 months. The highest prevalence of severe stunting was found 31.2% in age group 12-23 months. In age group 36 -47 months, severe stunting was found to be nil.

The highest prevalence of underweight was found to be 25% in age group 12-23 months and the lowest was found to be (4.3%) in 24-35 months. The age group 6 -11 months was found to be more severely underweight (11.1%). The prevalence of severe underweight was found nil in the age group 12-23, 36-47, 48-59 months.

4.6.3 Distribution of malnutrition based on gender

The rate of wasting was found to be higher in males 10.5% than that in females 6.8% which is similar to NDHS (2011) findings. The prevalence of stunting was found to be higher in males 23.8% as compared to females 15.3% and this finding is also similar to the findings of NDHS (2011). The prevalence of underweight was found higher in males13.4% than that in females 8.5% and this finding is also similar to the findings of NDHS (2011).

Among 67 males, 3% males were found to be severely wasted and 7.5% were moderately wasted while 11.9% were severely stunted and 11.9% were moderately wasted, 3% males were severely underweight and 10.4% were moderately underweight. Similarly, among 59 females, 1.7% females were found to be severely wasted while moderately wasted females were 5.1%. In case of stunted, 6.8% females were severely stunted while 8.5% females were moderately stunted and rate of severely underweight and moderately underweight females was found to be nil and 8.5% respectively as shown in Table 4.8.

Table 4.8 Gender wise distribution of stunting, underweight and wasting (n=126)

	Characteristics	Male (%)	Female (%)	All (%)
	Severely wasted (<-3)	3	1.7	2.4
WHZ	Moderately wasted (>-3 and <-2)	7.5	5.1	6.3
	Normal	89.6	93.2	91.3
	Severely stunted (<-3)	11.9	6.8	9.5
HAZ	Moderately stunted (>-3 and <-2)	11.9	8.5	10.3
	Normal	76.2	84.7	80.2
	Severely underweight (<-3)	3	Nil	1.6
WAZ	Moderately underweight (>-3 and <-2)	10.4	8.5	9.5
	Normal	86.6	91.5	88.9

4.6.4 Nutrition status comparison with WHO standard

4.6.4.1 Weight for age:

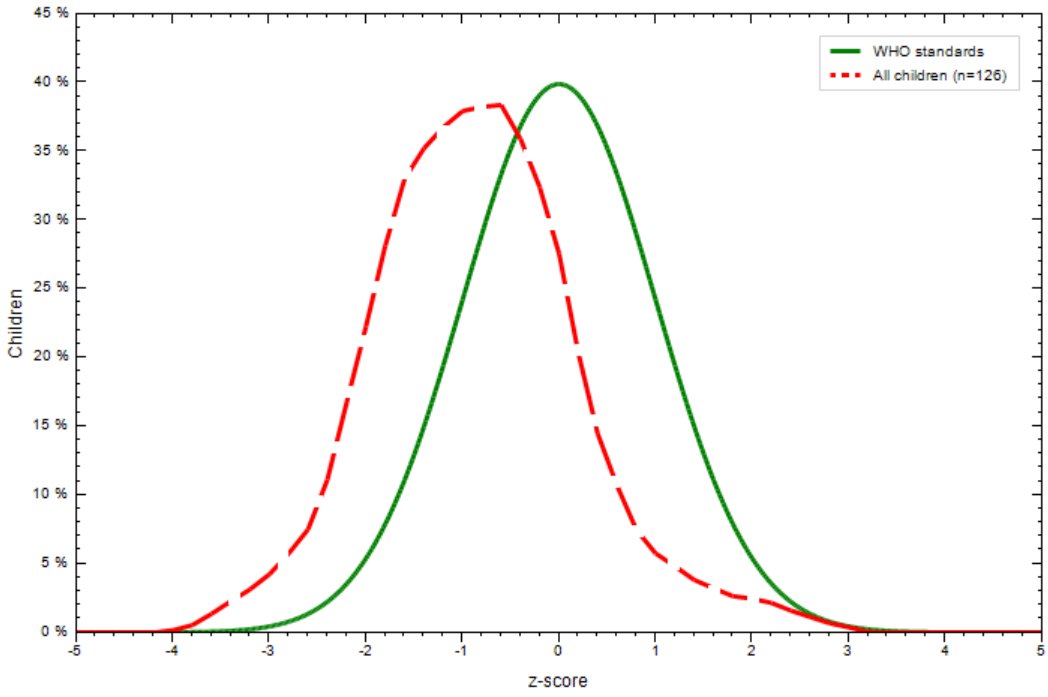

Figure 4.4 Weight for age curve with reference WHO standard

A WAZ <-2SD defines the presence of both acute and chronic malnutrition (underweight). The prevalence of underweight in the study area was found to be 11.1%

in which 9.5% were moderately underweight and 1.6% were severely underweight. Figure 4.2 shows that the median weight for Age z-score of survey children to be -1.016 which is less than the reference to WHO standard.

4.6.4.2 Weight for height:

A WHZ <-2SD defines the presence of acute malnutrition (wasting). The prevalence of wasting in the study area was found to be 8.7% of which 6.3% were moderately wasted and 2.4% were severely wasted. Figure 4.3 shows that the median weight for height z-score of survey children to be -1.54 which is less than the reference to WHO standard.

