ASSOCIATION BETWEEN MOTHERS KNOWLEDGE ON CHILD CARE AND NUTRITIONAL STATUS OF 6-59 MONTHS CHILDREN OF DHARAN SUB METROPOLITAN CITY

by

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Association between Mother's Knowledge on Child Care and Nutritional status of 6-59 months children of Dharan Sub Metropolitan City.

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Approval Letter

This *dissertation* entitled *Association between mother's knowledge on child care and nutritional status of 6-59 months children Dharan sub-metropolitan city* presented by Garima Poudel has been accepted as the partial fulfillment of the requirements for the Bachelor degree in Nutrition and Dietetics.

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Garima Poudel

Abstract

The aim of this study was to find out the nutritional status of 6-59 months children of Dharan Sub-metropolitan city, Sunsari and its association with mother's knowledge on child care. Only one child aged 6-59 months from each household (n=165) of Dharan using probability proportionate sampling was taken. Anthropometric measurement of the child was taken and data was taken on household socioeconomic characteristics, child characteristics, hygiene and sanitation practice using pre tested semi structured questionnaire. Data were analyzed using SPSS version 20 and WHO Anthro 3.3.2 version. Chi-square test was used to find out the factors associated with nutritional status of the children.

Prevalence of underweight, wasting and stunting was 7.9%, 1.2% and 25.5% respectively. It was seen that prevalence of underweight and wasting was similar in both sexes while stunting was seen higher in female children. Prevalence of stunting was seen high in 12-23 months and 48-59 months aged children. Underweight and wasting was more prevalent in 48-59 months aged children. . More than 30% of the mothers had good knowledge on child care, 57.6% had an average and 9.7% of mothers had poor knowledge on child care. The prevalence of stunting was significantly associated ($P<0.05$) with paternal education status, maternal education status and total annual income of the family. Similarly, study indicated that child weight at birth, knowledge of mother on correct time to initiate complementary feeding and type of complementary feeding given was significantly associated ($P<0.05$) with underweight.

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List of abbreviations

Abbreviation	Full Form
AAP	American Academy of Pediatricians
AAFP	American Academy of Family Physicians
ACOG	American College of Obstetricians and Gynecologists
FCS	Food Consumption Score
HAZ	Height for Age Z-score
ICMR	Indian Council of Medical Research
IDA	Iron Deficiency Anemia
IDD	Iodine Deficiency Disorder
MoHP	Ministry of Health and Population
MUAC	Mid Upper Arm Circumference
NDHS	Nepal Demographic Health Survey
NMICS	Nepal Multiple Indicator Cluster Survey
NPHC	National Population and Housing Census
ORS	Oral Rehydration Solution
ORT	Oral Rehydration Therapy

PCM	Protein Calorie Malnutrition
PEM	Protein Energy Malnutrition
RDA	Recommended Dietary Allowance
SAM	Severe Acute Malnutrition
SD	Standard Deviation
SLC	School leaving Certificate
SPSS	Statistical Package for Social Science
UNICEF	United Nations Children's Fund
VAD	Vitamin A Deficiency
WHZ	Weight for Height Z-score
WBG	World Bank Group
WFP	World Food Program
WHO	World Health Organization
WHZ	Weight for Height Z-score

Part I

Introduction

1.1 Background of the study

The word nutrition means 'the process of nourishing or being nourished,' especially the process by which a living organism assimilates food and uses it for growth and replacement of tissues. 'Nutrients are substances that are essential to life which must be supplied by food (Basavanthappa, 2011). Good nutrition allows children to survive, grow, develop, learn, play, participate and contribute – while malnutrition robs children of their futures and leaves young lives hanging in the balance (UNICEF/WHO/WBG, 2018).

Children under five years of age are very vulnerable to the malnutrition (Onis and Blossner, 2003). One of the important factors responsible for nutritional status of children is mother's education. Maternal education has a strong inverse relationship with all the measures of nutritional status. A high level of maternal education could lower childhood malnutrition, can lead to increased awareness of healthy behavior, sanitation practices and a more equitable sharing of household resources in favor of the children (Smiths and Haddad, 2000). 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 condition, food habits and local food resources. It should include effective demonstration feeding in which mothers take active part (Swaminathan, 2014).

Malnutrition rates remain alarming: stunting is declining too slowly while wasting still impacts the lives of far too many young children. Globally, approximately 151 million (22.2%) children under 5 suffer from stunting. These children begin their lives at a marked disadvantage: they face learning difficulties in school, earn less as adults, and face barriers to participation in their communities. Similarly, nearly 51 million (7.5%) children under 5 were wasted and 16 million were severely wasted. Two out of five stunted children in the world live in South Asia. Almost 58.7 million children in South Asia are stunted. Wasting in Southern Asia constitutes a critical public health emergency. More than half of all

wasted children in the world live in Southern Asia. 26.9 million children in South Asia are stunted (UNICEF/WHO/WBG, 2018).

Long term consequences of under nutrition during the early stages of child growth and development include likelihood of short stature in adult life, low educational achievements, giving birth to smaller children, lower economic status and reduced physical work capacity and productivity in adulthood (Victora *et al.*, 2008).

1.2 Statement of problem and justification

Nepal is one of countries with highest malnutrition rate. In Nepal, the nutritional status of mothers and children under five is extremely poor. Over the last 20 years, no improvement has been observed in the nutritional status of children (MoHP, 2011). Infant and under-5 mortality rates for the five-year period before the survey are 32 and 39 deaths per 1,000 live births, respectively. At these mortality levels, 1 in 25 children in Nepal does not survive to their fifth birthday (MoH *et al.*, 2016).

More than one-third (36%) of children under five in Nepal are stunted, or too short for their age. Stunting is more common in rural children (40%), compared to urban children (32%). By province, stunting ranges from 29% in Provinces 3 and 4 to 55% in Province 6. Children from the poorest households (49%) and whose mothers have no education (46%) are more likely to be stunted. Overall, 10% of children are wasted (too thin for height), a sign of acute malnutrition. In addition, 27% of children are under weight, or too thin for their age. The nutritional status of children in Nepal has improved since 1996. More than half (57%) of children under five were stunted in 1996 compared to 36% in 2016. More than half (53%) of children age 6-59 months are anemic. Anemia is more common in rural children (56%) and those whose mothers have no education (57%). Anemia in children ranges from a low of 43% in Province 3 and a high of 59% in Province 2 (MoH *et al.*, 2016).

Dharan, it is the 8th largest urban city in terms of population size which lies in province no. 1. This area consists of people with various castes, ethnic groups and religion with different economic groups. People of ethnicity Limbu, Rai, Newar, Kshettris etc. cover the major population whereas people of ethnicity Magar, Gurung , Tamang, Marwaris, Dalits etc. cover the minorities (NPHC, 2011).

The reason for choosing Dharan sub metropolitan city for the study is that this area has diverse group of population in terms of ethnicity, culture, education and economic status.

1.3 Conceptual Framework

According to the UNICEF conceptual framework for causes of malnutrition in society, there are immediate, underlying causes and basic or root causes of malnutrition as shown in figure 1.1.

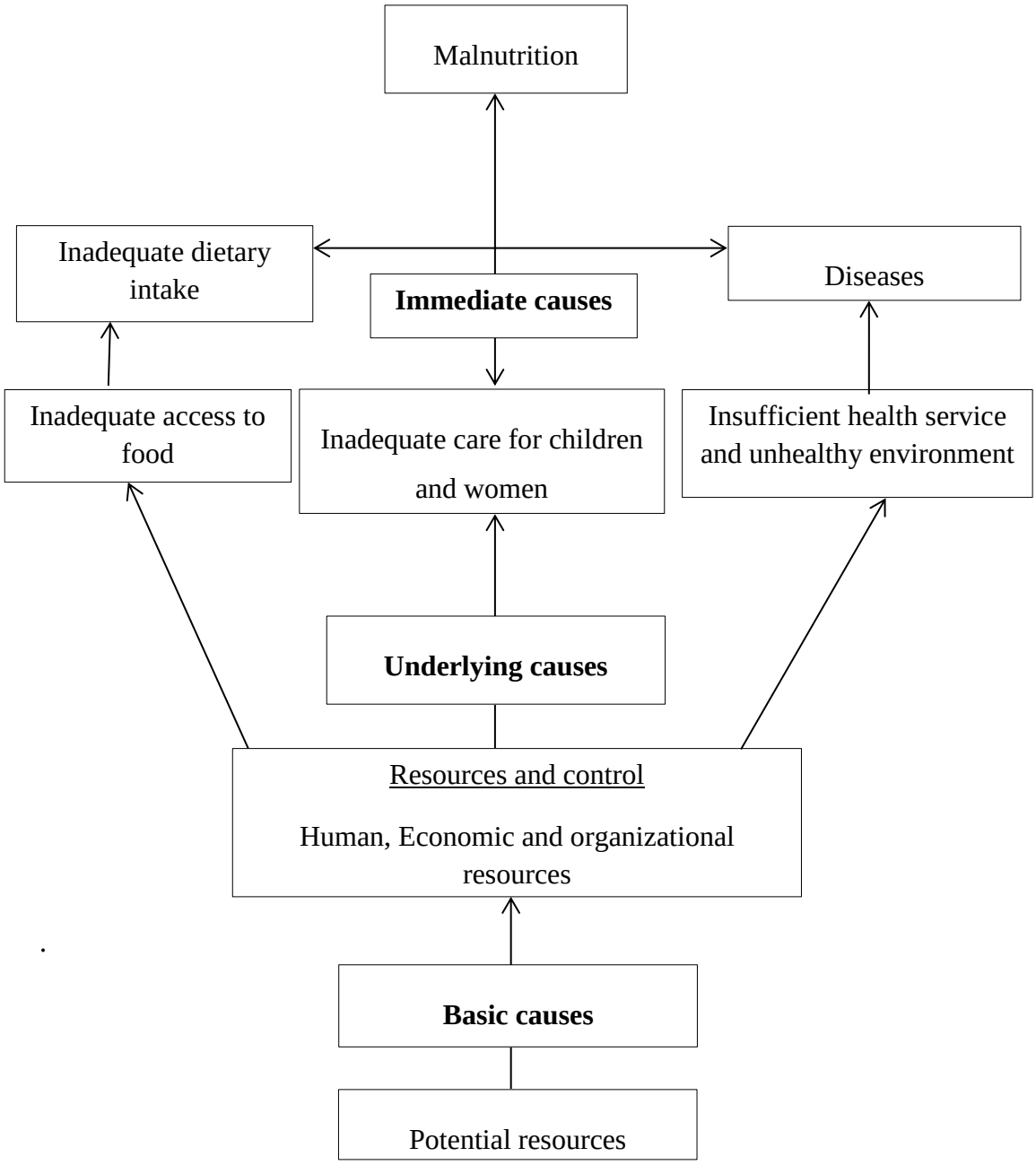

Figure 1.1 UNICEF conceptual framework (UNICEF, 2015)

The basic causes of malnutrition act at societal level which include political, cultural, religious, economic and social systems which limit the utilization of potential organizational, economic and human resources. The underlying causes of malnutrition act at household and family level. They include inadequate care for children and women, inadequate access to food and insufficient health services and unhealthy environment. The immediate causes of malnutrition act at individual level. They include inadequate dietary intake and diseases, which lead to child malnutrition, disability, and death.

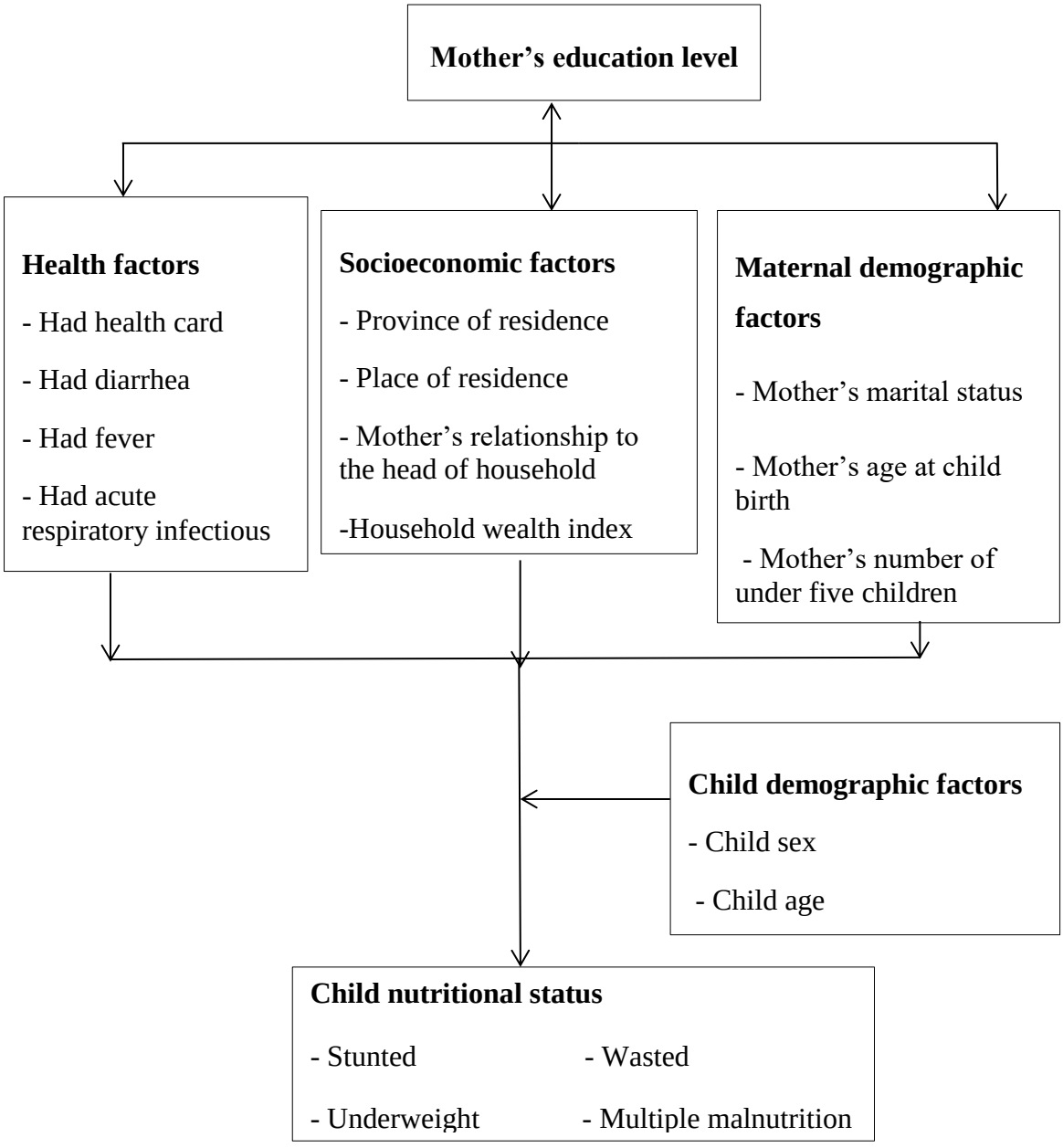

Figure 1.2 – Maternal education and child nutritional status (UNICEF, 2008)

According to the framework shown in figure 1.2, it assumes that maternal education makes difference in child nutritional status is related to socioeconomic status measured in term of household wealth index, place of residence and province of residence; and the relationship of mother to the head of household; maternal health factors measured by possession of health card, diarrheal problems, fever or acute respiratory infections and maternal demographic factors measured by the number of under-five children, maternal age at the index child birth and mother's marital status. Child nutritional status was measured by three indicators: wasting, stunting and underweight.

1.4 Objective of the study

1.4.1 General objective

The general objective of my study was to assess the association between mother's knowledge on child care and nutritional status of under-five year children of Dharan sub-metropolitan city.

1.4.2 Specific objective

The specific objectives of my study were:

a) To assess the prevalence of malnutrition among 6-59 months children of this area.
b) To assess the knowledge of mother on child care practices.
c) To assess the association between mother's knowledge and nutritional status of children.
d) To find out factors directly and indirectly associated with malnutrition.

1.5 Research question

a) What is the existing nutritional status of 6-59months of children of Dharan sub metropolitan city?
b) What is the level of mother's knowledge regarding child care practices?
c) What are the factors associated with the nutritional status of 6-59 months children of Dharan Sub metropolitan city?
d) Is there any association between mother's knowledge on child care and nutritional status of under five years children?

