FACTORS ASSOCIATED WITH NURITIONAL STATUS OF 6-59 MONTHS CHILDREN IN HARISIDDHI MUNICIPALITY, LALITPUR

by

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

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Approval Letter

This *dissertation* entitled *Factors associated with nutritional status of 6-59 months children in Harisiddhi municipality, Lalitpur* presented by Pritika Shakya has been accepted as the partial fulfillment of the requirement for the B.Sc. degree in Nutrition and Dietetics

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Abstract

A community based cross sectional study was conducted among 144 children aged 6-59 months in Harisiddhi Municipality, Lalitpur. Children were selected by simple random sampling technique. Anthropometric measurements and semi-structured questionnaire were used. Anthropometric measurement was then used to determine if children were underweight (weight-for-age), wasted (weight-for-height) and stunted (height-for-age) based on WHO reference. Statistical Package for the Social Science (SPSS) version 20 and World Health Organization (WHO) Anthro version 3.2.2 were used for analysing the data. Fisher exact test was used to identify the associated factors of malnutrition.

The study revealed, 19.4%, 6.3% and 11.1% of children were stunted, wasted and underweight respectively. And 6.9% were found to be overweight. The main associating factor with stunting ($p<0.05$) was child's age group and family size. Underweight was found associated ($p<0.05$) with weight at birth and Vitamin A and deworming supplementation. Wasting was not found statistically significant with any factors. The result of this study indicates that the nutritional status of the children under study was slightly lower than the national average. However, the problem of over nutrition is emerging. To get better nutritional status of children, greater emphasis should be given to under five year children with community based awareness programs to mother and care givers.

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List of Abbreviations

Abbreviation	Full form
BMI	Body Mass Index
CDR	Central Development Region
FAO	Food and Agriculture Organization
FANTA	Food and Nutrition Technical Assistance
FCHV	Female Community Health Volunteer
GDP	Gross Domestic Product
HDI	Human Development Index
HAZ	Height for Age Z Score
ICMR	Indian Council of Medical Research
IDA	Iron Deficiency Anaemia
IDD	Iodine Deficiency Disease
IYCF	Infant and Young Child Feeding
LBW	Low Birth Weight
LMIC	Low and Middle Income Countries
MAM	Moderate Acute Malnutrition
MoHP	Ministry of Health and Population
MUAC	Mid – Upper Arm Circumference
NDHS	Nepal Demographic Health Survey
PEM	Protein Energy Malnutrition
RDA	Recommended Daily Allowance
SAM	Severe Acute Malnutrition
SDGs	Sustainable Development Goals
UNDP	United Nations Development Programme
UNICEF	United Nations International Child Emergency Fund
VAD	Vitamin A Deficiency
WAZ	Weight for Age Z Score
WFP	World Food Program
WHZ	Weight for Height Z Score
WHO	World Health Organization

Part I

Introduction

1.1 General Introduction

Nutrition is defined by World Health Organization (WHO) as the intake of food, considered in relation to the body's dietary needs. An adequate, well balanced diet combined with regular physical activity is a cornerstone of good health. Numerous deficiency diseases continue to persist in the developing world, especially in the rural areas, as a result of essential nutrient deficiencies in the daily diet (Hartog *et al.*). Proper food and good nutrition are essential for survival, physical growth, mental development, performance and productivity, health and well-being. It is essential foundation of human and national development (WHO, 2000).

Malnutrition and diet are by far the biggest risk factors for the global burden of disease: every country is facing a serious public health challenge from malnutrition (Black *et al.*, 2013). Malnutrition manifests itself in many different ways; as poor child growth and development; as individuals who are skin and bone or prone to infection; as those who are carrying too much weight or whose blood contains too much sugar, salt, fat, or cholesterol; or those who are deficient in important vitamins or minerals. Out of a world population of 7 billion, about 2 billion people suffer from micronutrient malnutrition. Nearly 800 million people suffer from calorie deficiency. Out of 5 billion adults worldwide, nearly 2 billion are overweight or obese. One in 12 has type 2 diabetes. Out of 667 million children under age 5 worldwide, 159 million under age 5 are too short for their age (stunted). Fifty million do not weight enough for their height (wasted) and 41 million are overweight (Haddad *et al.*, 2016). The tragic consequences is that an estimated 45 per cent of deaths of children under age 5 are linked to malnutrition (Black *et al.*, 2013). The economic consequences represent losses of 11 per cent of Gross Domestic Product (GDP) every year in Africa and Asia, whereas preventing malnutrition delivers $16 in returns on investment for every $1 spent (Haddad *et al.*, 2016).