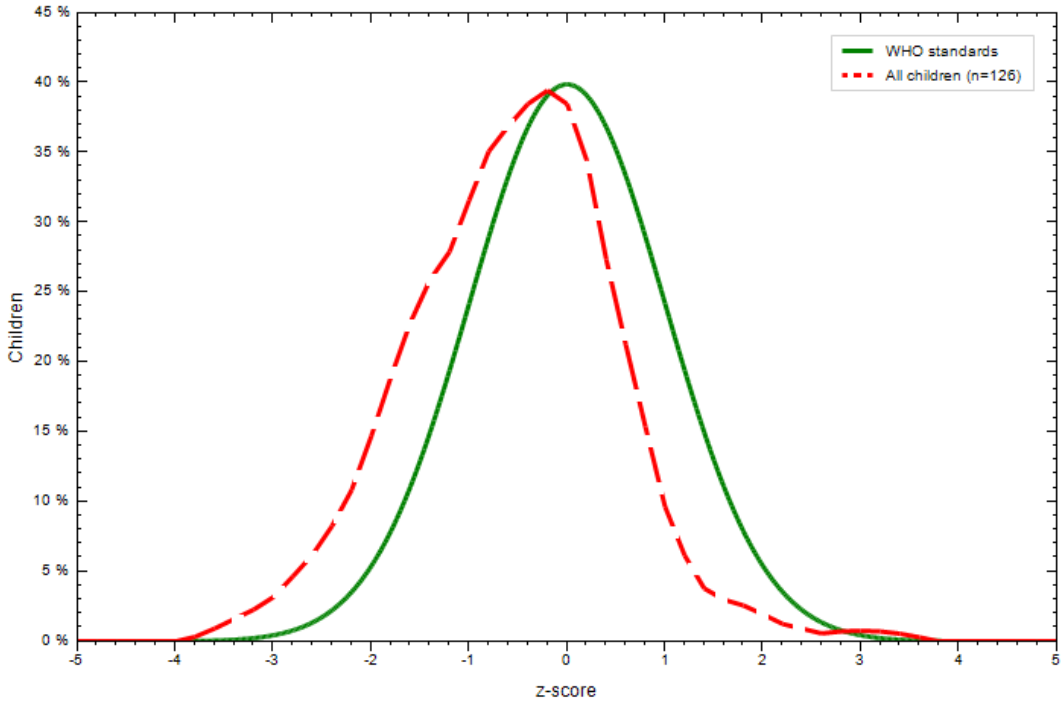

Figure 4.5 Weight for height curve with reference WHO standard

4.6.4.3 Height for age

A HAZ < -2SD defines the presence of chronic malnutrition (stunting). Among 126 surveyed children, the prevalence of stunting was found to be 19.8.% where 10.3% were moderately stunted and 9.5% were severely stunted. Figure 4.4 shows that the median height for Age z-score of survey children to be -1.016 which is less than the reference to WHO standard. This curve is skewed to the left side of WHO standard curve showing high prevalence of stunting among study population.

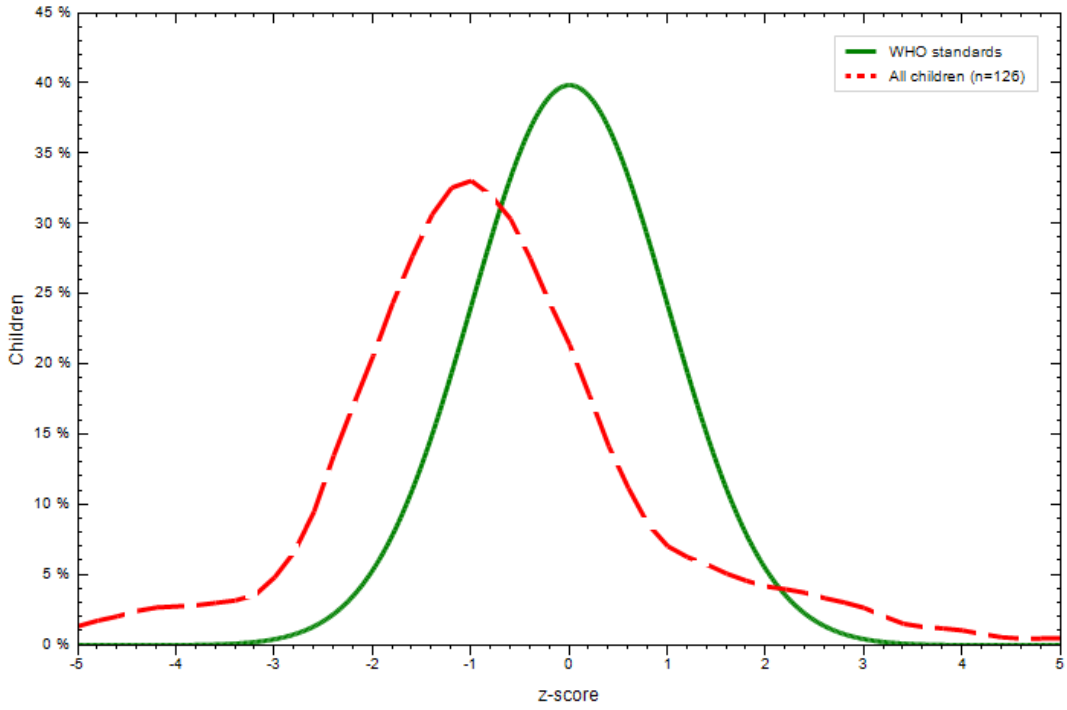

Figure 4.6 Height for age curve with reference WHO standard

4.7 Distribution of malnutrition based on MUAC

Based on MUAC measurement, no children were found to be severely malnourished, 0.8% were moderately malnourished and 99.2% were found to be normal.

Table 4.9 Distribution of malnutrition based on MUAC

MUAC categorization	Frequency	Percent %
Normal	125	99.2
moderately acute malnourished	1	0.8
Severely acute malnourished	Nil	Nil
Total	126	100

Similarly, a study conducted at *Sukumbashi basti* northwest boundary of *sardhu khola,* Dharan concludes 2.5% of children had suffered from severe acute malnutrition while 19.7% had moderate acute malnutrition based on MUAC (Basnet, 2017).

4.8 Factors associated with under nutrition of children

Under nutrition was assessed by stunting, wasting and underweight. Fisher's exact test were used to identify the characteristics that were related to nutritional status of children.