1.6 Significance of the study

a) Give the pictorial view of the nutritional condition of children and prevalence of malnutrition in the community.
b) Identify the individual group of people who are at the risk of being malnourished.
c) Provides the knowledge of awareness level on child care among the mothers of the study area.
d) Act as guide for the development of proper nutritional program in this community by undertaking the discovered facts.

1.7 Limitation of the study

a) Seasonal variation may exist.
b) All ethnic group of the study area might not be included in the survey.
c) The design of the study was cross sectional; so cause effect relationship could not be drawn.

1.8 Assumption

It was assumed that most of the children of the study might be malnourished and most of the mother had poor knowledge on child care practice.

Part II

Literature Review

2.1 Nutrition status

Nutrition has been defined as food at work in the body. Nutrition includes everything that happens to food from the time it is eaten until it is used for various functions in the body. Nutrients are components of food that are needed by the body in adequate amounts in order to grow, reproduce and lead a normal, healthy life. Nutrients include water, proteins, fats, carbohydrates, minerals and vitamins. There are several nutrients in each of the groups: proteins, fats, carbohydrates, minerals and vitamins; hence the plural form of these words has been used. Thus there are over 40 essential nutrients supplied by food, which are used to produce literally thousands of substances necessary for life and physical fitness (Mudambi and Rajagopal, 2012).

Nutritional status is defined as the health status of individuals or population groups as influenced by their intake and utilization of nutrients. The nutritional status is a powerful indicator of nutrition security and well-being of individual and reflects the nutritional and poverty situation of household. The nutritional status of pre-school children is a sensitive indicator, because children are most vulnerable to nutritional imbalances (Peiris and Wijensinghe, 2010). Nutritional status refers to the condition of health of the individual as influenced by the utilization of the nutrients. It can be determined only by the correlation of information obtained through a careful medical and dietary history, through physical examination and appropriate laboratory investigation (Srilakshmi, 2014).

2.2 Malnutrition in children

Malnutrition means an undesirable kind of nutrition leading to ill-health. It results from a lack, excess or imbalance of nutrients in the diet (Mudambi and Rajagopal, 2012). Malnutrition is an important root of infant and young child mortality. It reduces life span and is associated with more than half of all deaths of children worldwide (UNDP., 2008). Among children in developing countries, malnutrition as an important factor contributing to illness and death. Malnutrition during childhood can also affect growth potential and risk of mortality and morbidity in later years of life. Malnutrition among children is rampant among the South Asian countries. About half of all children deaths are associated

with malnutrition, of which three quarters are linked to mild and moderate forms (UNICEF, 2005).

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. Many factors can cause malnutrition, most of which relate to poor diet or severe and repeated infections, particularly in underprivileged populations. Malnutrition is thus a health outcome as well as a risk factor for disease and exacerbated malnutrition, and it can increase the risk both of morbidity and mortality. Although it is rarely the direct cause of death (except in extreme situations, such as famine), child malnutrition was associated with 54% of child deaths (10.8 million children) in developing countries in 2001. Malnutrition that is the direct cause of death is referred to as ―protein-energy malnutrition‖ in this guide (Blossner and Onis, 2005).

Malnutrition resulting from inadequate dietary intake is associated with growth failure and development of protein-energy malnutrition, especially during the gestation (Kathleen and Drora, 2010). Stunted growth is a reduced growth rate in human development. It is a primary manifestation of malnutrition in early childhood, including malnutrition during fetal development brought on by the malnourished mother. In developing countries, stunted growth is a common problem affecting a large percentage of children. Once established, stunting and its effects typically become permanent. Stunted children may never regain the height lost as a result of stunting, and most children will never gain the corresponding body weight. It also leads to premature death later in life because vital organs never fully developed during childhood (Badrialaily, 2008).

Medical conditions that can lead to malnutrition include (NHS, 2015):

1. A condition that causes a lack of appetite, such as cancer, liver disease, persistent pain or nausea.
2. A mental health condition, such as depression or schizophrenia, which may affect one’s ability to look after oneself.
3. A health condition that requires frequent hospital admissions.
4. A health condition that disrupts body’s ability to digest food or absorb nutrients, such as Crohn's disease or ulcerative colitis.

5. Dementia- people with dementia may be unable to communicate their needs when it comes to eating.
6. Dysphasia- a condition that makes swallowing difficult or painful.
7. Persistent vomiting or diarrhea.
8. An eating disorder, such anorexia nervosa.

People may also be at risk of becoming malnourished if their body has an increased demand for energy - for example, if it's trying to heal itself after major surgery, or a serious injury such as a burn, or if experience involuntary movements, such as a tremor (NHS, 2015).

2.3 Types of malnutrition

The main types of malnutrition prevailing in humans are protein energy malnutrition (PEM) and micronutrient malnutrition, brief descriptions of which are given in the following sections:

2.3.1 Protein energy malnutrition

Protein Energy Malnutrition (PEM) or Protein Calorie Malnutrition (PCM) is the name given to various degrees of nutritional disorders caused by inadequate quantities of protein and energy in the diet. Such deficiency occurs mainly in children below five years of age, when they are weaned from mother's milk and the diet substituted does not supply sufficient protein and energy or protein only. When such lack has been prevalent for a long time in the community, the parents' may fail to note the low weight and stunted growth of the children (Mudambi and Rajagopal, 2012).

It results from a diet lacking in energy and protein because of a deficit in all major macronutrients, such as carbohydrates, fats and proteins. In children, protein–energy malnutrition is defined by measurements that fall below 2 standard deviations under the normal weight-for-age (underweight), height-for-age (stunting) and weight-for-height (wasting). Protein-energy malnutrition usually manifests early, in children between 6 months and 2 years of age and is associated with early weaning, delayed introduction of complementary foods, a low-protein diet and severe or frequent infections (Muller and Krawinkel, 2005).

Classification of PEM (Muller and Krawinkel, 2005) is as follows:

2.3.1.1 Marasmus

Nutritional marasmus also referred as wasting is considered as a severe form of malnutrition, principally due to consumption of diet markedly deficient in both protein and calories and is usually participated by diarrheal diseases (Swaminathan, 2014). It mainly usually occurs in children that does not ingest enough protein, calories, carbohydrate and other important nutrients which is usually due to poverty and scarcity of food. However marasmus is not always a direct lack of nutrients. It can also be caused by the wrong nutrients or an inability to absorb or process nutrients properly because of infection (Mehta, 2016).

The term marasmus is derived from the Greek word marasmus, which means wasting. Marasmus involves inadequate intake of protein and calories and is characterized by emaciation. Marasmus is caused by a severe nutritional deficiency in general. It is usually found in very young infants and very young children. It can be prevented by breastfeeding. It is actually caused by the total or partial lack of nutritional elements in the food over a period of time (Muller and Krawinkel, 2005).

2.3.1.2 Kwashiorkor

The term kwashiorkor is taken from the Ga language of Ghana and means “the disease that the young child developed when displaced from his mother by another child or pregnancy”. Kwashiorkor usually manifests with edema, changes to hair and skin color, anemia, hepatomegaly, lethargy, severe immune deficiency and early death (Muller and Krawinkel, 2005).

Difference between marasmus and kwashiorkor (Samanka, 2012)is as follows:

1. Marasmus usually affects very young children while kwashiorkor affects slightly older children.
2. Marasmus children need to be treated with additional doses of vitamin B and a nutritious diet. Kwashiorkor patients are treated by adding more protein in their diet.
3. In marasmus weight is less than 60% of the mean for the age while in kwashiorkor body weight is 60-80% of the expected weight.

4. Edema is usually seen in kwashiorkor but not common with marasmus.
5. In marasmus, muscle wasting is obvious with severe loss of subcutaneous fat, but in kwashiorkor, muscle wasting is sometime hidden by edema.
6. Hair changes are uncommon in marasmus, but in kwashiorkor, hair is spare and de-pigmented.

2.3.1.3 Marasmic kwashiorkor

A child with features of both nutritional marasmus and kwashiorkor are diagnosed as having marasmic-kwashiorkor. A child with early kwashiorkor can developed marasmus by severe infective diarrhea and prolonged under feeding. Similarly an infant with marasmus may develop kwashiorkor if fed on protein deficient carbohydrate rich food along with adequate salt (Muller and Krawinkel, 2005).

2.3.2 Micronutrient malnutrition

There is substantial evidence that malnutrition, particularly micronutrient deficiencies, is a contributing factor in up to 35% of mortality in children less than 5 years of age and growing body of evidence exists that malnutrition plays a similar role in maternal mortality(Black *et al*., 2008). Micronutrient deficiencies may increase vulnerability to infection (Wintergerst *et al.*, 2007).

2.3.2.1 Vitamin A deficiency (VAD)

Vitamin A deficiency is found more in children than in adults. Among children, the male child seems to be more affected than the female child. Vitamin A is necessary for growth, and lack of it could result in stunted growth and abnormalities of bones and teeth. Deficiency of the vitamin also leads to dryness of the conjunctiva of the eye and cloudiness of the cornea. At this stage night blindness may be observed. Severe deficiency of vitamin A results in the cornea becoming dry and losing its transparency thus having a hazy appearance (Mudambi and Rajagopal, 2012).

In pregnant women, VAD causes night blindness and may increase the risk of maternal mortality. VAD is a public health problem in more than half of all countries, especially in Africa and South-East Asia, hitting hardest young children and pregnant women in low income countries. An estimated 250 million preschool children are vitamin A deficient and

it is likely that in vitamin A deficient areas a substantial proportion of pregnant women is vitamin A deficient (WHO, 2012).

2.3.2.2 Iron deficiency anemia (IDA)

Deficiency of iron causes anemia, a condition in which there is a decrease in the hemoglobin content of the red blood cells (erythrocytes), and there is an alteration in their size and shape. Hence hemoglobin content of blood has been used to study the incidence of anemia (Mudambi and Rajagopal, 2012).

According to American society of Hematology, iron deficiency is the most common cause of anemia and it may be caused due to several reasons as inadequate iron intake, pregnancy or blood loss due to menstruation, internal bleeding, inability to absorb iron etc. It occur in both men and women of any age and from any age group however some people may be at greater risk for IDA than other which include – women of childbearing age, pregnant women, women with heavy menstrual periods, people with poor diets, people who donate blood frequently, people with major surgery or physical trauma, GIT disease, inflammatory bowel syndrome, peptic ulcer disease infants and children especially those born prematurely or experiencing a growth spurt, vegetarians who do not replace meat with other iron rich food, children who rink more than 1624 ounces a day of cow‘s milk (as it not only contains little iron but ca also decrease absorption and irritate the intestinal lining causing chronic blood loss) (Stanley and Auerbach, 2016).

Anemia is very rare in healthy breast-fed infants. Anemia may be a greater problem in the lower socio-economic families (Onis and Blossner, 2003).

2.3.2.3 Iodine deficiency disorder (IDD)

Iodine deficiency in man leads to a number of disorders, which include goiter, cretinism, mental retardation, deaf-mutism, neuropsychic retardation and myxedema in elderly (Mudambi and Rajagopal, 2012).

Recently Iodine deficiency has been linked to autism in children (Hamza *et al.*, 2013). Iodine deficiency symptoms manifest as a result of improper thyroid hormone production i.e. when the thyroid gland does not receive enough iodine, trouble appears. Signs and symptoms of Iodine deficiency may vary according to individuals but they usually include- thyroid enlargement known as goiter; mental imbalance such as depression and anxiety;

mental retardation (in extreme case); fetal hypothyroidism leading to brain damage; autism (Eastman and Zimmermann, 2011).

2.3.2.4 Zinc deficiency

Zinc is an essential component of a large number of enzymes, and plays a central role in cellular growth and differentiation in tissues that have a rapid differentiation and turnover, including those of the immune system and those in the gastrointestinal tract. The positive impact of zinc supplementation on the growth of some stunted children, and on the prevalence of selected childhood diseases such as diarrhea, suggests that zinc deficiency is likely to be a significant public health problem, especially in developing countries. Zinc deficiency is often hard to identify as its clinical manifestations are largely non-specific. The symptoms of severe deficiency include dermatitis, retarded growth, diarrhea, mental disturbances and recurrent infections. In children, impaired growth (stunting) is one of the possible consequences of zinc deficiency (Abrams, 2017).

Zinc deficiency, a significant problem for most countries in the world, the World Health Organization (WHO) reports that the global prevalence of zinc deficiency is 31%.Ranked as the fifth leading risk factor in causing disease worldwide, underdeveloped nations regularly suffer from high mortality rates because of the connection that zinc deficiency has with childhood diarrhea and pneumonia. Zinc deficiency is such a serious global problem that 176,000 diarrhea deaths, 406,000 pneumonia deaths and 207,000 malaria deaths are caused by it; primarily in Africa, the Eastern Mediterranean and South-East Asia (WHO, 2012).

2.4 Nutritional requirements

Study conducted in Kenya showed that the proportion of stunted and underweight children was inversely and significantly ($P < 0.05$) correlated with children's energy intake and variety of foods (Mwaniki and Makokha, 2013). The recommended daily allowance (RDA) of nutrients for preschool children (1-6 years) is shown in Table 2.1.

Table 2.1 RDA of pre-school children

Nutrients	**(6-12) months**	**(1 to 2)years**	**(4 to 6) years**
Calories(Kcal)	80kcal/kg/day	1060	1350
Protein(g)	1.69gm/kg/day.	16.7	20
Fat(g)	19gm/ day	27	25
Calcium(mg)	-	600	600
Iron(mg)	-	9	13
Vitamin A(µg)	-	400	400
Zinc(mg)	-	5	7

Source: ICMR 2010

2.5 Global context of malnutrition.

The burden of malnutrition is much higher in South Asia compared to that in Africa and other parts of the world. The prevalence of underweight and stunting in South Asia has been recorded as 46 and 44 percent, respectively (De Onis *et al.*, 2000). Stunting in Southeast Asia dropped from 52 percent to 42 percent between 1990 and 2006. Study done on malnutrition among under-five children in Bangladesh revealed that, the high prevalence of stunting and underweight, i.e. 42% and 40%, respectively (Siddiqi *et al.*, 2011). In 2005 about 250 million people in developing countries, mainly young children and pregnant women, had vitamin A deficiency. On the other hand, 740 million people are deficient in iodine (300 million with goiter and 20 million with brain damage from maternal iodine deficiency during their fetal development), about two billion people are deficient in zinc and one billion have iron deficiency anemia (Muller and Krawinkel, 2005).

Micronutrient deficiencies affect about two billion people in the world. Vitamin A remains the major and preventable cause of early blindness (Williams, 2005). In 1988 an estimated 100000 infants become blind due to vitamin A deficiency and an equal number died from associated conditions (Bentley and Lawson, 1988). In 2005 about 250 million people in developing countries, mainly young children and pregnant women, had vitamin A deficiency. On the other hand, 740 million people are deficient in iodine (300 million with goiter and 20 million with brain damage from maternal iodine deficiency during their fetal development), about two billion people are deficient in zinc and one billion have iron deficiency anemia (Muller and Krawinkel, 2005).

Malnutrition rates remain alarming: stunting is declining too slowly while wasting still impacts the lives of far too many young children. Globally, approximately 151 million (22.2%) children under 5 suffer from stunting. These children begin their lives at a marked disadvantage: they face learning difficulties in school, earn less as adults, and face barriers to participation in their communities. Similarly, nearly 51 million (7.5%) children under 5 were wasted and 16 million were severely wasted. Two out of five stunted children in the world live in South Asia.58.7 million children in South Asia are stunted. Wasting in Southern Asia constitutes a critical public health emergency. More than half of all wasted children in the world live in Southern Asia. 26.9 million children in South Asia are stunted (UNICEF/WHO/WBG, 2018)

2.6 Nepalese context

More than one-third (36%) of children under five in Nepal are stunted, or too short for their age. Stunting is more common in rural children (40%), compared to urban children (32%). By province, stunting ranges from 29% in Provinces 3 and 4 to 55% in Province 6. Children from the poorest households (49%) and whose mothers have no education (46%) are more likely to be stunted. Overall, 10% of children are wasted (too thin for height), a sign of acute malnutrition. In addition, 27% of children are under weight, or too thin for their age. The nutritional status of children in Nepal has improved since 1996. More than half (57%) of children under five were stunted in 1996 compared to 36% in 2016(MoH *et al.*, 2016). A cross-sectional study conducted in Belahara VDC of Dhankuta district in Nepal showed the prevalence of underweight, stunting and wasting were 27%, 37% and 11%, respectively (Sapkota and Gurung, 2009).