Hunger and malnutrition remain among the most devastating problems facing the majority of world's poor and needy, and continue to dominate the health of the world's poorest nations (WHO, 2000). In developing countries, malnutrition is an important factor contributing to illness and death among children. The major outcomes of malnutrition

during childhood may be classified in terms of morbidity (incidence and severity), mortality, and psychological and intellectual development; there are also important consequences in adult life in terms of body size, work and reproductive performances, and risk of chronic diseases (de Onis and Blössner, 1997). So, it not only affects health of individual but also hampers quality of life.

Malnutrition is frequently part of a vicious cycle that includes poverty and disease. These three factors are interlinked in such a way that each contributes to the presence and permanence of the others. Socioeconomic and political changes that improve health and nutrition can break the cycle; as can specific nutrition and health interventions (de Onis and Blössner, 1997). National target setting can help drive action on nutrition, and setting targets that are SMART (specific, measurable, achievable, relevant, and time bound) can ensure focus and accountability (Haddad *et al.*, 2016).

Nepal being a food deficit, low income, and least developed country, malnutrition among children is also very common. Around 31 per cent people in the country live below poverty level (FAO, 2010). Globally, Nepal ranks 145th out of 188 countries in term of its Human Development Index (HDI) and with the lowest per capita Gross Domestic Product (GDP) in South Asia (UNDP, 2015). Nepal needs to take significant strides in improving nutrition. Nepal confronts various forms of nutritional problems ranging from deficits in energy intake and imbalances in consumption of specific macro and micronutrients. In the past, only inadequacy of dietary intake or losses was considered to be a problem (MSNP, 2013). However, there has been an increase in overweight/obesity as well by five percentage points since 2006 (MoHP, 2012).

Infant and under-five mortality rates in the past five years are 32 and 39 deaths per 1,000 live births, respectively (MoH, 2017). Poor nutrition is cited as the major factor in more than half of all child deaths (MSNP, 2013). Nepalese children under age five face multiple obstacles for survival and development. Exposure to infectious diseases, malnutrition, and poor hygiene and sanitation and lack of a healthy environment compromise early childhood development. In addition, a mother's nutritional status during pregnancy and her general well- being impact the health of her child during pregnancy as well as after delivery (MoHP, 2012). Despite the continuous effort of the state, about a half of under 5 children and women of reproductive age are undernourished whereas the problem of obesity is growing among urban population. Protein-energy malnutrition

(PEM) and micronutrient deficiency such as iodine deficiency disorders (IDD), iron deficiency anaemia (IDA) and vitamin A deficiency (VAD) are the most common form of malnutrition (MoHP, 2014/2015).

In Nepal about 36 per cent of children under five years of age are stunted, 10 per cent are wasted and 27 per cent are underweight, based on WHO Child Growth Standards. The results indicate that the nutritional status of children in Nepal has improved over the 2 decades. The percentage of stunted children declined by 14% between 2001 and 2006, declined by additional 16% between 2006 and 2011, and dropped by 12% between 2011 and 2016. A similar trend downwards is observed for underweight children. This decline has been in line with Millennium Development Goal (MDG) target. However, there is still a long way to go to meet the SDG target of reducing stunting to 31% and underweight to 25% among children under 5 by 2017 (MoH, 2017).

1.2 Statement of the problem

Nutritional status is the condition of the body as it relates to consumption and utilization of food (Joshi, 2010). Physical growth of children (under 5 years) is an accepted indicator of the nutritional well-being of the population they represent. Adults and older children can access proportionally larger reserves of energy than young children during periods of reduced macronutrient intake. Therefore, the young individuals are most at risk for malnutrition (WFP, 2005).

Harisiddhi is a municipality in Lalitpur district in the Bagmati zone of central Nepal. It is situated about 10 km far from Kathmandu, the capital city of Nepal. It lies in Southern and Eastern parts. Harisiddhi is one of the ancient towns of Kathmandu valley. The largest ethnic group living here is *Newar*. Other ethnic groups are *Brahmin, Chettris, Tamangs, Rai, Magar, Limbu* and others. The major occupation of the people is agriculture. Today they are also engaged in modern industry, business and service sectors. There are 3,644 households, 13,606 total population and 909 children below five years of age (Harisiddhi municipality and health post, 2016).

Faulty complementary feeding practices - primarily nutritionally inadequate and frequently contaminated foods that are introduced too early or too late - are a major contributing factor to infant and young child malnutrition. Inadequate knowledge about appropriate food and feeding practices is often a greater determinant of malnutrition than

the lack of food. Therefore, this study is designed to assess the prevalence of malnutrition and associated factors among children aged 6-59 months which can be used as vital indicator of the overall health and welfare of population.