4.8.1 Factors associated with stunting

Table 4.10 Factors associated with stunting (n=126)

Factors	**HAZ**		**P-value**
	Stunted	**Normal**	
Sex			
Male	16 (23.9%)	51 (76.1%)	0.267
Female	9 (15.3%)	50 (84.7%)	
Family size			
< 5	11 (25%)	33 (75%)	0.35
≥ 5	14 (17.1%)	101 (80.2%)	
Age of child			
< 24 months	9 (36%)	16 (64%)	0.046
≥ 24 months	16 (15.8%)	85 (84.2%)	
Birth order			
first child	18 (24%)	57 (76%)	0.179
Other child	7 (13.7%)	44 (86.3%)	
Drinking water purification			
Yes	19 (18.4%)	84 (81.6%)	0.398
No	6 (26.1%)	17 (73.9%)	
Time of initiation of breastfeeding			
Within 1 hour of birth	20 (17.9%)	92 (82.1%)	0.151
After 1 hours of birth	5 (35.7%)	9 (64.3%)	
Birth weight			
< 2.5 kg	5 (23.8%)	16 (76.2%)	0.765
> 2.5 kg	19 (19.4%)	79 (80.6%)	

Meat and fish intake by child per week			
< 2 times	12 (25%)	36 (75%)	0.261
≥ 2 times	13 (16.7%)	65 (83.3%)	
Pulses and legumes intake by child per week			
< 2 times	1 (7.7%)	12 (92.3%)	0.462
≥ 2 times	24 (21.2%)	89 (78.8%)	
Vegetable intake by child per week			
< 2 times	6 (31.6%)	13 (68.4%)	0.210
≥ 2 times	19 (17.8%)	88 (82.2%)	
Milk and milk product intake by child per week			
< 2 times	8 (34.8%)	15 (65.2%)	0.078
≥ 2 times	17 (16.5%)	86 (83.5%)	
Family size			
< 5	11 (25%)	33 (75%)	0.35
≥ 5	14 (17.1%)	101 (80.2%)	

*****Fisher's exact value, ° Statistically significant (P<0.05)

Table 4.12 shows that there was significant association of stunting with age of child (P=0.046).

The survey shows that there was significant association of stunting with age of children. The prevalence of stunting increases as the age of child increases. Moreover, our study supports this finding in which children with age group of 12-23 months were more likely to be stunted as compared with children in other groups. This was found similar with the study conducted in under five year children in Tigray, Northern Ethiopia (Mussie., 2014). This could be due to poor weaning and complementary feeding practices resulting into inadequate energy and protein intake. The poor feeding practice may be due to either lack of knowledge of mother or lack of adequate food.

4.8.2 Factors associated with underweight

Table 4.13 shows that, there was significant association of underweight with home garden (p=0.03).

Table 4.11 Factors associated with underweight (n=126)

Factors	**WAZ**		**P-value**
	Underweight	**Normal**	
Sex			
Male	9 (13.4%)	58 (86.6%)	0.411
Female	5 (8.5%)	54 (91.5%)	
Education			
Illiterate	2 (20%)	8 (80%)	0.307
Educated	12 (10.3%)	104 (89.7%)	
Family size			
< 5	4 (9.1%)	40 (90.9%)	0.769
≥ 5	10 (12.2%)	72 (87.8%)	
Age of child			
< 24 months	5 (20%)	20 (80%)	0.151
≥ 24 months	9 (8.9%)	92 (91.1%)	
Annual income			
< 1 lakh	1 (33.3%)	2 (66.7%)	0.302
≥ 1 lakh	13 (10.6%)	110 (89.4%)	
Birth order			
First child	11 (14.7%)	64 (85.3%)	0.155
other child	3 (5.9%)	48 (94.1%)	
Drinking water purification			
Yes	11 (10.7%)	92 (89.3%)	0.719
No	3 (13%)	20 (87%)	
Time of initiation of breastfeeding			
Within 1 hour of birth	12 (10.7%)	100 (89.3%)	0.655
After 1 hours of birth	2 (14.3%)	12 (85.7%)	

Birth weight			
< 2.5 kg	5 (23.8%)	16 (76.2%)	0.072
≥ 2.5 kg	9 (9.2%)	89 (90.8%)	
Home garden			
Yes	9 (8.3%)	99 (91.7%)	0.03
No	5 (27.8%)	13 (72.2%)	
Age of marriage			
< 20 or 20 years	72 (92.3%)	6 (7.7%)	0.104
>20 years	40 (83.3%)	8 (16.7%)	
Age of Pregnancy			
< 20 or 20 years	39 (88.6%)	5 (11.4%)	0.582
>20 years	73 (89)	9 (11%)	
Meat and fish intake by child per week			
< 2 times	6 (12.5%)	42 (87.5%)	0.773
≥ 2 times	8 (10.3%)	70 (89.7%)	
Pulses and legumes intake by child per week			
< 2 times	2 (15.4%)	11 (84.6%)	0.638
≥ 2 times	12 (10.6%)	101 (89.4%)	
Vegetables intake by child per week			
< 2 times	0 (0%)	19 (100%)	0.126
≥ 2 times	14 (13.1%)	93 (86.9%)	
Milk and milk product intake by child per week			
< 2 times	4 (17.4%)	19 (82.6%)	0.284
≥ 2 times	10 (9.7%)	93 (90.3%)	

*****Fisher's exact value, ° Statistically significant (P<0.05)

Significant association of home garden (p=0.003) with underweight is found similar to research conducted in South Ethiopia i.e. households without home garden children

were more underweight. 27.8% children without home garden were found underweight which percentage is also nearly similar to the Ethiopia research (30%). Home garden practices have been documented as an important supplemental source contributing to food and nutritional security and livelihoods (Petros *et al.*, 2018).

4.8.3 Factors associated with wasting

Table 4.14 showed that there was significant association of wasting with family size (p=0.049), birth weight (p=0.024) and milk and milk product intake by child (p=0.005).