Childhood mortality rates have declined since 1996. Infant mortality has decreased by more than half from 78 deaths per 1,000 live births in 1996 to 32 in 2016. During the same time period, under-5 mortality has declined threefold from 118 to 39 deaths per 1,000 live births. The 2016 NDHS tested children age 6-59 months and women age 15-49 for anemia. More than half (53%) of children age 6-59 months are anemic. Anemia is more common in rural children (56%) and those whose mothers have no education (57%). Anemia in children ranges from a low of 43% in Province 3 and a high of 59% in Province 2. Anemia prevalence among children has increased since 2011 when 46% of children were anemic. Four in ten women age 15-49 in Nepal are anemic. Anemia prevalence ranges from a low of 28% in Province 4 to 58% in Province 2. Since 2006, anemia among women has increased from 36% to 41% in 2016 (MoH *et al.*, 2016).

Despite the availability of nutritional products and good climatic opportunities for agricultural products, transportation facilities, easy access to health services most of the children suffered from malnutrition due to behavioral and socio-cultural practices in these districts (Bhandari and Chhetri, 2013).

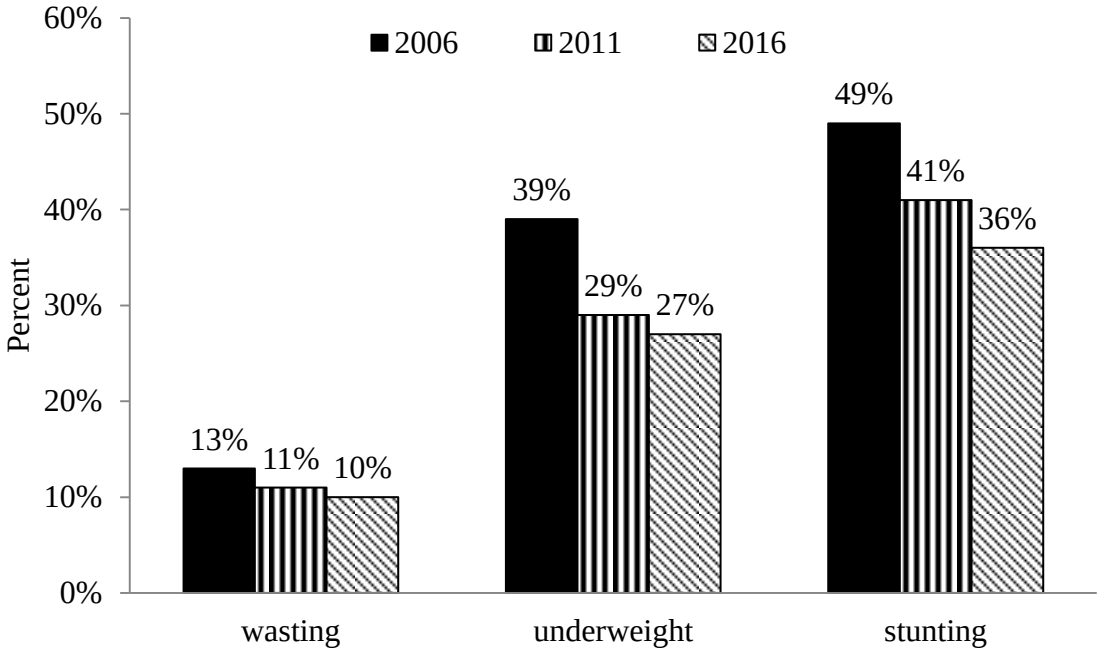

Figure 2.1 Trends in nutritional status (source: NDHS 2016)

2.7 Factors affecting nutritional status

There are multiple factors associated with childhood malnutrition and these are often interrelated. One simply cannot say that these are the cause of childhood malnutrition because it is a complex phenomenon. The most immediate determinants are poor diet and diseases which are themselves caused by a set of underlying factors; poverty, educational level of mother, faulty feeding practices, vitamin A status, low status of women, birth order, unsafe drinking water, mother's occupation, diarrhea, etc. These underlying factors themselves are influenced by the basic socio-economic and political conditions (Gharti Chhetri, 2005).

A study conducted in Padampur VDC, Chitwan showed that 23%, 37% and 26% of children are underweight, stunted and wasted respectively. It also reveals that children's age, occupation of mother and socio-economic status were significantly related to stunting (Ruwali, 2011). Significant association of underweight and stunting was found among different ethnic group while the association of wasting with sex, ethnicity and age groups were not found to be statically significant (Shrestha 2014). A study conducted in Jirel children, the MUAC measurement among 309 children, 51.13% were found to be normal and 12.62% were severely malnourished, according to Gomez classification, 37% children were normal but no one was found to be severely malnourished. 64% were found to be having mild to moderate malnutrition. According to Waterlow's classification 71% were found to be normal and 29% were stunted while no one was found to be wasted (Chapagain *et al.*, 2005).

A study conducted in Rupandehi district concludes that 46% of children aged 36 – 59 months were underweight and 65% were found to be stunted. 50% children born to illiterate mother were underweight and 58% born by mother less than 18 years of age were underweight (Acharya *et al.*, 2013).

Study conducted in Dhanusha, Central Terai of Nepal revealed that general economic status of the family does not have effect on nutritional status of children. Proportions of underweight and stunted children is same from the families with sufficient and insufficient income while the proportions of children underweight and stunted are higher from families who extract and discard rice scum (*maad* in Nepalese language) (Sah, 2004).

Cross-sectional study conducted in Kapilvastu district reveals that better socio-economic status, mother's age 20-35 years, birth order up to second, gap more than two year between two pregnancies, recommended exclusive breast feeding, early recommended supplementary feeding, complete immunization and timely care seeking had positive effect on children health which are also statistically significant (Bhandari and Chhetri, 2013).

2.8 Maternal education on nutrition

Knowledge of mothers has an important role in the maintenance of nutritional status of the children. Adequate knowledge regarding various aspects of feeding practices during pregnancy and during infancy is very essential especially among females as they are going to influence the feeding practices of this vulnerable group. The knowledge of child nutrition and caring practices can be expected to have significant bearing on their children's nutritional status but conflicting results have been reported in this regard whereas some studies have observed a positive relationship between childhood malnutrition and maternal knowledge and beliefs regarding nutrition (Kaur *et al.*, 2015).

Mother's nutritional knowledge is considered to have a great impact on the infants nutritional status as she has the capacity to take diet related conscious decisions (Foote and Marriot, 2003). However a combination of mothers" self-perception, assessment of infant's well- being, culture; food availability and financial status influence the actual complementary feeding, hence child nutritional status (Sellen, 2001).

A study in Rural Terai of Eastern Nepal shows that child malnutrition has significant relation with maternal education, socioeconomic status and feeding practices. The education of mothers has several positive effects on care of children in comparison to mother with no education. The educated mother utilizes the health care facility, discusses more about the illness of the child with health care provider and follows the instructions about feeding and caring practices given by the health workers. Faulty feeding practices like late initiation of breast feeding, starting artificial feeding before 6 months and early and late start of complementary foods causes malnutrition (Gharti Chhetri, 2005).

Study conducted in Nigeria revealed that most of the mothers had insufficient nutrition knowledge in which only 20% of mothers had good knowledge on health and nutrition of their children, 44.6% had fair knowledge and 35.5% had poor knowledge score (Jemide *et al.*, 2016).

Many studies have reported inverse relationship between maternal education and child malnutrition. A study carried in 2005 in Cambodia found that maternal education was strongly and inversely associated with stunting, but not with small birth size or wasting after controlling for socioeconomic status (Miller and Rodgers, 2009). Education permits women to exert greater control over health choices for their children. A series of studies have argued that maternal education improves the mother's knowledge about child health, including causes, prevention, and treatment of diseases. Further, maternal education promotes positive attitudes toward health-seeking behavior for their children, including awareness of the importance of immunization. Women's education promotes empowerment and influences participation in decisions that affect child nutrition and access to health services. Children whose mothers are educated end to live in more hygienic environments and are more likely to be vaccinated and have better nutritional outcomes (Emina *et al.*, 2009).

2.9 Status of Nepalese women

Education may enable women to make independent decisions, to be accepted by other household members, and to have greater access to household resources that are important to nutritional status. Several researches show that there is a strong linkage between maternal education and children's health. Children's born to educated women suffer less from malnutrition which manifests as underweight, wasting, and stunting in children. In general, the higher the level of education of a woman, the more knowledgeable she is about the use of health facilities, family planning methods, and the health of her children (Girma and Genebo, 2002). One in three women and 1 in 10 men age 15-49 has no education. Seventeen percent of women have only attended primary school, while 26% of women have attended some secondary education. Nearly one-quarter of women have their School Leaving Certificate (SLC) or above. About 7 in 10 women (69%) are literate (MoH *et al.*, 2016).

Women in Nepal marry at an earlier age than men. The median age at first marriage for women age 2549 is 17.9 years, compared to 21.7 years among men age 25-49. Women with no education marry 4.6 years earlier than women with SLC and above education (16.8 years versus 21.4 years). More than half (52%) of women are married by age 18, compared to 1 in 5 men (19%). In Nepal, 17% of adolescent women age 15-19 are already mothers or

pregnant with their first child. Teenage fertility is higher in rural areas (22%) than in urban areas (13%) (MoH *et al.*, 2016).

2.10 Exclusive breastfeeding

“Exclusive breastfeeding" is defined as giving no other food or drink – not even water – except breast milk. It does, however, allow the infant to receive oral rehydration salts (ORS), drops and syrups (vitamins, minerals and medicines). Breast milk is the ideal food for the healthy growth and development of infants; breastfeeding is also an integral part of the reproductive process with important implications for the health of mothers (WHO, 2015a).

Breast milk is ultimately the best source of nutrition for a new baby. Many components in breast milk help protect your baby against infection and disease. The proteins in breast milk are more easily digested than in formula or cow’s milk. The calcium and iron in breast milk are also more easily absorbed (APA, 2018).

As a global goal for optimal maternal and child health and nutrition, all women should be enabled to practice exclusive breastfeeding, and all infants should be fed exclusively on breast milk, from birth to 6 month of age (Khassawneh *et al.*, 2006). Breastfeeding is nearly universal in Nepal and the median duration of breast-feeding is long (33 months)(Khassawneh *et al.*, 2006). But on the contrary to the recommendations of WHO only 2/3rd of children less than 6 months of age are exclusively breast fed (Gupta, 2002).

Breastfeeding is recognized as the preferred form of infant nutrition by the American Academy of Pediatricians (AAP), the American Academy of Family Physicians (AAFP) and the American College of Obstetricians and Gynecologists (ACOG). Infants who are breastfeed experience nutritional and developmental health advantages that enhance their health throughout their lives. The choice to breastfeed conveys health benefits to the mother as well. Several studies have established that education and support for pregnant women can dramatically increase breastfeeding rates (Arora *et al.*, 2000).

WHO/ UNICEF provide the following feeding recommendations (NMICS, 2010):

- Exclusive breastfeeding for the first six months of life.
- Continued breast feeding for two years or more.

- Safe, appropriate and complementary foods beginning at six months of age.
- Frequency of complementary feeding: two times per day for 6-8 months old; three times per day for 9-11months.
- It is also recommended that breastfeeding be initiated within 1 hour of birth.

Two-thirds of children under six months are exclusively breastfed. Children under three breastfeed for an average of 30.5 months and are exclusively breastfed for 4.3 months (MoH *et al.*, 2016).

2.11 Continued breastfeeding for 2 years and beyond

Continued, frequent, on-demand breastfeeding until 2 years of age and beyond makes an important nutritional contribution for a child (WHO, 2010). Globally, over one-third of infants are exclusively breast-fed up to 6 months, while 90% continue breast-feeding during the second half of infancy (Jones *et al.*, 2003).

In Kenya, the median duration for any breastfeeding among children is 21 months (KNBS and Macro, 2010). Maternal characteristics are related to breastfeeding up to two years of age and beyond. In India, a study on determinants of duration of breast feeding amongst women in Manipur, Bangladesh revealed that, living in a rural area and maternal unemployment were found to be associated longer breastfeeding duration (Singh and Singh, 2012). In Kenya, the median duration of any breastfeeding is slightly longer in rural areas (21 months) than in urban areas (19 months), where shortest periods (15 months) of breastfeeding are reported in Nairobi Province (KNBS and Macro, 2010).

In Nepal, the mean duration of breastfeeding was noted as 30 months and it was reported that male children were breastfed for longer period of time than females. The median duration of breast feeding was 34 months and it was higher for children living in Western Mountain, Western Hill, Mid-western Hill and far Eastern Terai sub regions. Education status of mother was found to be indirectly related with breastfeeding practice i.e. children of mothers with some secondary and higher level of education were breastfed for a shorter period of time than mother with no or primary education (MoHP, 2011).

During complementary feeding, for infants and young children aged 6-23 months, breastfeeding contributes significantly to the overall nutrient intake, fills most of the

energy needs and remains an important source of vitamin A and C, as well as essential fatty acids and can provide to their total energy needs (Mukuria *et al.*, 2006).

2.12 Complementary feeding in Nepal

Complementary foods should be introduced when a child is six months old to reduce the risk of malnutrition (MoH *et al.*, 2016). WHO recommends that infants start receiving complementary foods at six months (180 days) of age in addition to breast milk. Foods should be adequate, meaning that they provide sufficient energy, protein and micronutrients to meet a growing child's nutritional needs. Foods should be prepared and given in a safe manner to minimize the risk of contamination. Feeding young infants requires active care and stimulation to encourage the child to eat. The transition from exclusive breastfeeding to full use of family foods is a very vulnerable period. It is the time when many infants become malnourished, contributing significantly to the high prevalence of malnutrition in children under five years of age worldwide. It is essential therefore that infants receive appropriate, adequate and safe complementary foods to ensure the right transition from the breastfeeding period to the full use of family foods (WHO, 2015a).

Common traditional weaning foods include:

1. Porridge (*lito*), made from roasted rice flour (occasionally maize or millet), ghee (clarified butter) and sugar
2. *Jaulo*, made from rice and turmeric or rice and salt.
3. *Dhindo*, made from maize flour (or millet or wheat)
4. *Maar*, made in lowland areas by cooking rice, cracked maize and soybeans together
5. *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 maad 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, 2006).

Appropriate complementary feeding is: (WHO, 2002):

- timely – meaning that foods are introduced when the need for energy and nutrients exceeds what can be provided through exclusive and frequent breastfeeding;
- adequate – meaning that foods provide sufficient energy, protein, and micronutrients to meet a growing child's nutritional needs;
- safe– meaning that foods are hygienically stored and prepared, and fed with clean hands using clean utensils and not bottles and teats;
- properly fed – meaning that foods are given consistent with a child's signals of appetite and satiety, and that meal frequency and feeding method – actively encouraging the child to consume sufficient food using fingers, spoon or self-feeding – are suitable for age.

2.13 Diarrhea in children

Diarrhea is common in children under five years of the age in Nepal. In Nepal, the major risk factors in acquiring diarrhea are poor water quality and sanitary conditions, unhygienic stool disposal, contamination of food items and poor household economic conditions. Annually, about 30,000 to 45,000 children under-five die due to diarrhea in Nepal. Managing diarrhea at home is quite common among rural mothers, but their level of knowledge is poor (Ansari *et al.*, 2012).

Oral Rehydration Therapy (ORT) is the giving of fluid by mouth to prevent and/or correct the dehydration that is a result of diarrhea. As soon as diarrhea begins, treatment using home remedies to prevent dehydration must be started. If adults or children have not been given extra drinks, or if in spite of this dehydration does occur, they must be treated with a special drink made with oral rehydration salts (ORS) (Ruxin, 2014).

A study conducted in Morang revealed that knowledge about signs of dehydration was poor in most mother and none of the mothers were able to mention all the steps for correct and complete preparation of oral rehydration salt (ORS) and salt-sugar-water (SSW) solutions (Ansari *et al.*, 2012).

According to NDHS 2016, Eight percent of children under five had diarrhea in the two weeks before the survey. Diarrhea was most common among children age 6-11 months (15%). Nearly two-thirds of children under five with diarrhea were taken to a health

facility or providers for treatment or advice. Children with diarrhea should drink more fluids, particularly through oral rehydration therapy (ORT) which includes oral rehydration solution (ORS), recommended home fluids, and increased fluids. Additionally, children under five with diarrhea should receive zinc. While 68% of children under five with diarrhea received ORT, 16% received no treatment. Only 10% of children under five with diarrhea received ORS and zinc (MoH *et al.*, 2016).