1.3 Objectives of study

1.3.1 General objective

The objective of the nutritional study is to assess the factors associated with nutritional status of 6-59 months children in Harisiddhi Municipality.

1.3.2 Specific objectives

a) To determine the nutritional status of children aged 6-59 months at Harisiddhi Municipality.
b) To identify associated factors of malnutrition among children aged 6-59 months at Harisiddhi Municipality.

1.4 Research questions

a) What is the existing nutritional status of 6-59 months children in Harisiddhi Municipality?
b) What are the factors associated with the nutritional status of 6-59 month children of Harisiddhi Municipality?

1.5 Significance of the study

The nutritional information obtained from this study will be helpful for the followings:

a) Facilitate analysis of socio-economic factors, demographics of the community.
b) For the identification of most vulnerable or affected individuals or groups needing special assistance.
c) Discover the problems related to nutrition, care practices and feeding behaviour of the community.
d) Encourage local people to improve current nutritional status by improving feeding pattern and knowledge of children, pregnant and lactating women.
e) Serve as helpful guide to plan suitable nutritional and health programs for this community.

1.6 Limitations

The study had the following limitations:

a) It may not be representative of the whole Nepal's population thus; the results may not be extrapolated to other population without further study.
b) This study is conducted with limited resources, which makes impossible to include many other important questions and other clinical and biochemical assessment.

Part II

Literature review

2.1 Malnutrition

'Malnutrition' is a general term for a medical condition caused by an improper or insufficient diet. The term usually refers to generally bad or faulty nutrition and is most often related to under nutrition. According to the World Health Organization (WHO), malnutrition is the 'cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance and specific functions', and is the greatest risk factor for illness and death worldwide. It can be associated with both under nutrition and over nutrition. Malnutrition and the state of deficiency or excess of energy, protein and other nutrients lead to measurable adverse effects on tissue, body function and appearance and clinical outcomes (Katsilambros *et al.*, 2010).

2.1.1 Forms of malnutrition

There are four forms of malnutrition (Jelliffe, 1966):

a) Under-nutrition: The pathological state results from the consumption of an inadequate quantity of food over an extended period of time.
b) Over-nutrition: It is the pathological state resulting from the consumption of an excessive quantity of food and hence a calorie excess, over an extended period of time.
c) Specific deficiency: It is the pathological state resulting from a relative or absolute lack of an individual nutrient.
d) Imbalance: This pathological state results from a disproportionate consumption of essential nutrients with or without the absolute deficiency of any nutrient as determined by the requirements of a balance diet.

2.1.2 Causes of malnutrition

The UNICEF conceptual framework, developed in the 1990s, shown below in Fig 2.1 summarizes the causes of malnutrition.