Table 4.12 Factors associated with wasting (n=126)

Factors	**WHZ**		**P-value**
	Wasted	**Normal**	
Sex			
Male	7 (10.4%)	60 (89.6%)	0.540
Female	4 (6.8%)	55 (93.2%)	
Education			
Illiterate	2 (20%)	8 (80%)	0.212
Educated	9 (7.8%)	107 (92.2%)	
Family size			
< 5	4 (4.9%)	78 (95.1%)	0.049
≥ 5	7 (15.9%)	37 (84.1%)	
Age of child			
< 24 months	3 (12%)	22 (88%)	0.455
≥ 24 months	8 (7.9%)	93 (92.1%)	
Annual income			
< 1 lakh	1 (33.3%)	2 (66.7%)	0.243
≥ 1 lakh	10 (8.2%)	113 (91.9%)	
Birth order			
first child	8 (10.7%)	67 (89.3%)	0.523
other child	3 (5.9%)	48 (94.1%)	
Age of pregnancy			
< 20 or 20 years	38 (86.4%)	6 (13.6%)	0.137

>20 years	77 (93.9%)	5 (6.1%)	
Age of marriage			
< 20 or 20 years	70 (89.7%)	8 (10.3%)	0.334
>20 years	45 (93.8)	3 (6.2)	
Drinking water purification			
Yes	7 (6.8)	96 (93.2%)	0.115
No	4 (17.4%)	19 (82.6%)	
Time of initiation of breastfeeding			
Within 1 hour of birth	8 (7.1%)	104 (92.9%)	0.106
After 1 hours of birth	3 (21.4%)	11 (78.6%)	
Birth weight			
<2.5	5 (23.8%)	16 (76.2%)	0.024
>2.5	6 (6.1%)	92 (93.9%)	
Meat and fish intake by child per week			
< 2 times	7 (14.6%)	41 (85.4%)	0.102
≥ 2 times	4 (5.1%)	74 (94.9%)	
Vegetables intake by child per week			
< 2 times	2 (10.5%)	17 (89.5%)	0.671
≥ 2 times	9 (8.4%)	98 (91.6%)	
Milk and milk product intake by child per week			
< 2 times	6 (26.1%)	17 (73.9%)	0.005
≥ 2 times	5 (4.9%)	98 (95.1%)	

*****Fisher's exact value, ° Statistically significant (P<0.05)

Statistically significant association was between the family size and wasting (P=0.049). It would be possible to relate that increased size of the family in Ethiopia implies the increased dependency ratio, which further burden for the typical households. The finding of this study indicates the positive association between wasting

and having larger family size (Adeba *et al.*, 2014). Child birth weight was also significant with wasting (p=0.024) which is similar to the research conducted in Bangladesh where wasting on low birth weight children was higher than normal birth weight children. Wasting on low birth weight children on Bangladesh is 24.6% and this study is 23.8%. Low birth weight of child is due to lack of mother's education and other socio-demographic conditions (Rahman *et al.*, 2016).

Wasting (0.005) is significantly associated with milk and milk protein intake by child per week. There is convincing evidence that dairy protein has a specific stimulating effect on linear growth and that it is also effective in promoting weight gain in children with malnutrition (Michaelsen, 2013). Among children who drank milk at age 4 years, higher milk consumption was associated with higher z-scores of BMI, height and weight-for-height at 4 years (all $p<0.05$) (DeBoer *et al.*, 2015). A Malaysian study measured the impact of the school milk program on the nutritional status of children. A significant reduction in the prevalence of protein–energy malnutrition was determined in terms of wasting (2.6% to 1.7%) from the start of the school feeding program until two years later (N, 2016).

PART V

Conclusion and Recommendation

5.1 Conclusion

Conclusively, this study has generally assessed the nutritional status of 6-59 months children of Dharan-6, Panbari and findings are important to understand prevalence and determinants of nutritional status among 6-59 months children in Dharan-6, Panbari. The results of the study indicate that malnutrition is still an important problem among children of 6-59 months in Dharan-6, Panbari. From this study the following points can be concluded:

a) The overall magnitude of malnutrition among 6-59 months children of Dharan-6, Panbari was 8.7%, 19.8% and 11.1% for wasting, stunting and underweight respectively. Among them severely wasted, severely stunted and severely underweight was found to be 2.4%, 9.5% and 1.6% respectively.

b) The highest percentage of wasting was found in the age group 6-12 months 22.2%. Stunting was found highest in the age group 12-23 months 43.8% and underweight in the age group 12-23 months 25%. Male children were more affected by the under nutrition than female children.

c) There was significant association of stunting with age of child.

d) Home garden were associated with underweight.

e) There was significant association of wasting with family size, milk and milk product intake by child per week and birth weight.

f) Based on MUAC, moderate wasting was found to be 0.8% and there is no severely wasted children.

g) This study points out the need of making a comprehensive, integrated and multi-sectorial plan for addressing the problem of malnutrition in long term.

5.2 Recommendation

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

a) Different nutritional related education through health workers and mobilization of FCHVs like timely introduction of complementary and feeding food behavior should be advocated to uplift the feeding practices.

b) People of survey area should be encourage to feed their children milk and milk products, also encourage for home gardening to improve nutritional status.

c) Public awareness programs should be launched in the area in regard to improve the anti-natal and post-natal care of mother which is important for better nutritional status of child.

Part VI

Summary

In developing countries like Nepal, malnutrition is a major public health problem. According to NDHS 2016 shows that, 36% of children under five years of age are stunted, 10% are wasted and 27% are underweight (MoHP., 2016). A community based cross-sectional study was conducted to assess the factors associated with nutritional status of 6 – 59 months children in Dharan-6, Panbari of Sunsari District, Nepal. The study included 126 children selected using simple random sampling technique; anthropometric measurements (weight, height, MUAC) were performed to find the nutritional status of children. A structured questionnaire was administered to the mother or caretaker of children to determine the associated factors. Data collected was analyzed using WHO Anthro version 3.2.2 and SPSS version 20. Fisher's test was used to analyze the factors associated with nutritional status.