2.14 Nutritional status assessment

Nutritional assessment is the interpretation of anthropometric, biochemical (laboratory), clinical and dietary data to determine whether a person or groups of people are well nourished or malnourished (over-nourished or under-nourished) (Gibson, 2005). Four different methods are used to collect data used in assessing a person's nutritional status: anthropometric, biochemical or laboratory, clinical, and dietary (Lee and Nieman, 2012)

2.15.1 Direct method

2.15.1.1 Anthropometric measurement

Nutritional anthropometry is concerned with the measurement of the variations of the physical dimensions and the gross composition of human body at different age levels and degrees of nutrition (Jellifie, 1966). A good account of anthropometric assessment, including advantages and limitations, has been given by (Gibson, 2005).

For studies of both individuals and populations, the anthropometric indices can be compared to the reference population using percentiles or Z-score system derived from the reference data. In most industrialized countries, percentiles are used, whereas in low-income countries, the use of Z-scores is preferred (Gibson, 2005).

Z-score is defined as a score that indicates how far a measurement is from the median, also known as standard deviation (SD) score and is often used to assess anthropometric measures to help evaluate children's growth and nutritional status. Compared to percentiles, Z-scores have a number of advantages: first, they are calculated based on the distribution of the reference population (mean and standard deviation), and thus reflect the reference distribution; second, as standardized quantities, they are comparable across ages, sexes, and anthropometric measures; third, Z-scores can be analyzed as a continuous variable in studies. In addition, they can quantify extreme growth status at both ends of the

distribution (Wang and Chen, 2012). The commonly used anthropometric measurements or indicators of nutritional status for preschooler children are briefly discussed in the following section:

a) Height for age

Weight and height of child are measured using standard digital balance and stadiometer (respectively) and index is expressed in standard deviation units from the median of WHO child growth standards adopted in 2006. The standard methods for taking measurements have been described in WHO/UNICEF (1986 Children whose weight-for-height Z-scores (WHZ) are below minus one standard deviations (< -1 SD) are considered mildly wasted. Similarly, WHZ below -2 and -3 SD are considered moderately and severely wasted, respectively. The term "wasting" is used to describe a condition in which children fail to gain weight according to height (INDEPTH., 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, 2015b)

b) Weight for age

Children whose weight-for-age is below minus two and minus three standard deviations from the median of the reference population are considered moderately and severely underweight or low weight for their age. The measure reflects the effects of both acute and chronic under nutrition (INDEPTH., 2008).

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 ≤ -3 standard deviations (SD) for any index (Hommes, 2005).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, 2015b).

c) Weight for height

Children whose height-for-age is below minus two standard deviations from the median of the reference population are considered stunted or short for their age. Stunting is the

outcome of failure to receive adequate nutrition over an extended period and is also affected by recurrent or chronic illness (Joshi, 2008).

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, 2015b).

d) Mid upper arm circumference

MUAC is the best indicator for identifying children at high risk of death from malnutrition and is easy to teach to community based workers, making it practical, especially in poor communities (Collins *et al.*, 2006).

WHO standards show that in a well-nourished population there are very few children aged 6–60 months with an MUAC <115 mm; children below this cut-off have a highly elevated risk of death(WHO, 2006). There is very little change in a child's arm circumference between the ages of one to five years. This measurement therefore gives a simple measure of wasting. Children between 12 to 59 months old can be screened using the MUAC and when a child is older than six months but longer than 65cm, the MUAC can also be used (Mother and Child Nutrition, 2009a). Children aged 6 to 59 months; with an arm circumference less than 115mm are severely and acutely malnourished (WHO, 2007).

e) Edema

Bilateral pitting edema is a sign of Kwashiorkor, one of the major clinical forms of severe acute malnutrition. When associated with Marasmus (severe wasting), it is called Marasmic-Kwashiorkor. Children with bilateral edema are automatically categorized as being severely malnourished, regardless of their weight-for-height index, and referred immediately to the nearest center (Smith, 2013).

f) Head and chest circumference:

Measurement of head circumference is important because it is closely related to brain size. It is often used with other measurements to detect pathological conditions too.

2.15.1.2 Biochemical method

In nutritional assessment, biochemical or laboratory methods includes measuring a nutrient or its metabolite in blood, feces, or urine or measuring a variety of other components in blood and other tissues that have a relationship to nutritional status. The quantity of albumin and other serum proteins frequently is regarded as an indicator of the body's protein status, and hemoglobin and serum ferritin levels reflect iron status. Serum lipid and lipoprotein levels, which are influenced by diet and other lifestyle factors, reflect coronary heart disease risk. Biochemical tests, also known as biomarkers, often can detect nutrient deficits long before anthropometric measures are altered and clinical signs and symptoms appear. Some of these tests are useful indicators of recent nutrient intake and can be used in conjunction with dietary methods to assess food and nutrient consumption (Lee and Nieman, 2012).

2.15.1.3 Clinical assessment

Clinical assessment of nutritional status involves a detailed history, a thorough physical examination, and the interpretation of the signs and symptoms associated with malnutrition. The patient's personal and family history, medical and health history, and physical examination are clinical methods used to detect signs and symptoms of malnutrition(Lee and Nieman, 2012). It is defined as assessment of the health of those parts of the body that can be readily observed in a routine physical examination. Clinical examination can be done by observing certain signs and symptoms which are associated with various nutrient deficiencies in various organs of body like skin, hair, mouth, tongue, nails, etc.(Bauer, 2002).

2.15.1.4 Dietary assessment

Dietary methods generally involve surveys measuring the quantity of the individual foods and beverages consumed during the course of one to several days or assessing the pattern of food use during the previous several months. These can provide data on intake of nutrients or specific classes of foods (Lee and Nieman, 2012).

These methods may be used to assess the third dimension of food security, utilization and adequacy. The quantities of foods consumed are converted into macro and micronutrients and intake adequacy per day may be calculated from the recorded quantities and compared to RDA. The assessment can be carried out at two levels, viz., (i) Household level, and (ii) Individual level. The household level assessment is meant to reflect, in a snapshot form, the economic ability of a household to access a variety of foods whereas individual level assessment aims to reflect nutrient adequacy. Increase in dietary diversity is associated with socio-economic status and household food security (household energy availability) (Kennedy et al., 2010).

(i) Household methods

Household food consumption methods attempt to measure all food and beverages available for consumption by a household, family group, or institution during a specified time period. The following methods are used (Gibson, 2005):

i. Food accounts.
ii. Household food records.
iii. Household dietary diversity.
iv. Household 24-h recalls.

(ii) Individual methods

These include:

a) 24-h recall

Respondent recalls exact foods taken during the preceding 24 h period, giving detailed descriptions of all foods and beverages consumed, including cooking methods, and (vitamin) supplements. Quantities are estimated in household measures and entered on a data sheet. Then energy and nutrient intake per day may be calculated from the recorded quantities and compared to RDA to check adequacy (Gibson, 2005).

b) Food frequency questionnaire

The frequency-of-use of food items or food groups consumed during a specified time period is assessed by use of a questionnaire. It is semi-quantitative and can allow derivation of energy and selected nutrient intakes with the introduction of portion size

estimates and computerized self-administered questionnaires. This may be used to assess economic ability to access food and nutrient adequacy when compared to RDA (Gibson, 2005).

Recall methods are affected by the subject's memory, ability of respondent to convey accurate estimates of portion size consumed the degree of motivation of the respondent and the persistence of the interviewer. It is, however believed that 24 h is a short memory period and the respondent can provide reliable information (Kanyuira, 2010).

2.15.2 Indirect method

These include three categories (Jellifie, 1966):

2.15.2.1 Vital health statistics

Vital health statistics like infant mortality rate, under-five mortality rate, nutritionally relevant diseases (for example diarrhea, tropical ulcer, tuberculosis and measles). A variety of vital statistic may be considered as indirect indicators of the nutritional status of the community (Jellifie, 1966).

2.15.2.2 Ecological variable

Ecological variables include crop production, soil, irrigation, storage, transport and economic level of the population, as well as on such cultural influence as local cooking practice and food classifications, especially in relation to the distribution or restriction of foods for vulnerable age groups (Jellifie, 1966)**.**

2.15.2.3 Socioeconomic factor

Socio-economic factor like per capita income, occupation, prices of food, budgeting, etc.(Jellifie, 1966).

2.16 Literature review from previous studies

Stunting in Southeast Asia dropped from 52 percent to 42 percent between 1990 and 2006. Study done on malnutrition among under-five children in Bangladesh revealed that, the high prevalence of stunting and underweight, i.e. 42% and 40%, respectively (Siddiqi *et al.*, 2011).

A study conducted in Padampur VDC, Chitwan showed that 23%, 37% and 26% of children are underweight, stunted and wasted respectively. It also reveals that children's age, occupation of mother and socio-economic status were significantly related to stunting (Ruwali, 2011). Significant association of underweight and stunting was found among different ethnic group while the association of wasting with sex, ethnicity and age groups were not found to be statically significant (Shrestha 2014).

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about feeding and caring practices given by the health workers (Gharti Chhetri, 2005). A study conducted in Morang revealed that knowledge about signs of dehydration was poor in most mother and none of the mothers were able to mention all the steps for correct and complete preparation of oral rehydration salt (ORS) and salt-sugar-water (SSW) solutions (Ansari *et al.*, 2012).

Part III

Materials and methods

3.1 Research design

The study carried out was cross-sectional survey of under-five year aged children living in Dharan Sub metropolitan city. Nutritional survey of under five children in Dharan consisted of:

1. Household survey with the help of questionnaire (Appendix B)
2. Anthropometric measurements of 6-59 months children (Appendix B)
3. Food consumption Score of mother and children

3.2 Research materials

Following relevant materials were used for the survey:

- **Digital weighing machine**
  Weighing machine of capacity for 100kg and having the least count of 0.1 kg manufactured by Micro life Pvt. Ltd.
- **Height measuring Scale (Stadiometer)**
  The height measuring scale of 2m capacity and minimum measurement capacity was 0.1 cm. It was prepared under the supervision of Central Campus of Technology, Department of Nutrition and Dietetics.
- **MUAC tape**
  MUAC tape was used for measuring mid upper arm circumference. The tape was flexible, non-stretchable and used to measure the nearest 0.1cm
- **Set of questionnaire**
  A well designed and pretested questionnaire was used.

3.3 Study area

The study was carried out in Dharan Sub-metropolitan city, Sunsari district, Koshi zone, Nepal. It is located in Province no 1 as shown in appendix C.

3.4 Study variables

The study variables were divided into two categories:

a) Dependent variables

1. Stunting (height for age): Height for age below -2SD from the National center for Health Statistics/WHO reference median value (NCHS/WHO).
2. Wasting (weight for height): Weight for height below -2 SD from the NCHS/WHO reference median value.
3. Underweight (weight for age): Weight for age below -2SD from the NCHS/WHO reference median value.

b) Independent variables

1. Socioeconomic and demographic factors: head of household, ethnicity, family size, family type, income, occupation, education.
2. Maternal characteristics: age, level of education, iron and folate intake,.
3. Children characteristics: birth weight, age, sex.
4. Child care practices: Feeding practices, Hygiene.
5. Food Consumption Score.

3.5 Target population

The target population of the study for taking measurements was 6-59 months children of Dharan Sub-Metropolitan city, Sunsari and interview was taken from their mothers with following inclusion and exclusion criteria:

- **Inclusion criteria:** The children of 6-59 months from Dharan were selected for survey and the mothers of respective children were also selected for questionnaire.
- **Exclusion criteria:** The study participants who were seriously ill or whose mothers were not available at household during the time of survey.

3.6 Sampling method

In Dharan, there are 20 wards and each ward has 5 to 100margs or toles. The total population of 6-59 months children in Dharan as well as in each ward was obtained from the municipality office. Then sample size was calculated for known population. Then according to the population size of the each ward, sample size was calculated using probability proportionate sampling.

3.7 Sample size

A sample size of 165 under five children was taken by using a single proportion formula (Font et al., 1999; Bellera et al., 2012; Jemal et al., 2016) assuming prevalence rate of malnutrition to be 50% in the survey area, 95% confidence interval (CI), 8% margin of error (d) and 10% non-response rate was added to the total calculated sample size.

Calculation of sample size for infinite population: -

Sample size (n0) = $Z^2 \times p\ (1-p)/d^2$

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

P= estimated prevalence of malnutrition (50%)

d= margin of error (8%)

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

=150.0625

According to the information collected from municipality office of Dharan the total no. of 6 -59 months aged children are 14532.Thus, we apply finite population sample formula to obtain new sample size to conduct survey in Dharan.

Therefore, New SS = $n_0 / [1+ \{(n0-1) / POP)]$

Where, New SS = New sample size for finite population

n_0= Sample size in infinite population

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

New sample size obtained as: $n_0 / [1+ \{(n_0-1) / POP\}]$

= 150 / [1+ ((150-1) / 14532)]

=148.47

Thus calculated sample size is adjusted for non-response. So, considering non-response rate as 10%, the adjusted sample size is calculated to be 162.847 i.e. 165.

3.8 Data collection techniques

The data collected with the help of structured questionnaire form which included food consumption score questions also and by face to face interview with mother of child answer of every question was coded and recorded with unique identity number for each household. Anthropometric measurement of child was taken. This entailed measurement of height, weight, MUAC using standardized protocol. The relevant data recorded were as follows:

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

Length/height: For children below 24 months of age recumbent length was taken and for children above 24 months standing length was taken with the help of stadiometer. Child height was measured to the nearest one decimal place.

Weight: Weight was measured by digital weighing scale and read to the nearest 0.1 kg with minimum/lightly/clothing and no shoes. Those who were unable to stand alone, their weights were obtained from the difference between weight of mother (carrying the child) and the weight of mother alone.

MUAC: MUAC tape was used and was taken on the left hand midway between the elbow and shoulder. Care was taken to make sure that the hands were relaxed and hanging by the side

Food Consumption Score (FCS)

These were the steps adopted to collect information on food consumption (WFP, 2008) as:

1) Using standard 7-day food frequency data, all the food items were grouped into specific food groups (Appendix B).
2) The consumption frequency of each food groups was then multiplied by its weight.
3) New weighted food group scores were obtained.
4) The weighed food group scores was summed and food consumption score (FCS) was thus obtained.

There is no standard threshold of FCS for our country, so here the FCS was categorized as poor, borderline and acceptable on the basis of quartiles.

FCS based on quartiles	Categorization for child	Categorization for mother
Poor (less than 25th percentile)	<67	<65
Borderline(25th- 75th percentile)	81-87	77-87
Acceptable(more than 75th percentile)	>87	>87

Mother's knowledge level score

There was twenty self-administrated questionnaire related to knowledge questionnaire. Based on the responses, each correct answer was given a score of "one "and the wrong answer was given a score of "zero". The range of knowledge level score was adapted from National Journal of Community Medicine (Shettigar *et al.*, 2013). The obtained score was categorized as:

Score	Categorization
0-10	Poor
11-16	Average
17-20	Good

3.9 Pretesting

The prepared set of questionnaire (Appendix B) and anthropometric instruments were pre tested among few mothers and their children of 6-59 months age during the preliminary visit. Pre testing was conducted in order to maintain accuracy and clarity of questionnaire, to check the consistency in interpretation of questions and to identify ambiguous item (Gibson, 2005). Questionnaire was revised inn accordance with the findings of pre testing and all ambiguous, misleading and wrongly interpreted questions were omitted.

3.10 Reliability and validity

3.10.1 Reliability

A scale should be reliable i.e., should give the same measurement under similar conditions. For example, an economic status scale is reliable only if two persons with apparently same economic stats show the same scores. Reliability means dependability, stability, consistency, predictability and accuracy of the scale used (M. L. Singh, 2005)..

Reliability of the instruments (Stadiometer and weighing balance) was tested by the test retest method. Two consecutive measurements were made at a short time difference by the same observer and were compared. Instruments was set at 0 reading before taking measurements with standardized reference one

3.10.2 Validity

A scale is said to be valid when it correctly measures what it is expected to measure. Validity defines the strength of the final results and weather they can be regarded as accurately describing the real world (M. L. Singh, 2005). The questionnaire was pre-tested prior to data collection to ascertain content and face validity.

3.11 Data analysis

Quantitative data was coded first and was entered in SPSS 20 (Page *et al.*, 2003), MS Excel (2010) and WHO Anthro version 3.2.2 (M. Blossner *et al.*, 2010). Chi square test was used to identify the associated factors of malnutrition. Verified test parameters were used to establish the relationship between the variables and nutritional status of children.

3.12 Logical and ethical considerations

Ethical clearance was obtained from Nepal health and Research Council (NHRC) as shown in Appendix D. Permission to conduct survey in Dharan Sub Metropolitan city was obtained from the respective office. The study participants were provided with oral consent prior to study. Respondents were assured that data collected was for the purpose of the study and privacy and confidentiality of collected information shall be maintained.