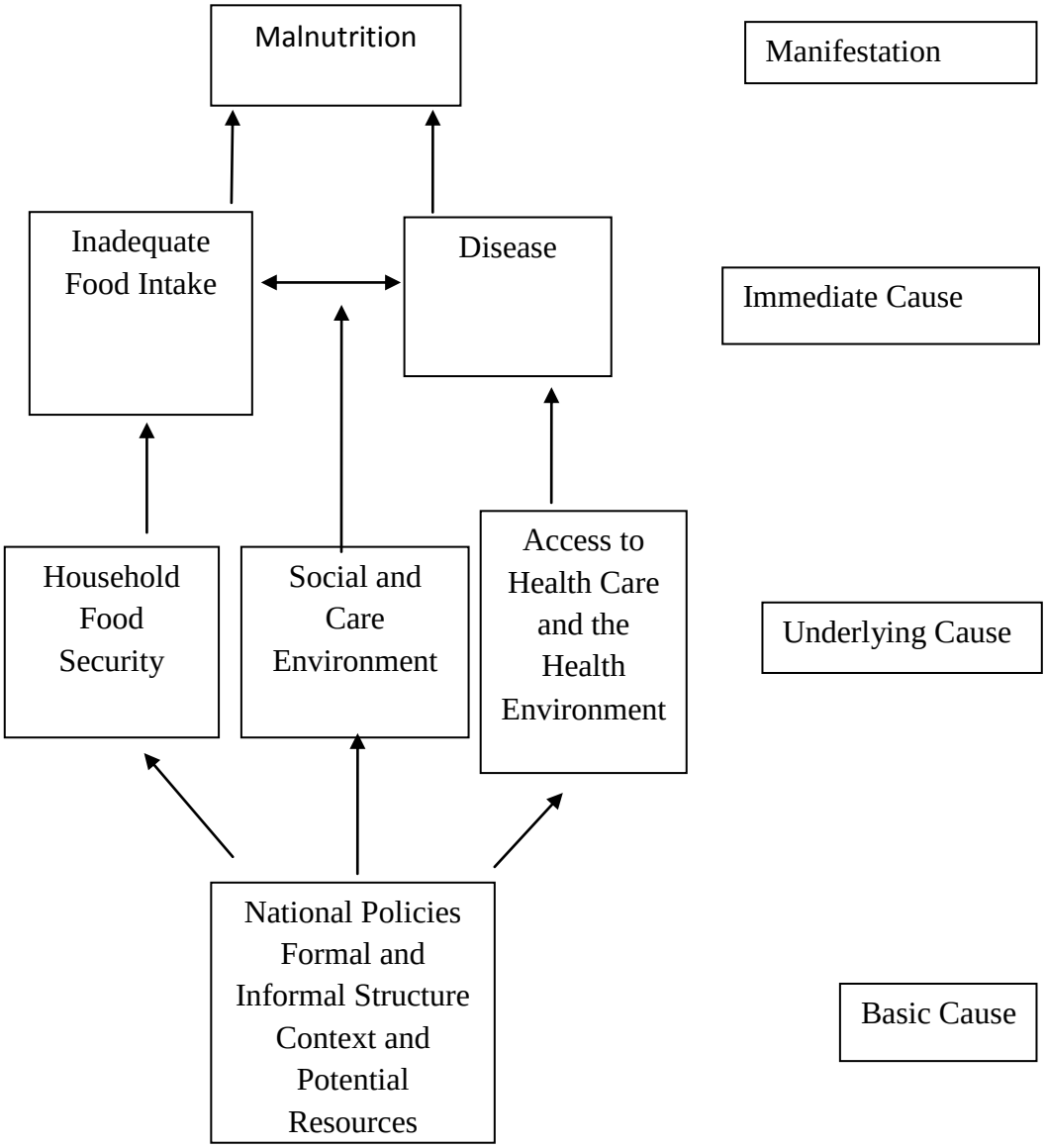

Fig 2.1 UNICEF conceptual framework (UNICEF, 2015)

The immediate causes of the conceptual framework include inadequate food intake and risks posed by the disease environment on the individual. Inadequate food intake refers to both quantity of food and quality of the diet. The nutritional quality of food intake holds importance in driving the biological processes that govern the growth and development of

the musculoskeletal and the nervous system. The second part of inadequate food intake is the quality of the food. The quality of a diet is reflected by the dietary diversity and the micronutrient content of the diet. The second immediate cause in the conceptual framework is disease. Disease can be a cause and consequence of malnutrition. Common childhood and infections and diarrheal diseases can lead to poor absorption or ability to retain nutrient (Reinhardt and Fanzo, 2014).

The immediate determinants of child nutritional status are, in turn, influenced by three underlying determinants manifesting themselves at the household level. These are food security, adequate care for mothers and children, and a proper health environment, including access to health services. Associated with each is a set of resources necessary for their achievement (Smith and Lawrence, 1999).

Food security is achieved when people has physical, social and economic access to food for an active and healthy life. The resource necessary for gaining access to food are food production, income for food purchase, or in-king transfers of food (whether from other private citizens, national or foreign governments, or international institutions). No child grows without nurturing from other human beings. This aspect of child nutrition is captured in the concept of care for children and their mothers, and the latter who give birth to children and who are commonly their main caretakers after they are born. Care, the second underlying determinant, is the provision in households and communities of 'time, attention, and support to meet the physical, mental and social needs of the growing child and other household members.' Examples of caring practices are child feeding, and health seeking behaviours, support and cognitive stimulation for children, and care and support for mothers during pregnancy and lactation (Smith and Lawrence, 1999).

A key factor affecting all underlying determinants is poverty. A person is considered to be in absolute poverty when the person is unable to satisfy his or her basic needs – food, health, water, shelter, primary education, and community participation – adequately. The effects of poverty on child malnutrition are pervasive. Poor households and individuals are unable to achieve food security, have inadequate resources for care, and not able to utilize (or contribute to the creation of) resources for health on a sustainable basis (Smith and Lawrence, 1999).

Finally, the underlying determinants of child nutrition (and poverty are, in turn influenced by basic determinants. The basic determinants include the potential resources available to a country or community, which are limited by the natural environment, access to technology, and the quality of human resources (Smith and Lawrence, 1999). The proper use of resources may be affected by economic, social, political, technical, ecological, cultural and other constraints. It may be affected by lack of tools or training to use them and by limited knowledge, skills and general ability to use the resources. The cultural context is of special importance for its influence, especially at the local level, on the use of resources and the establishment and maintenance of institutions (FAO, 2016).