According to length/height for age, 19.8% of children were stunted. Among them, 9.5% were severely stunted and 10.3% were moderately stunted. Stunting was found higher in male 23.9% than female 15.3% and the highest percentage of stunting 43.8% was found in age group 12-23 months.

According to weight for age, 11.1% of children were underweight. Among them, 1.6% were severely underweight and 9.5% were moderately underweight. Prevalence of underweight was found higher in male (13.4%) than female (8.5%) and the highest percentage of underweight (25%) was found in age group 12-23 months.

According to weight for height, 8.7% of children were wasted. Among them, 2.4% were severely wasted and 6.3% were moderately wasted. Prevalence of wasting was found higher in male (10.4%) than female (6.8%) and the highest percentage of wasting (22.2%) was found in age group 6-11 months.

Fisher's exact test analysis of the determinants of nutritional status indicated that, there was significant association of stunting with age of child (P=0.046). Similarly, home garden (p=0.03) were significantly associated with underweight. There was significant association of wasting with family size (p=0.049), child birth weight (p=0.024) and milk and milk product intake by child (p=0.005).

Reference

ACF., I. and Network. (2009). Acute Malnutrition: A Preventable Pandemic.

Adeba, A., Garoma, S., Fakadu, H. and Garoma, W. (2014). Prevalence's of wasting and its associated factors of children among 6-59 months age in Guto Gida district, Oromia regional state, Ethiopia. **5** (1).

Adhikari, O. (2015). Assessment of Nutritional Status of Children 6 – 59 Months of Age and Factors Associated with it in Nirajan (SUKUMBASI) Basti, Dharan-15 Dissertation Tribhuvan University,

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, ,

Arnon, S. (1984). Breast feeding and toxigenic intestinal infections: Missing links in crib deaths? **6**, 193-201.

Basnet, s. (2017). Factors associated with nutritional status of 6-59 months children in Sukumbashi basti northwest boundary of sardhu khola, Dharan. Dissertation Tribhuwan University,

Bhandari, S. and Banjara, R. M. (2015). "Micronutrients Deficiency, a Hidden Hunger in Nepal: Prevalence, Causes, Consequences, and Solutions.".

Bhatta., K., Mishra., S. and Gurung, G. (1998). Nutritional status of Bishanku Narayan Village. pp. 614-619.

Burk, M. (1984). Brief introduction for food economics to malnutrition problems.Integration Nutrition into Agriculture and Rural Development project. A mannual nutrition in agriculture. .

Caballero., B. and and Maqboal, A. (2003). "International Nutrition. In W. Walker, Watkins, J.& Duggan, C. (Ed.), Nutrition in Pediatrics". London: BC Decker Inc.

CBS. (2012). Breastfeeding and Infant and Young child Feeding in Nepal [Report]. Government of Nepal, Central Bureau of Statistics. Kathmandu, Nepal, Retrieved from www.cbs.gov.np.

CBS. (2014, March). "National Population and Housing Census 2011 (Village Development Committee/Municipality)SUNSARI". Report No. 6. p. p.27.

Retrieved from http://cbs.gov.np/image/data/Population/VDC-Municipality%20in%20detail/06%20Sunsari_VDCLevelReport.pdf.

CBS. and UNICEF. (2014). "Multiple Indicator Cluster Survey". p. 26.

Chandra, R., and Kumari, S. (1994). Nutrition and Immunity: An Overview. **124** (18), 1433-1435.

Chua, S., Aralkuraran, S. and and Lim, L. (1994). Influence of breastfeeding and nipple stimulation in postpartum uterine activity. **101**, 804-805.

Cochi, S., Fleming, D. and and Hightower, A. (1986). Primary invasive haemophilus influenza type b disease: A population-based assessment of risk factors. **108**, 887-896.

Collins, S., Dent, N., Binns, P., Bahwere, P., Sadler and K. and Hallam, A. (2006). Management of severe acute malnutrition in children. The Lancet. 368, 1992-2000. .

Cumming, R. a. K., R. (1993). Breastfeeding and other reproductive factors and the risk of hip fractures in elderly women. **22**, 684-691.

Davis, M., Savitz, D. and and Graubarad, R. (1988). Infant feeding and childhood cancer. **2**, 365-368.

DeBoer, M. D., Agard, H. E. and Scharf, R. J. (2015). Milk intake, height and body mass index in preschool children. **100** (5), 460-465. 10.1136/archdischild-2014-306958.

Devkota., C. S., De, A. and Sathian, B. (2015). Nutritional Deficiencies: Major Public Health Problem in Nepal. 3.

Dewey, K., Heinig, M. and and Nommsen, L. (1995). Differences in morbidity between breast-fed and formula-fed infants. **126**, 696-702.

FAO. (2005). "Nutrition :A Guide to Data Collection, Analysis, Interpretation and Us.".

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. Divison. Eds Rome, Italy.

Ford, R., Taylor, B. and and Mitchell, E. (1993). "Breastfeeding and the risk of sudden infant death syndrome". **22**, 885-890.

Gerestein, H. (1994). Cow‟s milk exposure and type l diabetes mellitus. **17**, 13-19.

Gharti, C. (2005). Factors associated with Malnutrition among Children in Rural Terai of Eastern Nepal. Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), India,

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.

Gomez., F., Golvan., R., Craviato, J. and Fronk, E. (1955). (Malnutrition in infancy and childhood with special preference to kwashiorkor.

Google map. (2018). Map data.

Gorstein, J., Shrestha, R., Pandey, S., Adhikari, R. and 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.

Harmeet, K. (2018). Assessment of nutritional status of under-5 children using who growth standards. **7** (7), 30.

Hartog, A. P. d., Staveren, W. A. v. and Brouwer, I. D. (2006). "Food habits and consumption in developing countries". Wageningen Academic. The Netherlands.

Hommes. (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.