Part IV

Results and discussion

The study was carried out in Dharan Sub Metropolitan city, Sunsari district from December 3 to December 12, 2017. The aim of the study was to determine the status of Mother's knowledge on childcare and nutritional status of 6-59 months children of Dharan. Anthropometric measurements and household survey were carried out to collect information regarding socioeconomic status and nutritional outcomes. The collected data were analyzed using WHO anthro 3.2.2 and SPSS version 20.

4.1 Socioeconomic and demographic characteristics

As shown in Table 4.1 majority (73.3%) of the households were headed by male whereas 26.7% of the survey household was headed by female. Similarly, 43% of the families were nuclear family and 57% of the families were joint family. Most (86.1%) of the family of the surveyed population followed Hinduism, 4.8% of the families followed Christianity, 0.6% of the families were Muslim, 3.6% followed Buddhism and 4.8% followed other religion.

Regarding father's occupation of the surveyed children 2.4% of them were involved in agriculture, 19.4% of them were involved in business, 27.3 % of them had gone for foreign employment, 9.7% of them were labor, 9.1% were involved in other occupations and 2.4% of the fathers were unemployed.

Regarding their education status 6.7% had primary level education, 52.1% had secondary level education, 25.5% were intermediate, 8.5% had bachelors or masters level education and 7.3% of the mothers had not received any education. One in three women and 1 in 10 men age 15-49 has no education. Seventeen percent of women and 19% of men have only attended primary school, while 26% of women and 34% of men have attended some secondary education. Nearly one-quarter of women and 37% of men have their School Level Certificate (SLC) or above. About 7 in 10 women (69%) and 9 in 10 men (89%) are literate(MoH *et al.*, 2016).Most of the family (73.9%) had their annual income between 1 lakh-3 lakh, 13.3% of the families had their annual income below 1 lakh and 12.7% of the families had annual income above 3 lakh.

Table 4.1 Socioeconomic and Demographic Characteristics

Variables	Frequency	Percent
Head of the Household		
Male	121	73.3
Female	44	26.7
Family Type		
Nuclear	71	43
Joint	94	57
Religion		
Hinduism	142	86.1
Christianity	8	4.8
Muslim	1	0.6
Buddhism	6	3.6
Others	8	4.8
Father's Occupation		
Agriculture	4	2.4
Business	32	19.4
Employment	49	29.7
Foreign Employment	45	27.3
Labor	16	9.7
Others	15	9.1
Unemployed	4	2.4
Father's Education		
Primary	11	6.7
Secondary	86	52.1
Intermediate	42	25.5
Bachelor and above	14	8.5
None	12	7.3
Family Income		
Less than 1lakh	22	13.3
1 Lakh-2 Lakh	122	73.9
More than 3 Lakh	21	12.7
House Structure		
Cemented	138	83.6
Mud	14	8.5
Others	13	7.9

4.2 Maternal characteristics

Among the mothers of surveyed children 75.2% were housewives, 3% were involved in agriculture, 11.5% in business, 6.7% were employed in firms, 2.4% were labor and 1.2% were involved in other occupation.

Table 4.2 Maternal characteristics of surveyed population (n=165)

Variables	Frequency	Percent
Mother's Occupation		
Housewife	124	75.2
Agriculture	5	3
Business	19	11.5
Employment	11	6.7
Labor	4	2.4
Others	2	1.2
Mother's Education		
Primary	14	8.5
Secondary	87	52.7
Intermediate	44	26.7
Bachelor and above	13	7.9
None	7	4.2
Age at Marriage		
Less than 20	72	43.6
More than 20	93	56.4
Age at first Pregnancy		
Less than 20	45	27.3
More than 20	120	72.7
Iron Folate		
Yes	152	92.1
No	13	7.9
Vaccination		
Yes	154	93.3
No	11	6.7

Similarly about their education, 8.5% of the mothers had primary level education, 52.7% had secondary level education, 26.7% were intermediate, and 7.9% had bachelor or master level education whereas 4.2% had not received any education which is represented in figure 4.1.

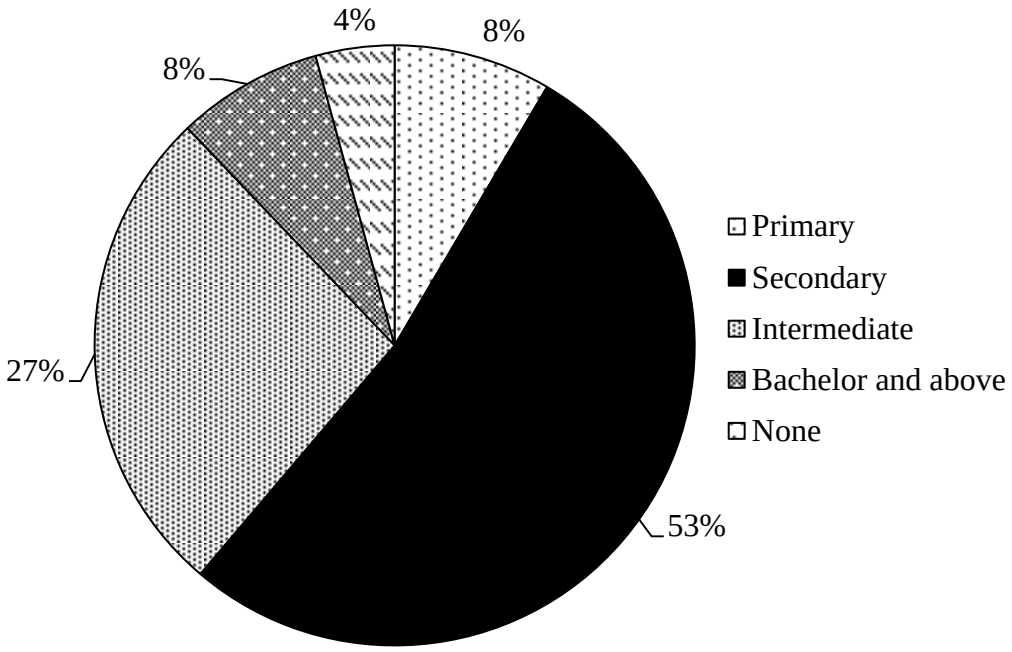

Fig.4.1 Surveyed Mother's Education level

Among the mothers of surveyed children, 56.4% of them had married after the age of 20 whereas 43.6% of them had married before the age of 20. More than half (52%) of women are married by age 18(MoH *et al.*, 2016).

Regarding their first pregnancy 72.7% of them got pregnant after the age of 20 and 27.3% of them got their first pregnancy before the age of 20. In Nepal, 17% of adolescent women age 15-19 are already mothers or pregnant with their first child (MoH *et al.*, 2016).

A higher percent of mother 92.1% had taken iron and folic acid tablets during pregnancy and also most (93.3%) of them had received vaccination during pregnancy. The majority of women (91%) take iron tablets or syrup during pregnancy. Eighty-nine percent of women's most recent births were protected against neonatal tetanus (MoH *et al.*, 2016).

4.3 Child characteristics

Among the surveyed children, most of the under five children were female (55.15%) and rest (44.85%) of them were male children.

According to the age group the highest (27.88%) number of children were from 12-23 months old, 23.03% of the children were from age group of 48-60 months, 19.39% of the

children were from 24-39 months, 15.76% were 36-47 months old and 13.94% were from the age group of 6-11 months as shown in figure 4.2.

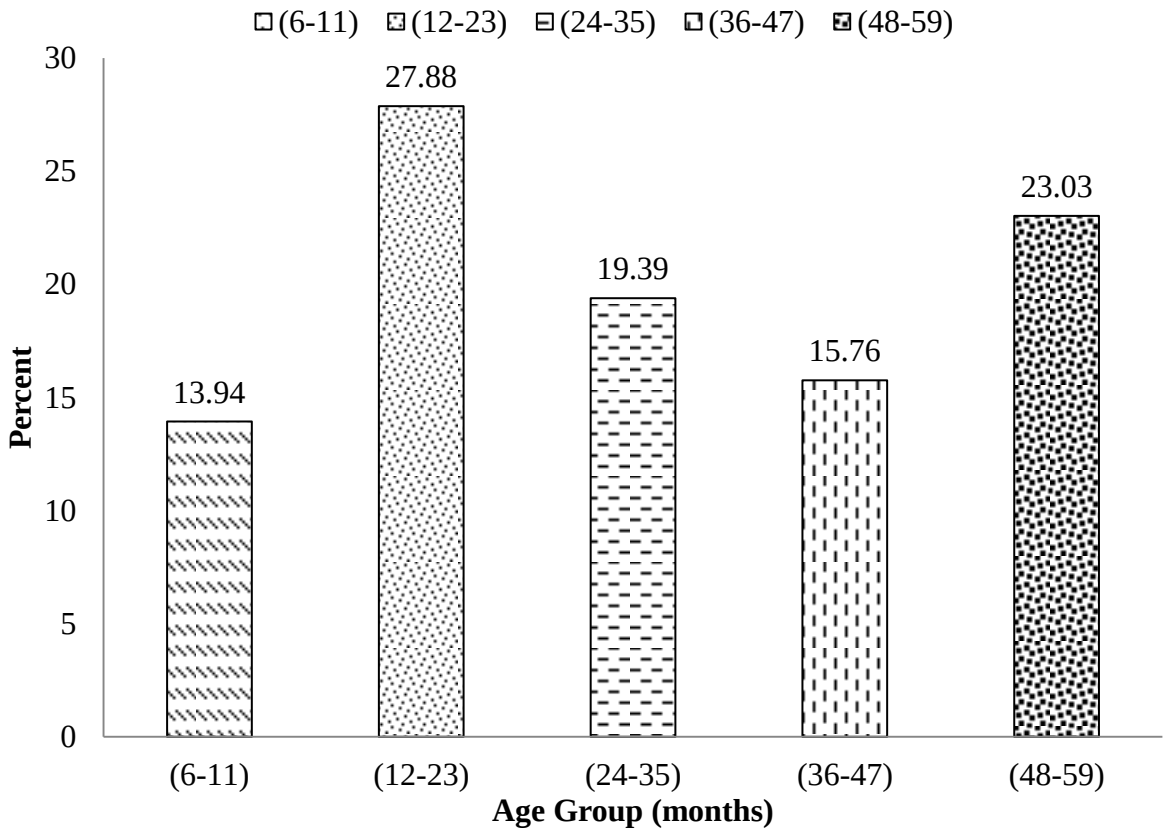

Fig 4.2 Distribution of age group of the surveyed children

The birth weight of 73.3% of the children was greater than 2.5 kg, 10.3% of their birth weight was 2.5 kg and 7.3% of their weight was less than 2.5kg and 9.1% of them were unaware about their child's weight after birth.

Now, the food consumption score of the 23.6 % children was found to be poor, 54.5% of the children were in borderline and 21.8% of the children had acceptable food consumption score.

Table 4.3 Child characteristics of surveyed children (n=165)

Variables	Frequency	Percent
Gender		
Male	74	44.85
Female	91	55.15
Age Group (months)		
6-11	23	13.94
12-23	46	27.88
24-35	32	19.39
36-47	26	15.76
48-60	38	23.03
Birth Weight		
Greater than 2.5 kg	121	73.3
2.5 kg	17	10.3
Less than 2.5 kg	12	7.3
unaware	15	9.1
Food Consumption Score		
Poor	39	23.6
Borderline	90	54.5
Acceptable	36	21.8

4.4 Child care characteristics (a)

Though, it is recommended to breast feed a child as soon as birth or within 1 hour of birth Table 4.4 shows that 61.8 % of the surveyed children were breast fed as soon as their birth, 21.8% were breast fed within 24 hours whereas 15.8 % were breast fed after 24 hours and 0.6% were not breastfed at all.

Colostrum was given to 81.8% of the surveyed children which is good for the child's health and nutrition and such desirable practices should be encouraged in the community. Breastfeeding is very common in Nepal with 99% of children ever breastfed. More than half (55%) of children are breastfed within the first hour of life(MoH *et al.*, 2016).

Table 4.4 Child care characteristics (a)

Variables	Frequency	Percent
Initiation of breastfeeding		
Within 1hour	102	61.8
within 24hour	36	21.8
after 24hour	26	15.8
Not breastfed	1	0.6
Colostrum Feeding		
Yes	135	81.8
No	30	18.2
Pre-Lacteal Feed		
Yes	30	18.2
No	135	80.8
Exclusive breast feeding		
Yes	98	59.4
No	67	40.6
Duration of Breastfeeding		
<2 years	5	3
2 years	12	7.3
>2 years	40	24.2
still feeding	107	64.8
Not fed	1	0.6
Suffered from diarrhea		
Yes	84	50.9
No	81	49.1
Vitamin A		
Yes	152	92.1
No	13	7.9
Deworming Tablet		
Yes	121	73.3
No	44	26.7
Cow milk		
Yes	120	72.7
No	45	27.3

Pre-lacteal food impairs the newborns' opportunity to obtain immune factors through feeding on colostrum (Zarban *et al.,* 2009) and increases the risk of the inoculation of pathogenic microorganisms through contaminated pre-lacteal food.

The pathogenic microorganisms might enhance host susceptibility to different infectious diseases and cause damage to the intestinal mucosal cells, thereby leading to malabsorption of nutrients (Rah *et al.,* 2008).

Among the surveyed children, 59.4% were exclusively breast fed whereas 40.6% were given other foods except from mother's milk including water.

In the survey, 3% of the children were breast fed till below 2 years of age, 7.3% were fed breast milk till 2 years of age, 24.2% above 2 years of age i.e. 3 years, 4 years and 5 years whereas 0.6% of the children were not breastfed at all. During the survey, 64.8% of the children were still breast feeding.

Among the surveyed children, 50.9% of them had not suffered from diarrhea recently whereas 49.1%of them had suffered from diarrhea Regarding the vitamin A supplementation and deworming tablet, higher percentage of children i.e. 92.1% had received vitamin A supplementation and 73.3% had received deworming tablet.

Since, 13.94% of the children were below 12 months of age therefore, they had not received deworming tablets. Eighty-six percent of children age 6-59 months received a vitamin A supplement (MoH *et al.*, 2016).

Also, among the surveyed children, 72.7% of them were given cow milk and 27.3% were not given cow milk.

4.5 Child care characteristics (b)

Among the surveyed children, 9.1% of the children had started complementary feeding at the age of 4 or less than 4 months, 7.9% at 5 months of age and 83% of them started at 6 months of age. Among them 30.3% was given lito, 20% was given rice porridge, 43% were given same food as other family members, 3% sarbottam pitho and 3.6% were given other types of food Also, 21.2% mothers were found restricting some kinds of food to children like cold drinks, ice cream or spicy foods and 78.8% of them did not restrict any kind of food to children.

Table 4.5 Child care characteristics (b) (n=165)

Variables	Frequency	Percent
Initiation of complementary food		
4 or Less than 4 months	15	9.1
5 months	13	7.9
6 months	137	83
Type of complementary food		
Lito	50	30.3
Same as other family members	71	43
Rice porridge	33	20
Sarbottam Pitho	5	3
Others	6	3.6
Restrict Food		
Yes	35	21.2
No	130	78.8
Feeding Material		
Bottle	71	43
Spoon	94	57
Treatment Place		
Hospital	120	72.7
Dhamijhakri	2	1.2
Unaware	1	0.6
Both	42	25.5
Drinking water		
By Filtering	113	68.5
Boiling	36	21.8
Others	3	1.8
Direct use from source	13	7.9

Similarly, 40% of the mothers used bottle, 57% used spoon and 3% used neither of it. When the child falls sick, 72.7% said they would take them to hospital and 1.2% preferred taking them to witch doctor (dhami jhakri). Also 25.5% mothers took their child to witch doctors first and then to hospital for treatment whereas 0.6% was unaware where would

they take their child during illness. For drinking water, 68.5% of them used filtration, 21.8% of them boiled the water before drinking, and 1.8% used other methods while 7.9% used it directly from source.

4.6 Household characteristics

Extraction of maad was not done in most (86.1%) of the house, 10.9% of the house discarded it even after extraction, 1.8% mixed it on animal's feed and only 1.2% preferred it mixing in curry.

Table 4.6 Household characteristics (n=165)

Variables	Frequency	Percent
Use of maad		
mix on curry	2	1.2
Do not extract	142	86.1
Mix on animal's feed	3	1.8
Discard	18	10.9
Type of salt		
Iodized salt	165	100
Source of water		
Tap	165	100
Toilet Availability		
Yes	165	100
Fruits Tree		
Yes	61	37
No	104	63
Kitchen Garden		
Yes	91	55.2
No	74	44.8
Livestock ownership		
Yes	71	43
No	94	57

Due to the wide availability of iodized salt the entire surveyed house used iodized salt in food preparation. Similarly for the water source the entire source was tap water and the entire house had toilet facility.

Fruits tree was maintained in 37% of the houses among the surveyed population and 55.2% had maintained kitchen garden at the house. Regarding livestock, 43% of the surveyed household had livestock whereas 57% did not had livestock.

4.7 Mother's knowledge on breastfeeding

Higher (70.9%) population of mother had idea about exclusive breastfeeding and 29.1% mothers were unaware about it. Though the mothers had knowledge on exclusive breastfeeding only few (59.4%) of them actually practiced breastfeeding.

Table 4.7 Mother's knowledge on breastfeeding practices (n=165)

Variables	Frequency	Percent
On Importance of colostrum		
Right	95	57.6
Wrong	7	4.2
Don't know	63	38.2
Initiation of breastfeeding		
within 1 hour	125	75.8
within 24 hours	19	11.5
Unaware	21	12.7
On Exclusive breastfeeding		
Yes	117	70.9
No	48	29.1
Duration of breastfeeding		
<2 years	2	1.2
2 years	57	34.5
>2 years	100	60.6
don't know	6	3.6
Need of Pre lacteal Feed		
Yes	32	19.4
No	133	80.6

Regarding duration of breastfeeding, 60.6% of mothers thought it is good to breast feed a child above 2 years of age, 34.5% said a child should be breast fed till 2 years of age, 1.2% said below 2 years of age where as 3.6% were unaware about it. About the need of pre lacteal feed, higher (80.6%) mothers were sure that pre lacteal feed is not necessary but 19.4% of mothers said that it is important for the child.

About breastfeeding questions, when they were asked about the reason for importance of colostrum 57.6% of the mothers gave right answer, 4.2% gave wrong answer and 38.2% of the mothers did not know about the importance of colostrum.

Similarly about initiation of breastfeeding, 75.8% mothers think breastfeeding must be initiated as soon as birth i.e. within an hour, 11.5% mothers thought it would be better in 24 hours and 12.7% were unaware about it.

4.8 Mother's knowledge on child care characteristics

Most (81.8%) mothers said that correct time for initiating complementary feeding for the child was in the age of 6 months while others still believed that correct time was 4 months (6.7%), 5 months (7.3%) and 7 months (4.2%). Though higher percent (86%) of mothers had knowledge on correct time to initiate complementary feeding only 83% mothers initiated it at 6 months.

Regarding the frequency of complementary feeding given to the child most (96.4%) of the mother said that a child should be fed 3 or more times whereas few mothers (3.6%) said less than 3 times. When they were asked about when they prefer to wash vegetables before cooking, 89.7% mothers washed vegetables before cutting and 10.3% mothers washed it after cutting it. In regard to the knowledge on sarbottam pitho in mothers, 66.1% mother had knowledge about what it is and 33.9% mothers did not know about it.

Population of mothers knowing about malnutrition was only slightly higher (54.5%) and when they were asked about the causes of malnutrition only (33.9%) answered correctly. Rest (18.2%) gave the wrong reasons for causing malnutrition and 47.9% were unaware about the causes of malnutrition.

Mothers regarding bottle feeding as safe method was found about 32.1% and 66.7% did not consider it sound to use for feeding while 1.2% did not know about it.

Table4.8 Mother's knowledge on child care (n=165)

Variables	Frequency	Percent
Initiation of complementary feeding		
4months	11	6.7
5 months	12	7.3
6 months and above	142	86.1
frequency of complementary feeding		
Less than 3	6	3.6
3 or more times	159	96.4
Wash Vegetables		
Before cutting	148	89.7
After cutting	17	10.3
Sarbottam pitho		
Yes	109	66.1
No	56	33.9
On malnutrition		
Yes	90	54.5
No	75	45.5
On causes of malnutrition		
Right	56	33.9
Wrong	30	18.2
Don't know	79	47.9
On diarrhea		
Yes	152	92.1
No	13	7.9
On causes of diarrhea		
Right	82	49.7
Wrong	58	35.2
Don't know	25	15.2
On ORS making		
Yes	106	64.2
No	59	35.8
foods during diarrhea		
Soup	92	55.8
same as usual	19	11.5
Others	21	12.7
unaware	33	20
maad nutrients		
Yes	118	71.5
No	47	28.5
On bottle feeding		
Yes	53	32.1

No	110	66.7
Don’t know	2	1.2

Similarly in questions about diarrhea, 92.1% mothers knew about diarrhea but only 49.7% mothers gave the right factors causing diarrhea. Rest (35.2%) gave wrong reasons for causing diarrhea and 15.2% were unaware about it. Among the surveyed mothers, 64.2% of them knew to prepare ORS solution at home and 35.8% did not know about it. The foods that should be given during diarrhea, 55.8% mothers said soup, 11.5% said same as usual, 12.7% said other kinds of foods and 20% mothers were unaware about what sort food should be given when suffering from diarrhea.

Although higher percentage of mothers did not extract maad due to the use of rice cookers and not feeling the need of it, most (71.5%) mothers knew that maad consisted of useful nutrients while 28.5% did not know about it.

4.9 Mother’s knowledge level score

Regarding the mother’s level of knowledge, 32.7% mothers had good level of knowledge in child care, 57.6% scored average whereas 9.7% scored poorly in respect to knowledge questions. It can be concluded that higher percent of mothers had an average knowledge on child care. The mother’s knowledge score was done as described by (Shettigar *et al.*, 2013).

Table 4.9 Mother’s knowledge level score (n=165)

Level of Knowledge	**Score**	**Mother’s Score (n=165)%**
Good	17-20	54(32.7%)
Average	16-17	95(57.6%)
Poor	1-10	16(9.7%)

4.10 Nutritional status of children

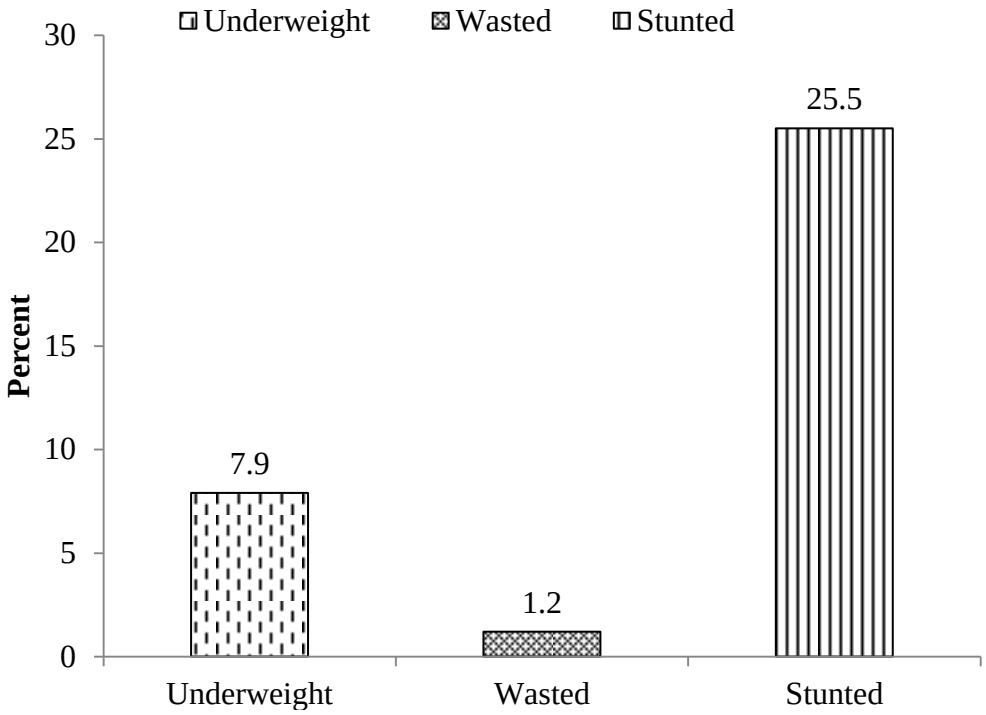

Fig 4.3 Nutritional status of surveyed children

The total children taken for survey was 165 among them 74 were males and 91 were females. Among these children 7.9% were underweight, 1.2% was wasted and 25.5% were stunted. According to the report of NDHS 2016, 27% of under five children are underweight, 10% are wasted and 36% are stunted.

The result of this study showed that prevalence of stunting was relatively higher than that of underweight and wasting in Dharan but the percent is comparatively lower than that of data provided by NDHS 2016.

Study conducted in rural Terai of Eastern Nepal by Gharti Chhetri, (2005) showed that stunting was 36.6%, wasting was 29.8% and underweight was 53.3% which is also relatively higher percentage of malnutrition than present study.

4.11 Distribution of malnutrition according to age group

From the Table 4.11, it is observed that prevalence of stunting, underweight and wasting was high among the children of age group 48-59 months. Stunting was seen more in 12-23 months and 48-59 months. Stunting in early stages of one's life is associated with adverse

functional effects, including cognition deficiencies, educational performance, low adult incomes, loss of productivity and, when accompanied by too much weight increase later in childhood, increased risk of nutrition-related chronic diseases (Cousens *et al.*, 2010).

Study by (Rajaretnam and Hallad, 2000) using the NFHS-II data of India reported that children aged 12–47 months become less and less underweight but more and more stunted after reaching 2 years of age which is similar to my study. The reason may be a deficiency in proper supplementary food for children.

Table 4.10 Distribution of malnutrition according to age group (n=165)

		HAZ (%)		WAZ (%)		WHZ (%)	
		Stunting		Underweight		Wasting	
Age(months)	N	<-3SD	<-2SD	<-3SD	<-2SD	<-3SD	<-2 SD
6-11	23	8.7	21.7	Nil	4.3	Nil	Nil
12-23	46	8.7	28.3	Nil	Nil	Nil	Nil
24-35	32	Nil	21.9	Nil	6.3	Nil	Nil
36-47	26	11.5	26.9	7.7	11.5	Nil	Nil
48-59	38	10.5	28.9	2.6	18.4	2.6	7.9

4.12 Distribution of malnutrition according to MUAC measurement

Table 4.11 Distribution of malnutrition according to MUAC measurement (n=165)

MUAC range (cm)	**Frequency**	**Percent**
Normal (>12.5)	162	98.18
Moderate(11.5-12.5)	3	1.82
Severe(<11.5)	nil	nil

On the basis of Mid Upper Arm Circumference (MUAC), most (98.18%) of the children were normal and only (1.82%) of them were moderately malnourished.

4.13 Weight for age curve

The median weight for age z-score of survey children was found to be 0.55. This cause the curve slightly skewed to the left side of WHO standard curve showing the prevalence of underweight among study population as shown in Fig. 4.8.

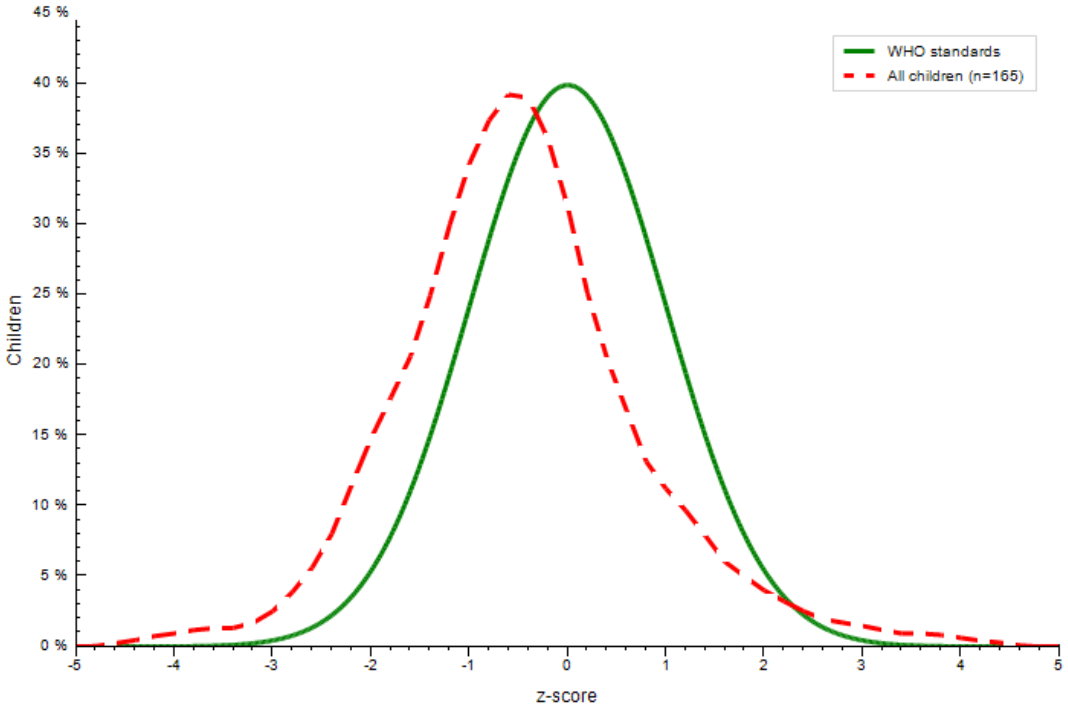

Fig 4.4 Weight for Age curve with reference to WHO standard

4.14 Factors associated with underweight

Statistically significant association was found between child's birth weight (0.001), type of complementary food given (0.016) and knowledge on correct time to initiate complementary feeding (0). In the study, it was seen that underweight was high among the children whose birth weight was 2.5 kg (35.3%), less than 2.5 kg (8.3%) and whose birth weight was unknown (6.7%). Only 4.2% of the children with birth weight greater than 2.5 kg were underweight. Similar study by (Rahman *et al.*, 2016) suggested that once a baby is born underweight, the risk of becoming malnourished during the first five year of life is higher compared to a baby of normal weight.

Similarly the children who were given rice porridge (18.2%), Sarbottam pitho (20%) and other foods (16.7%) as complementary feeding were found to be more underweight than the children who were given lito (6%) and same food (2.8%) as other family members.

Knowledge on correct time to initiate breastfeeding was significantly associated with underweight. Though higher percent of mother had knowledge on initiating complementary feeding at 6 months lesser percent of mothers actually initiated complementary feeding at 6 months. Faulty feeding practices like late initiation of breast

feeding, starting artificial feeding before 6 months and early and late start of complementary foods causes malnutrition (Gharti Chhetri, 2005).

Table 4.12 Result of Chi-square test for factors associated with underweight (n=165)

Variables	WFA		Chi-square value	P-value
	Normal	Underweight		
Birth weight				
>2.5 kg	116 95.9%)	5 (4.2%)		
2.5 kg	11(64.7%)	6(35.3%)	21.59	0.001*
<2.5kg	11(91.7%)	1(8.3%)		
unaware	14(93.3%)	1(6.7%)		
Father's Education				
Primary(1-5)	11(100%)			
Secondary(6-10)	76(88.4%)	10(11.6%)		
Intermediate	40(95.2%)	2(4.8%)	5.26	0.73
Bachelor and above	14(100%)	0		
None	11(91.7%)	1(8.3%)		
Mother's Education				
Primary(1-5)	14(100%)			
Secondary(6-10)	78(89.7%)	9(10.3%)		
Intermediate	42(95.5%)	2(2.6%)	7.23	0.512
Bachelor and above	7(100%)	0		
None	11(84.6%)	2(15.4%)		
Total Income				
<1 Lakh	18(81.8%)	4(18.2%)		
1 - 3 Lakh	114(93.4%)	8(6.4%)	8.162	0.086
>3 Lakh	20(95.2%)	1(4.8%		
Knowledge on correct time to initiate complementary feeding				
4 months	9(81.8%)	2(18.2%)		
5 months	10(83.3%)	2(16.7%)	20.588	0*
6 months and above	133(93.7%)	9(6.3%)		
Knowledge on type of complementary food				
Lito	47(94%)	3(6%)		
same food as other family members	69(97.2%)	2(2.8%)		
rice porridge	27(81.8%)	6(18.1%)	18.76	0.016*
sarbottam pitho	4(80%)	1(20%)		
Others	5(83.3%)	1(16.7%)		

*Statistically significant at 5% level of significance (P-value <0.

Knowledge of mother other than initiation of complementary food and type of food was not associated with underweight. Other socio-demographic factors (head of household, type of family, no. of children under 5, father's education, mother's education, father's occupation, mother's occupation, house structure, total family income) did not have significant association with underweight.