Jellife, D. B. (1966). "The Assessment of the Nutritional Status of the Community.". World Health Organization. Geneva, Switzerland.

Joshi. (2008). ""Basics of Clinical Nutrition"". Jaypee Brothers Medical Publishers (P) LTD. Ansari Road, Daryanganj.

Joshi. (2016). ""Nutrition And Dietetics"" (Fourth ed.). McGraw Hill Education (India) Private limited. Chennai, India.

Katwal, H. (1992). An Area Nutritional Survey. Central Campus of Technology,. Tribhuvan University,

Keller, W. (1982). "Choices of Indicator of Nutritional Status".

Khanna, K., Gupta, S., Passi, S. J., Seth, R., Mahna, R. and Puri, S. (2005). "Nutrition and Dietetics" (1 st ed.). Elite Publishing House Pvt. Ltd. New Delhi.

Koletzko, S., Sherman, P., Corey, M., Griffiths, A. and and Smith, C. (1989). Role of infant feeding practices in development of crohn‟s disease in childhood. (298), 1617-1618.

Michaelsen, K. F. (2013). Cow's Milk in the Prevention and Treatment of Stunting and Wasting. **34** (2), 249-251. 10.1177/156482651303400219.

MoHP. (2011). Nepal Demographic and Health Survey [Report]. Ministry of Health and Population, New ERA, Nepal and ICF International Calverton Maryland, USA

Kathmandu, Nepal, Nepal.

MoHP. (2006). "Nepal Demographic and Health Survey". Kathmandu: Ministry of Health and Population, New ERA, Nepal and ICF International Calverton Merryland, USA

MoHP. (2011). "Nepal Demographic and Health Survey". Kathmandu: Ministry of Health and Population, New ERA, Nepal and ICF International Calverton Merryland, USA

MoHP. (2016). "Nepal Demographic and Health Survey.". Kathmandu: Ministry of Health and Population, New ERA, Nepal and ICF International Calverton Merryland, USA

Muller, O. and Michael , K. (2005). Malnutrition and Health In Developing Countries. . **173**, pp. 279 -286.

Mussie. (2014). Nutritional Status and Associated Factors among Under- Five Children Tigray,Norther Ethopia. 579-586.

N, I. (2016). "Role of Protein-Based Food (PBF) in Combating Undernutrition; Milk and Eggs as an Example". Vol. 6.

Newcomb, P., Storer., B. and Longnecker., a. M. (1994). Lactation and a reduced risk of premenopausal breast cancer. **330**, 81-87.

Nidhi, s. k. (2002). Weaning practices in Nepal. **52**, pp. 6.

Niraula, S. P., Barnwal, S. P., Paudel, S., Mishra, S., Dahal, S., Das, S., Pradhan, S., Ghimire, S., Khanal, S., Sharma, S., Rajput, S., Bhattarai, S. and and Jha, N. (2013). Prevalence and associated risk factors with malnutrition among under-five Nepalese children of Borbote village, Ilam. **11**, 111-118.

Onis, M. and Blossner, M. (2003). Global Database on Child Growth and Malnutrition. **32**.

Otten, J. J., Hellwig, J. P. and and Meyers, L. D. (2006). "Dietary Reference Intakes: The Essential Guide to Nutrient Requirements ". The National Academies Press. Washington DC.

Passimore, D. (1986). "Human Nutrition & Dietetics".Churchil, Livingstone.

Petros, L., Mulugeta, A., Kabeta, A. and Fekadu, T. (2018). Comparison of Nutritional Status of Pre-school Children from Households with Home Garden and Without Home Garden in Wondogenet Woreda, South Ethiopia. **15** (292), 2.

Pisacane, A., L. Grazinno and Mazzarella, G. (1992). Breastfeeding and urinary tract infection. **120**, 87-89.

Rahman, M. S., Howlader, T., Masud, M. S. and Rahman, M. L. (2016). Association of Low-Birth Weight with Malnutrition in Children under Five Years in Bangladesh: Do Mother's Education, Socio-Economic Status, and Birth Interval Matter? **11** (6), e0157814. 10.1371/journal.pone.0157814.

Ramchandran, P. (1987). ""In Nutrition:Monitoring and Assessment"". Oxford University Press. India.

Rashed, S. (2009). ASSESSMENT OF NUTRITIONAL STATUS: Alexandria Faculty of Medicine.

Rigas, A., Rigas, B. and and Glassman, M. (1993). Breastfeeding and maternal smoking in the etiology of crohn‟s disease and ulcerative colitis in childhood. **3**, 387-392.

Salam, A., R., Phail, M., C., Das, K. and J., a. B., A., Z.,. . (2013). Effectiveness of Micronutrient Powders (MNP) in women and children. **13**.

Sandberg, D., Smith, M., Fornari, V. and Godstein, M. a. L., F. (1991). Nutritional dwarfing: is it a consequence of disturbed psychosocial functioning?

Scoane, N. and Lathan, N. (1971). Nutritional Anthropometry in identification of Malnutrition in Childhood.

Scrimshaw, N. S. (1997). Nutrition from womb to tomb. *In:* "Food and Nutrition Bulletin.18. No 1. ".).

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/utils/getfile/collection/p15738coll2/id/125413/filename/125414.pdf.

Srilakshmi, B. (2002). ""Nutrition Science"" (1st ed.). New Age International (p) Ltd. Delhi, India.

Srilakshmi, B. (2014). "Dietetics". Vol. 7. New Age International (P) Ltd. New Delhi.

Srilakshmi, B. (2016). ""Nutrition Science"" (5th ed.). New Age International (p) Ltd. Delhi, India.

Sveger, T. (1985). Breastfeeding, beta-antitrypsin deficiency and liver disease. **254** (3036).

Swaminathan, M. (1991). " Advanced Text Book on food and Nutrition" (second ed.).Madras, India:BAPPCO.

Swaminathan, M. (2008). "Food and Nutrition" (2 nd ed.). Vol. II. Bangalore Printing & Publishing Co. , Ltd. Bangalore.