Maternal characteristics such as age at marriage, age at first pregnancy, iron and folic tablets in pregnancy, vaccination during pregnancy did not have significant association with underweight. Child care characteristics initiation of breastfeeding, colostrum feeding, feeding pre lacteals, exclusive breastfeeding, vitamin A and de worming tablets consumption, cow milk consumption and food consumption score were not significantly associated with underweight. Environmental variables such as source of drinking water, water treatment method, Toilet facilities, kitchen gardening and keeping livestock at home were not associated with underweight.

4.15 Height for age curve

The median height for age z-score of survey children was found to be -1.2.This is why the curve is slightly skewed to the left side of WHO standard curve showing the prevalence of stunting among study population as shown in Fig. 4.7

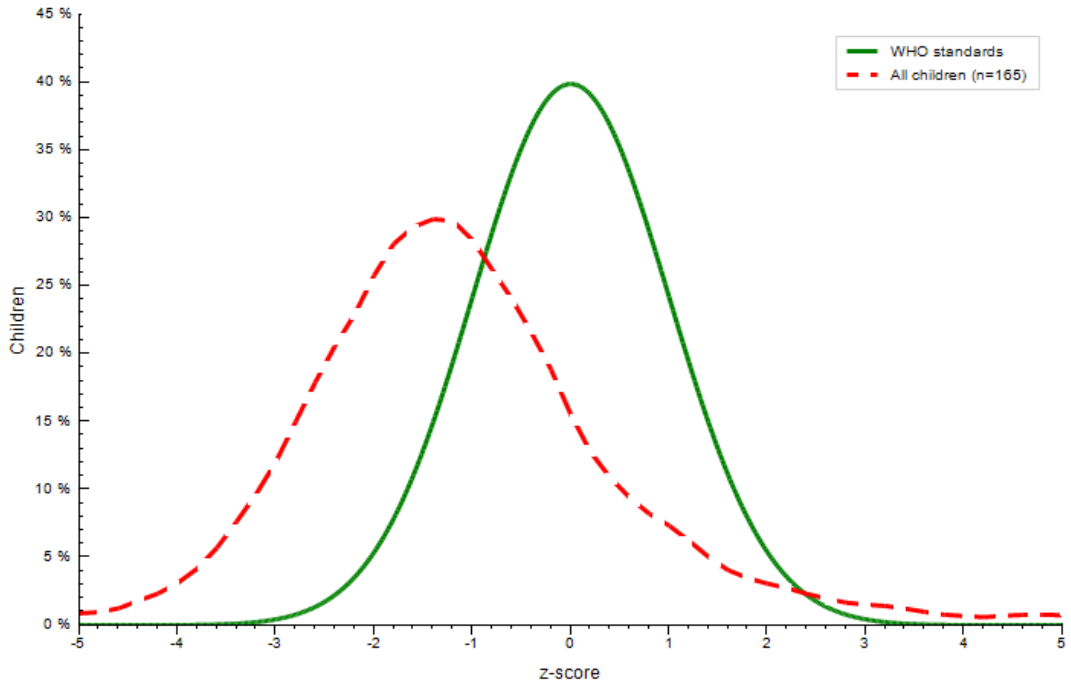

Fig. 4.5 Height for age curve with WHO standard

4.16 Factors associated with stunting

It was seen that children from fathers with no education, primary education and secondary level education were more stunted with 50%, 45.5% and 29% prevalence respectively. Father's education is one of the most important determinants of child malnutrition (Smiths and Haddad, 2000). In the similar study(Alom *et al.*, 2012) the likelihood of children being stunted decreased with increasing father's educational status.

The findings support the reality that educated fathers were more conscious of their children's health than uneducated fathers. Literate fathers are more likely to introduce new feeding practices, which helps to improve the nutritional status of their children.

Similarly, the study showed that stunting was high among the children from mothers with no education (46.2%), with primary level education (28.4%) and secondary level education (25.3%). In the study conducted by (Azpeitia *et al.*, 2017), it was seen mother's education status is significantly associated with child's nutritional status. Mother's education has significant association with stunting. Educated mothers are likely to be more aware about child health. Mother's education is the best predictor for health and nutrition inequalities among infants and young children in rural Uganda. This suggests a need for appropriate formal education of the girl child aimed at promoting child health and nutrition (Wamani *et al.*, 2004).

Similarly, children from mothers with no education were most stunted (46.2%). The prevalence rates differed only slightly among the mothers with primary education (28.4%) and secondary level education (25.3%). Stunting was less prevalent among the children from mothers with intermediate level education and mothers with bachelors and above education. On the research done by (Brahmam *et al.*, 2011), mothers education status was significantly associated with the prevalence of stunting, under weight and wasting in the child.

Stunting was seen high among the children of family with annual income below 1 lakh i.e. 50%. It was also found that 23.8% of the children from family with annual income between 1 lakh to 3 lakh were stunted and only 9.6% children were stunted from the family with annual income above 3 lakh. Household income factors are strong indicators of child nutrition status. Usually, children belonging to higher income households have better nutritional status than those of lower income households (Vella *et al.*, 1994). In the similar

study, conducted by (Alom *et al.*, 2012). Odds of being stunted for children decreased with an increase in household wealth index.

Table 4.13 Result of Chi-square test for factors associated with stunting

Variables	HFA		Chi-square value	P-value
	Normal	Stunted		
Birth weight				
>2.5kg	96(79.3%)	25(20.3%)		
2.5 kg	9(52.9%)	8(47.1%)	8.7	0.19
<2.5kg	9(75%)	3(25%)		
unaware	9(60%)	6(40%)		
Father's Education				
Primary(1-5)	6(54.5%)	5(45.5%)		
Secondary(6-10)	61(70.9%)	25(29%)		
Intermediate	38(90.5%)	4(9.5%)	17.46	0.026*
Bachelor and above	12(85.7%)	2(14.3%)		
None	6(50%)	6(50%)		
Mother's Education				
Primary(1-5)	10(71.4%)	4(28.4%)		
Secondary(6-10)	65(74.7%)	22(25.3%)	15.59	0.048*
Intermediate	35(79.5%)	9(20.5%)		
Bachelor and above	6(85.7%)	1(14.3%)		
None	7(53.8%)	6(46.2%)		
Total Income				
<1 Lakh	11(50%)	11(50%)		
1 - 3 Lakh	93(76.2%)	29(23.8%)	11.9	0.018*
>3 Lakh	19(90.5%)	2(9.6%)		
Knowledge about initiating complementary feeding				
4 months	6(54.5%0	5(45.5%)		
5 months	7(58.3%)	5(41.7%)	5.38	0.25
6 months and above	110(77.5%)	32(22.5%)		
Knowledge about complementary food				
Lito	38(76%)	12(24%)		
same food as other family members	55(77.5%)	16(22.5%)		
rice porridge	21(63.6%)	12(36.4%)	4.011	0.856
sarbottam pitho	4(80%)	1(20%)		
Others	5(83.3%)	1(16.7%)		

*Statistically significant at 5% level of significance (P-value <0.05)

Mother's knowledge on various aspects such as breastfeeding, complementary feeding, malnutrition, diarrheal conditions and its treatment were not associated with stunting. Other socio-demographic factors (head of household, type of family, no. of children under 5, father's occupation, mother's occupation, house structure) did not have significant association stunting.

Maternal characteristics such as age at marriage, age at first pregnancy, iron and folic tablets in pregnancy, vaccination during pregnancy did not have significant association with stunting.

Child care characteristics initiation of breastfeeding, continued breast feeding for 2 years, colostrum feeding, feeding pre lacteals, exclusive breastfeeding, vitamin A and de worming tablets consumption, cow milk consumption and food consumption score were not significantly associated with stunting.

Environmental variables such as source of drinking water, water treatment method, Toilet facilities, kitchen gardening and keeping livestock at home were not associated with stunting.

4.17 Weight for height curve

The median weight-for-height z-score of survey children was found to be 0.23. This is why curve is slightly skewed to the right side of the WHO standard curve not showing the prevalence of wasting among the study population as shown in the Fig. 4.6.

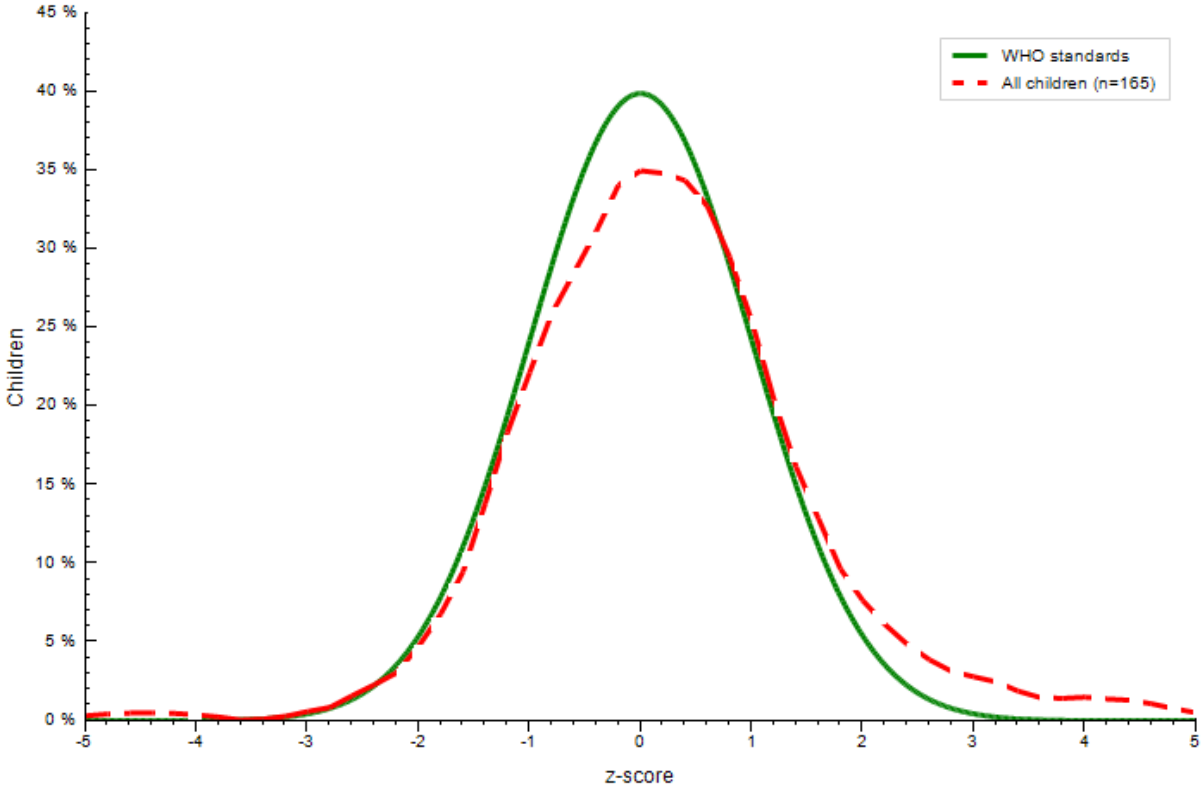

Fig 4.6 Weight for Height curve with reference to WHO standard

4.18 Factors associated with wasting

There was no any significant association seen with wasting. Mother's knowledge on various aspects such as breastfeeding, complementary feeding, malnutrition, diarrheal conditions and its treatment were not associated with wasting. Other socio-demographic factors (head of household, type of family, no. of children under 5, mother's education, father's education, total family annual income, father's occupation, mother's occupation, house structure) did not have significant association wasting.

Maternal characteristics such as age at marriage, age at first pregnancy, iron and folic tablets in pregnancy, vaccination during pregnancy did not have significant association with wasting.

Child care characteristics birth weight, initiation of breastfeeding, colostrum feeding, feeding pre lacteals, continued breastfeeding for 2 years, exclusive breastfeeding, vitamin A and de worming tablets consumption, cow milk consumption and food consumption score were not significantly associated with wasting. Environmental variables such as

source of drinking water, water treatment method, Toilet facilities, kitchen gardening and keeping livestock at home were not associated with stunting.

Table 4.14 Result of Chi-square test for factors associated with wasting (n=165)

Variables	WFH		Chi-square value	p value
	Normal	Wasted		
Birth weight				
>2.5 kg	120(99.2%)	1(0.8%)		
2.5 kg	17(100%)	nil	10.415	0.108
<2.5 kg	12(100%)	nil		
unaware	14(93.3%)	1(6.7%)		
Father's education				
Primary	11(100%)			
Secondary	85(98.8%)	1(1.2%)		
Intermediate	41(97.6%)	1(2.4%)	3.86	0.87
bachelor and above	14(100%)			
None	12(100%)			
Mother's education				
Primary	14(100%)	nil		
Secondary	85(97.7%)	2(2.2%)		
Intermediate	44(100%)	nil	1.815	0.99
bachelor and above	7(100%)	nil		
None	13(100%)	nil		
Total income				
<1 lakh'	22(100%)			
1-3 lakh	121(99.2%)	1(0.8%)	7.242	0.124
> 3 lakh	20(95.2%)	1(4.8%)		
knowledge on initiation of complementary feeding				
4 months	11(100%)	nil		
5 months	12(100%)	nil	0.328	0.988
6 months and above	140(98.6%)	2(1.4%)		
knowledge on type of complementary food				
Lito	50(100%)	nil		
same food as other family members	71(100%)	nil		
rice porridge	31(93.9%)	2(6%)	8.098	0.424
sarbottam pitho	5(100%)	nil		
Others	6(100%)	nil		

*Statistically significant at 5% level of significance (P-value <0.05)

4.19 Association between mother's knowledge score and malnutrition

No association was seen between the total knowledge scoring of mothers and the nutritional status of the children. However, prevalence of underweight, wasting and stunting was seen higher among the children of mothers with poor knowledge on child care.

Table 4.15 Association between mother's knowledge score and nutritional status (n=165)

	HFA			
	normal	**stunted**	**chi-square**	**p-value**
Good	40(75.4%)	13(24.6%)	0.571	0.752
not good	83(74.1%)	29(25.9%)		
	WFH			
	normal	**wasted**		
Good	52(98.1%)	1(1.9%)	2.59	0.274
not good	111(99.1%)	1(0.9%)		
	WFA			
	normal	**underweight**		
Good	50(94.3%)	3(5.7%)	1.482	0.477
not good	102(91.1%)	10(8.9%)		

*Statistically significant at 5% level of significance (P-value <0.05)

Part V

Conclusion and Recommendation

5.1 Conclusion

The following conclusions were made from the study:

1. The prevalence of stunting, wasting and underweight in 6-59 months aged children residing in Dharan Sub-metropolitan city was 25.5%, 1.2% and 7.9% respectively. It was seen that stunting and underweight was more prevalent than wasting.
2. Only few of the mothers had poor knowledge regarding child care whereas rest of the mothers managed to score good or average
3. The child's birth weight, correct time to initiate complementary feeding and the type of complementary food given to children was significantly associated with underweight.
4. Similarly, paternal education level, maternal education level and the total annual income of the family was significantly associated with stunting.

5.2 Recommendations

On the basis of the results obtained from the study following recommendation could be made in order to improve the nutritional status of the survey area in future:

1. There is the need for intervening nutritional and health education as educated mother is most likely to provide better care in terms of good nutrition and better hygiene which in turn improve the nutritional status.
2. Promotion of locally available nutritious food and practice of kitchen garden at home should be encouraged to the mothers.
3. Importance of consumption of food from all food groups in accordance with their economic condition should be emphasized among the mothers or care takers.
4. Similar cross-sectional descriptive or longitudinal survey can be conducted to determine the magnitude and distribution of malnutrition and other probable causes of malnutrition.

Part VI

Summary

Association between mothers‟ nutritional knowledge in childcare practices and nutrition status of 6-59 months children of Dharan Sub metropolitan city, Sunsari was carried out by taking 165 children. Probability Proportionate sampling method was taken for data collection. Anthropometric measurements (like height, weight, MUAC, edema) were taken to access the nutritional status of children and structured questionnaire was ask to their mothers to examine knowledge level in child care practices. The data collected were analyzed by using SPSS version 20(Page *et al.,* 2003) and WHO Anthro 3.2.2 (M. Blossner *et al.,* 2010) version and Chi-square test was used to test the association between factors assumed responsible for malnutrition.

Prevalence of underweight, wasting and stunting was 7.9%, 1.2% and 25.5% respectively. It was seen that prevalence of underweight and wasting was similar in both sexes while stunting was seen higher in female children. Among 165 children, 74 were male and 91 were female. Prevalence of underweight and stunting was more prevalent in 48-59 months aged children.

Majority of households (73.3%) were headed by male. Regarding family type, 43% of families were from nuclear family while 57% from joint families. Most (73.9%) of the family had income between 1-3 lakh. Regarding, paternal education, 86.1% of the father's had received secondary or above secondary level of education.

Most (87.3%) of the mother were educated with secondary level or above level of education. More than 70% of mothers under the survey were house-wife and 43.6% of mothers had married before getting 20years old. 55.2% of mothers practiced kitchen gardening and 43% owned live stocks.

Out of 165 children, 64.8% were still breast feeding and 31.5% of the children were breast fed till 2 years and above. Only 61.8% had received breast milk within an hour of birth and 81.8% had received colostrum. Though pre-lacteal feed is not suggested 18.2% children still received some kind of pre-lacteal feed. Among the mothers 70.9%had knowledge on exclusive breastfeeding but only 59.4% of them practiced it. Complementary feeding was given at 6 months to 83% of the children. 92.1% received

vitamin A and 73.3% received deworming tablets. Regarding food consumption score 23.6% had poor food consumption score.

Knowledge of mothers in reason for importance of colostrum, 57.6% gave the right reasons. Similarly, 75.8% had knowledge that breastfeeding should be initiated within an hour of birth and 80.6% mothers believed that pre-lacteal feed was not needed for the child. Also higher (81.8%) of mothers had knowledge that complementary feeding should be initiated at 6 months of age.

Only 33.9% could give the right causes of malnutrition. Though 92.1% of mothers knew about diarrhea only 49.7% could actually give the right causes for diarrhea and 55.8% knew what foods to be given to child suffering from diarrhea. On overall scoring on mothers knowledge on child care 9.7% mothers had score poorly and rest of them scored an average or good level.

Chi–square test analysis of the determinants of nutritional status indicated that, paternal education status, maternal education status and total annual income of the family were associated with stunting. Similarly, weight of the child at birth and the type of complementary food given to the child was significantly associated with underweight.

From the study it was seen that malnutrition particularly stunting is more prevalent in Dharan sub-metropolitan city. To reduce the burden of malnutrition among these children, a combined effort by the government, nongovernmental organizations and the community is essential to improve the nutritional status of children. Effective, efficient and equitable program should be designed to reduce child malnutrition. A healthy mother can give birth to a healthy children, thus the intervention programs for improving the nutritional status of children must focus not only on children but also on their mothers.

The result obtained from this dissertation can be used by the government as well as other organizations for eradicating the malnutrition problem.

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Appendices

Appendix A

केन्द्रिय प्राविधि क्याम्पस

हात्तिसार, धरान

पोषण तथा आहार बिज्ञान, चौथो बर्ष

मन्जुरिनामा

नमस्कार|

म गरिमा पौडेल,केन्द्रिय प्राविधि क्याम्पस, धरानमा पोषण तथा आहार बिज्ञान, चौथो बर्षमा अध्ययनरत बिध्यार्थी हु|यस संकायको चौथो बर्षको पाठ्यक्रम अन्तर्गत म सोधपत्र गरिरहेको छु|मेरो सोधकार्यको बिषय"धरान उपमहानगरपालिकको ६-५९ महिनाको बाल्बलिकाहरुको पोसन स्थिती र उनिहरुको आमाको बाल्बलिकाको पोसन स्याहार सम्बन्धी ज्ञान को अध्ययन "रहेको छ|यो जानकारीले हाम्रो अध्यनलाई सहज बनाई हामीलाई सहयोग गर्नेछ र यसले यस नगरपालिकाको 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 गर्ने छु साथै तपाइको बच्चाको केहि नाप लिनेछु|यो सर्वेक्षणले तपाइको बच्चाको पोषण स्थित बारे थाहा हुन्छ र बच्चालाई पोषण सम्बन्धि बिशेस हेरचाह आवश्यक पर्ने वा नपर्ने पनि थाहा पाउन सक्नुहुनेछ|अध्ययनका केहि प्रश्नहरु नितान्त व्यक्तिगत पनि हुन सक्छन र तपैले दिनु भएको सबै जानकारीहरु महत्वोपूर्ण हुनेछन र सो जानकारीहरु एकदमै गोप्य राखिनेछ साथै तपैले दिनुभएको सूचना तथा तथ्यांकको दुरुपयोग गरिनेछैन|यो अध्ययनमा तपाइको सहभागिता स्वैिच्छक हुनेछ|यदि तपाइलाई कुनै वा सबै प्रश्न व्यक्तिगत वा सम्वेदनसिल लागेमा उत्तर नदिन पनि सक्नुहुन्छतर म यो आशा गर्दछु कि तपाई यस अध्ययनमा सहभागी हुनु हुनेछ |के तपाई यस अध्ययनमा सहभागी हुन इच्छुक हुनुहुन्छ ? (इच्छुक भए मात्र प्रश्न गर्ने नभए अन्तर्वार्ता टुंग्याउने)

म यस अध्ययनमा सहभागीहुन इच्छुक छु र यस अध्ययनका लागि आवश्यक पर्ने मेरो बच्चाको नाप तौल लिन अनुमति दिन्छु |

शहवागीको हस्तक्चर

Appendix B

Code No.	Ward No.
Child's Name Date of Birth	Age Gender: Male / Female
Mother's Name	Age

B. Child's Description

Anthropometric measurement of children

Height (cm)	Weight (Kg)	MUAC (cm)	edema (Yes / No)

1. Weight of newly born child? >2.5 kg / 2.5 kg / < 2.5 kg / unaware
2. Did your child is affect by any disease recently? ……

C. Family member's description

1) Head of the household. (male/female)
2) Total members…….male……..female…….
3) Total children……male……female……
4) Family type. Single/ joint
5) Religion: Hindu / Christian /Muslim/ Buddhism/other
6) What is your husband's occupation?

   Agriculture / Business / Employment/ Foreign Employment / Labor / Other
7) What is your occupation?

Housewife / Agriculture / Business / Employment/ Foreign Employment / Labor / Other

8) Father's education level?

Primary Level (1-5) / Secondary Level (6-10) / Intermediate / Bachelor and above/ None

1) Mother's education level? Primary Level (1-5) / Secondary Level (6-10) / Intermediate / Bachelor and above/ None
2) Family's annual Income? 1 lakh/ 1-3 lakh/ > 3 lakh
3) House structure? Cemented / Mud

D. Mother's health description

1. Age of marriage? Less than 20/ more than 20
2. Age at first pregnancy? Less than 20/ more than 20
3. Age of second pregnancy?
4. Did you take iron and folic acid tablet during your pregnancy? Yes/ No
5. Vaccinations during pregnancy? Yes / No

E. Child Care Practices

1. When did you first initiate breast feeding? Within 1hr of birth/ within 24hrs/ after 24hrs
2. Did you feed colostrum to your child? Yes / No
3. What was your child's age up to which you breast-fed? …….
4. Had your child suffered from diarrhea? Yes / No
5. Did you give Vitamin A capsule? Yes/ no
6. De-worming tablet supplementation? Yes / No
7. Do you feed cow milk to your child? Yes / No
8. Did you feed anything except mother's milk to your child during the first 6months?Yes/ No
9. At what age did you start feeding other foods to the child? 4/5/6/7 months
10. What food items do you fed to your child?
    a. *Lito* iii. Same as other family members
    b. *Rice porridge* IV. Sarbottam pitho v. Others
11. Do you restrict any foods to your child? Yes / No

    If yes, why do you? ……
12. How did you feed your baby? A)bottle B)spoon
13. Was pre lacteal feed given to your child? Yes /No

    If yes why?.....
14. What would you do with the *maad* ?
    a. Mix on curry iii. Mix on animal's feed
    b. ii. Do not extract iv. Discard

F. Mother Nutritional Knowledge

1) At what time is it suitable to initiate breastfeeding?

   Within 1 hour/ 8 hours /24 hours / unaware
2) Why colostrum feeding is important to the child? …….

3) Do you know about exclusively breastfeeding? Yes / No
4) How long a child should be breastfed? 1/ 2/ 3/ 4/ 5 years or more/don't know
5) Is pre-lacteal feed essential for the child? Yes/no
6) At what age to start feeding other foods to the child? 4/5/6/7 months
7) How many times per day child should be fed food? <3 / 3 / 4 / 4 and more
8) What kinds of salt are good to use at home?
   Iodized salt/ non-iodized salt / anyone(doesn't matter)
9) Do you know about *sarbottam pitho*? Yes/ No
10) Do you have knowledge about malnutrition? Yes/ No
11) If you know about malnutrition, what may be the cause of it? ……
12) Do you have knowledge about diarrhea? Yes / No
13) If you know about diarrhea, what may be the cause of it? ……..
14) Do you know to prepare Oral Rehydration Solution (ORS) at home? Yes/ No
15) What kinds of food should be given to the children during diarrhea?
    a. Soup iii. unaware
    b. Same as usual iv.others……..
16) Do you know extracted *maad* also have nutrients? Yes/ No
17) When will you wash your vegetables?
    Before cutting / after cutting
18) Where do you take your child for treatment during illness?
    a. Hospital (health post) ii. *Dhami-jhakri*
    b. iii. unaware iv.Both
19) Do you think bottle feeding is good/safe for the baby? Yes/no

G. Additional knowledge

1. What is your source of water for general household purposes?
   i. Water pumps iii. Boring
   ii. Tap iv. Other
2. How do you prepare drinking water?
   i. By filter iii. Other
   ii. Boiling iv. Direct use from source
3. Do you have toilet in your home? Yes /No

4. Do you have fruits tree at your home? Yes / No

5. Do you have kitchen garden at your home? Yes/ No

6. Which pets do you owe, if any?

Buffalo

Goat

Cow / Ox

Duck / Chicken

Pig

Other …….

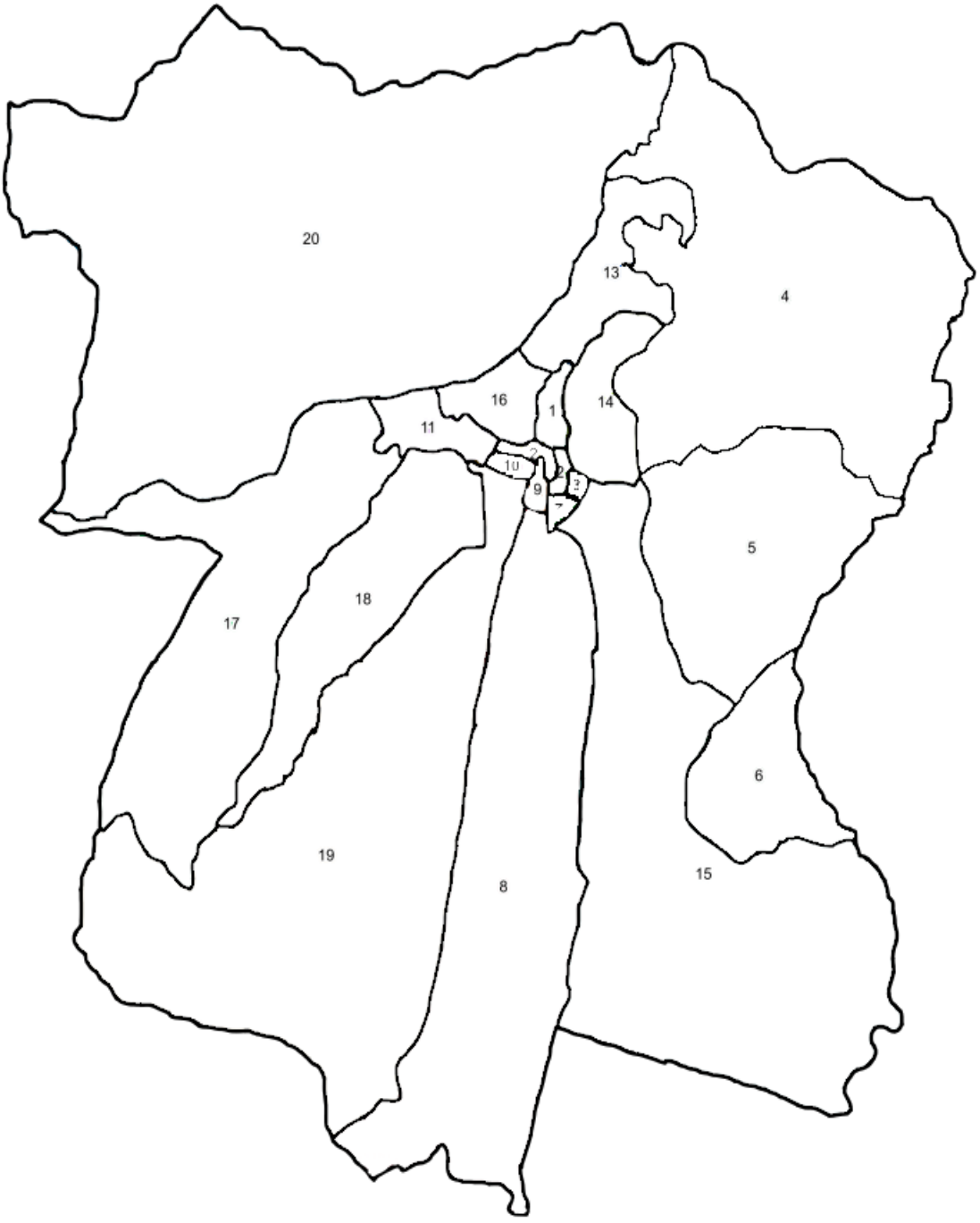
Table 1 Child's food consumption score

Food items	Food group	Weight(a)	Consumption per week(no. of days)(b)	FCS (ab)
Cereals				
Pulses and nuts				
Vegetables				
Fruits				
Animal products				
Dairy/dairy products				
Oil/fat				
Sugar				
condiment				

Table 2 Mother's food consumption score

Food items	Food group	Weight (a)	Consumption per week(no. of days)(B)	FCS (a*b)
Cereals: Corn, wheat rice, bread, roots, tubers	Staple	2		
Pulses and nuts: peanuts,beans, gram dal	Pulses	3		
Vegetables	Veg	1		
Fruits	Fruits	1		
Animal products	Meat and fish	4		
Dairy/dairy products	Dairy	4		
Oil and fat	Oil	0.5		
Sugar	Sugar	0.5		
condiment	condiment	0		

Appendix C (study area)



Appendix D

Government of Nepal

Nepal Health Research Council (NHRC)

Ref. No.: 1814

18 February 2018

Ms. Garima Poudel
Principal Investigator
Central Campus of Technology

Ref: **Approval of thesis proposal** entitled **Association between mother's knowledge on child care and the child's nutritional status of Dharan submetropolitan city, Sunsari**

Dear Ms. Poudel,

It is my pleasure to inform you that the above-mentioned proposal submitted on **24 January 2018 (Reg. no. 36/2018)** has been approved by Nepal Health Research Council (NHRC) National Ethical Guidelines for Health Research in Nepal, Standard Operating Procedures Section 'C' point no. 6.3 through Expedited Review Procedures.

As per NHRC rules and regulations, the investigator has to strictly follow the protocol stipulated in the proposal. Any change in objective(s), problem statement, research question or hypothesis, methodology, implementation procedure, data management and budget that may be necessary in course of the implementation of the research proposal can only be made so and implemented after prior approval from this council. Thus, it is compulsory to submit the detail of such changes intended or desired with justification prior to actual change in the protocol. Expiration date of this proposal is **March 2018.**

If the researcher requires transfer of the bio samples to other countries, the investigator should apply to the NHRC for the permission. The researchers will not be allowed to ship any raw/crude human biomaterial outside the country; only extracted and amplified samples can be taken to labs outside of Nepal for further study, as per the protocol submitted and approved by the NHRC. The remaining samples of the lab should be destroyed as per standard operating procedure, the process documented, and the NHRC informed.

Further, the researchers are directed to strictly abide by the National Ethical Guidelines published by NHRC during the implementation of their research proposal and **submit progress report in between and full or summary report upon completion.**

As per your thesis proposal, the total research budget is **NRs 25,000.00** and accordingly the processing fee amounts to **NRs. 1,000.00.** It is acknowledged that the above-mentioned processing fee has been received at NHRC.

If you have any questions, please contact the Ethical Review M & E Section at NHRC.

Thanking you,

Prof. Dr. Anjani Kumar Jha
Executive Chairperson

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Appendix E (Photo Gallery)

Figure 1 Measurement of mid upper arm circumference

Figure 2 Measurement of the height