UN. (2010). Multisectoral Plan for Chronic Malnutrition Reduction in Mozambique 2011-2014 (2020) [Report]. Mozambique,

UNICEF. (2006). "Progress for Children, Defination of Malnutrition".

UNICEF. (2013). Stunting [Report]. India, india., Retrieved from http://unicef.in/Whatwedo/10/Stunting.

UNICEF. (2016). Breastfeeding Week Promotes Better Nutrtition and Child Health in Nepal.

UNICEF. (1996). Nepal Multiple Indicator Surveillance. [Report].

UNICEF. (2016). Breastfeeding Week Promotes Better Nutrtition and Child Health in Nepal.

UNICEF. and Valid International. (2015). NEPAL Integrated Management of Acute Malnutrition(IMAM) Guideline *In.*).

UNWFP. (2008). Fighting Hunger World Wide. What is Malnutrition? New York: United Nation.

Vaidya, Y. (1987). Weaning food in Nepal. [Cited in R. Gyawali. (2002). Nutritional survey of Satar community. M. Tech. Dissertation].

Waterlow, J. and Ruthishause, I. (1974). "Malnutrition in man -in choice of indicator of nutrtitional status". Vol. 3. Hans Huber Publisher. Vienna.

WFP. (2011). Forms of Malnutrition.

WHO. (1962). Expert Committee On Medical Assessment of Nutritional status [Report]. Vol. 258. World Health Organisations. Geneva, Switzerland, Retrieved from http://whqlibdoc.who.int/trs/WHO_TRS_258.pdf.

WHO. (1966). Forms of malnutrition [Report]. New York,

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

WHO. (1996). Protein Energy Malnutrition its Types and Causes.

WHO. (2005). Evaluating the public health significance of micronutrient malnutrition. [Report]. Vol. 2. WHO.

WHO. (2015). Global Database on Child Growth and Malnutrition. Retrieved from http://www.who.int/nutgrowthdb/about/introduction/en/index6.html.

WHO/FAO. (2004). "Vitamin and Mineral Requirements in Human Nutrition" (2 ed.). World Health Organization. Geneva, Switzerland.

Wright, A., Holberg, C. and and Martinez, F. (1989). Breast feeding and lower respiratory tract illness in the first year of life. **299**, 945-949.

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

PART VI

Appendices

Appendix-A

Consent letter

केन्द्रिय प्राविधि क्याम्पस

हात्तिसार ,धरान

पोषण तथा आहार बिज्ञान ,चौथो बर्ष

मन्जुरिनामा

नमस्कार,

मेरो नाम मिलन रा**ई** हो,म केन्द्रिय प्राविधि क्याम्पस ,धरानमा पोषण तथा आहार बिज्ञान)BND),चौथो बर्षमा अध्ययनरत बिध्यार्थी हु ।यस संकायको चौथो बर्षको पाठ्यक्रम अन्तर्गतम सोधपत्र गरिरहेको छु । मेरो सोधकार्यको बिषय *"धरान उपमहानगरपालिकाको पानमारामा ६ देखि ५९ महिनाका बालबालिकाहरुको पोषण स्थितिको अध्ययन"* रहेको छ । यो अध्ययनको उदेश्य यहाँको बालबालिकाको पोषण स्थितिको बारे जानकारी संकलन गर्नु रहेको छ । यो जानकारीले हाम्रो अध्यनलाई सहज बनाई हामीलाई सहयोग गर्ने छ र यसले यस उपनगरपालिकाको पोषण स्थितिलाई सुधार गर्नलाई केहि मदत गर्न सक्नेछ।

तपाइको छोरा / छोरी यस अध्ययनको लागि सहभागी हुन छानिनु भएको छ र म तपाइलाई यस सर्वेक्षणका केहि प्रश्नहरु गर्नेछु साथै तपाइको बच्चाको केहि नाप लिने छु । यो सर्वेक्षणले तपाइको बच्चाको पोषण स्थित बारे थाहा हुन्छ र बच्चालाई पोषण सम्बन्धि बिशेस हेरचाह आवश्यक पर्ने वा नपर्ने पनि थाहा पाउन सक्नु हुनेछ । अध्ययनका केहि प्रश्नहरु नितान्त व्यक्तिगत पनि हुन सक्छन र तपाइले दिनुभएको सबै जानकारीहरु महत्वपूर्ण हुनेछन र सो जानकारीहरु एकदमै गोप्य राखिने छ साथै तपैले दिनुभएको सूचना तथा तथ्यांकको दुरुपयोग गरिने छैन । यो अध्ययन मा तपाइको सहभागिता स्वेच्छाले हुनेछ । यदि तपाइलाई कुनै वा सबै प्रश्न व्यक्तिगत वा सम्वेदनशिल लागेमा उत्तर नदिन पनि सक्नुहुन्छ । तर म यो आशा गर्दछु कि तपाई यस अध्ययनमा सहभागी हुनुहुनेछ।

के तपाई यस अध्ययनमा सहभागी हुन इच्छुक हुनुहुन्छ ?) इच्छुक भए मात्र प्रश्न गर्ने)

म यस अध्ययनमा सहभागी हुन इच्छुक छु र यस अध्ययनका लागि आवश्यक पर्ने मेरो बच्चाको नापतौल लिन अनुमति दिन्छु:

अन्तरबार्ता लिनेको सहि ..... : अन्तरबार्ता दिनेको सहि..... :

Appendix B

Survey Questionaire

<u>सर्वेक्षण प्रश्नपत्र</u>

फारम न.....:अन्तर्वार्ताको मिति :२०७५..../..../

खण्ड १ :सामान्य जानकारीहरु) उत्तर्दतालाई सोध्ने(

१. बच्चाको नाम :.....

२. जन्म मिति :...../...../.....

३. बुबाको नाम :.....

४. आमाको नाम :.....

५. धर्म :.....

६. ठेगाना, वार्ड न:.....

७. शारीरिक जांच र **पोषण स्थिति:**

Weight(kg)	Height(cm)	Oedema	Age (month)	MUAC(cm)	Sex
					Male female

खण्ड २: पारिवारिक विवरण(उत्तरदातालाई सोध्ने)

८. जम्मा परिवार सदस्य संख्या:

१)महिला संख्या :..... २)पुरूष संख्या:..... ३)**६** देखि **५९** महिनाको बच्चा:.....

९. पेशा:

१)बाबुको:..... २) आमाको:.....

१०. शिक्षा?

१) बुबाको(निरक्षर, ...) २)आमाको(निरक्षर, ...)

११. बार्षिक आम्दानी (परिवारको)

१)**१** लाखभन्दा कम २) **१** लाख देखि **३** लाखसम्म ३) **३** लाखभन्दा बढि

१२. तपाइको घरमा अहिले सम्म कुनै बच्चाको मृत्यु भएको छ ?

१)छ २. छैन

१३. छ भने कारण:.....

१४. यो बच्चा तपाइको कति औ सन्तान हो?.....

१५. बच्चाको जन्म कस्तो प्रकारको हो?

१)प्राकृतिक २) शल्यक्रिया गरेर

१६. बच्चाको जन्मदाको तौल?

१)२.५ के.जी भन्दा कम २) २.५ के.जी भन्दा बढि

१७. यो बच्चा जन्मिदा अघिल्लो बच्चाको उमेर कति थियो ? ..... वर्ष/महिना

खण्ड ३: व्यक्तिगत तथा वातावरणिय स्वास्थ

१८. तपाईले पिउनका लागि प्रयोग गर्ने पानीको श्रोत क हो ?.....

१९. तपाईले पिउने पानीको शुद्दिकरण गर्नु हुन्छ कि हुदैन ?

१)गर्छु २)गर्दिन

२०. चर्पीको प्रयोग गर्नुहुन्छ कि गर्नुहुन्न?

१)गर्छु २) गर्दिन

२१. घरमा खान बनाउन उर्जाको स्रोतको रुपमा के को प्रयोग गर्नुहुन्छ?.....

२२. फोहोर मेलाको उचित ब्यबस्थापन गर्नुहुन्छ कि गर्नुहुन्न?

१)गर्छु २) गर्दिन

खण्ड ४: आमालाई सोध्ने पोषण र स्तनपान सम्बन्धि प्रस्नहरु

२३. तपाईलाई स्वास्थ समस्या (recent) कुनै छ कि छैन?.....

२४. बच्चालाई स्वास्थ समस्या (recent) कुनै छ कि छैन?.....

२५. बच्चा जन्मेको १ घन्टाभित्र आफ्नो बिगौती दूध खुवाउनुभयो कि खुवाउनुभएन?

१)खुवाए २) खुवाइन

२६. बच्चालाई ६ महिना सम्म आफ्नो दुध खुवाउनु भयो ?

१)खुवाए २) खुवाइन

२७. बच्चालाई २ बर्ससम्म स्तनपान गराउनुभयो कि भएन?

१)गराए २) गराइन

२८. बच्चालाई कस्तो खालको पुरक आहार खुवाउनुभयो?.....

२९. बच्चालाई कस्तो खालको नुन खुवाउनुभयो?

१)आयोडिनयुक्त २) साधारण

३०. तपाइको विवाह हुदा तपाई कति बर्षको हुनुहुन्थ्यो ?..... बर्ष

३१. तपाइको पहिलो बच्चा हुदा तपाई कति बर्षको हुनुहुन्थ्यो ?..... बर्ष

३२. घरमा करेशाबरी छ?

१)छ २) छैन

३३. बच्चाले हप्तामा कतिपटक माछा मासु खान्छ?

१)२ पटकभन्दा कम २) २ देखि ४ पटक ३) ४ पटकभन्दा बढि ४) खंदैन

३४. बच्चाले हप्तामा कतिपटक गेडागुडी खान्छ?

१)२ पटकभन्दा कम २) २ देखि ४ पटक ३) ४ पटकभन्दा बढि ४) खंदैन

३५. बच्चाले हप्तामा कतिपटक हरियो साग खान्छ?

१)२ पटकभन्दा कम २) २ देखि ४ पटक ३) ४ पटकभन्दा बढि ४) खंदै

३६. बच्चाले हप्तामा कतिपटक दूध तथा त्यसका परिकार खान्छ?

१)२ पटकभन्दा कम २) २ देखि ४ पटक ३) ४ पटकभन्दा बढि ४) खंदै

खण्ड ५: रोग र खोप बारे विवरण(आमालाई सोध्ने)

३७. तपाई गर्भवती हुदा खोप लगाउनु भएको थियो ?

१)थियो २) थिएन

३८. तपाई गर्भवती हुदा आइरन र फोलिक चक्की खानुभएको थियो ?

१)थियो २) थिएन

३९. तपाईले बच्चालाई भिटामिन ए र जुकाको औषधि खुवाउनु भएको थियो ?

१) थियो २) थिएन

४०. बच्चा बिरामी हुदा कहाँ लैजानु हुन्छ ?

१) स्वास्थ संस्था २) धामीझाक्क्री ३) दुवै ४) अन्य

४१. तपाईले गर्भवती हुदा जुकाको औषधि खानुभएको थियो ?

१) थियो २) थिएन

४२. बच्चालाई हालसम्म सबै खोप लगाउनुभएको छ ?

१) छ २) छैन

४३. तपाई धुम्रपान गर्नुहुन्छ कि गर्नुहुन्न?

१) गर्छु २) गर्दिन

४४. तपाई मध्यपान गर्नुहुन्छ कि गर्नुहुन्न?

१) गर्छु २) गर्दिन

Appendix C

Photo Gallery

Measurement of Height

Measurement of height of Under 2 Years child

Measurement of MUAC

Questionaire test