Malnutrition may manifest itself as a health problem, and health professionals can provide some answers, but they alone cannot solve the problem of malnutrition. Agriculturists, and often agricultural professionals, are required to ensure that enough foods, and the right kinds of food, are produced. Educators, both formal and non-formal, are required to assist people, particularly women, in achieving and ensuring good nutrition. Tackling malnutrition often requires the contributions of professionals in economics, social development, politics, government, the labour movement and many other spheres (FAO, 2016).

2.1.3 Protein energy malnutrition

Protein energy malnutrition is defined as a range of pathological conditions arising from coincident lack of varying proportions of protein and calorie, occurring most frequently in infants and young children and often associated with infection (WHO).The term protein-energy malnutrition (PEM) applies to a group of related disorders that include marasmus, kwashiorkor and intermediate states of marasmus-kwashiorkor. The peak prevalence of kwashiorkor is frequently seen in the age group of 2-3 years and marasmus in 1-2 years (SriLakshmi, 2014).

The following are the causes for underweight for age which may precipitate into PEM (SriLakshmi, 2014):

a) Due to poverty, mother is not able to provide sufficient food to the child resulting in under nutrition.
b) The starchy gruels made from local staple food like rice, wheat, bajra, ragi, jowar or maize would result in “dietary bulk with a low caloric density”. Hence the child may

not be able to meet calorie requirement. Malted foods meet calorie requirement as they increase the caloric density.

c) Abrupt weaning, late weaning ignorance of importance of weaning can lead to under nutrition.
d) Malnutrition can result in less enzymes synthesis and less appetite to less consumption to food.
e) Chronic infections like primary complex may result in anorexia.
f) Infestation like ascariasis particularly giardiasis may lead to anorexia.

2.1.3.1 Marasmus

The term derived from the Greek word meaning 'to waste', has been in usage in medical literature since old times. This is the childhood equivalent of starvation in adults. Clinically, the presentation is of an irritable or apathetic child who fails to thrive, is markedly emaciated and has incessant diarrhoea. The appetite may be extreme or reduced. There is extreme shrivelling of the body with occasional dehydration, loss of subcutaneous fat, marked wasting of muscles, and low body weight and length. The abdomen may be shrunken or distended with gas. There may also be associated vitamin deficiencies like hypo-vitaminosis A (Joshi, 2010)

2.1.3.2 Kwashiorkor

This term used by 'Ga' tribe in and around Accra in Ghana meant 'the sickness the older child gets when the next baby is born'. The child is apathetic, anaemic, anorexic, diarrhoeic and oedematous. The oedema may be varying in degree and distribution and associated with ascites and pleural effusions (Joshi, 2010) .

The skin changes may involve any part of the body, the more common sites being lower limbs, buttocks and perineum. The skin changes show characteristic areas of desquamation and pigmentation or depigmentation. Cracks appear at folds and ulcers may develop at anal region and over pressure points. The muscular wasting is extreme and may result in incapability to crawl or walk. The hair is sparse, softer and thinner than normal. Its colour also might change and become reddish, brown or grey (dyschromatrichia). There are associated symptoms such as angular stomatitis, cheilosis and atrophy of the tongue, anaemia, hepatomegaly; and at times, tremors (Joshi, 2010) .

2.1.3.3 Marasmic Kwashiorkor

As the name implies, this is a combination in varying degrees of the features of the two conditions marasmus and kwashiorkor, and is found in places where PEM is prevalent. It is the superimposition of kwashiorkor on any degrees of marasmus. Clinically, some features of both marasmus and kwashiorkor are present and the picture may be complicated further by gastrointestinal or respiratory infections, due to which the child is usually brought to medical attention (Joshi, 2010).

2.1.4 Micronutrient Deficiency

Iron Deficiency Anaemia (IDA): Iron deficiency is the world's most widespread nutritional disorder, affecting both industrialized and developing countries. In the former, iron deficiency is the main cause of anaemia. In developing countries, the risk of anaemia is worsened by the fact that iron deficiency is associated with other micronutrient deficiencies (folic acid, vitamins A and B_{12}), parasitic infestations such as malaria and hookworm, and chronic infestations such as HIV. In the poorest populations, the usual diet is not only monotonous but also based on cereals which are low in iron and contain high levels of absorption inhibitors. In these cases, iron stores are characteristically low, particularly in young children and pregnant women (WHO, 2000).

Iron deficiency has profound negative effects on human health and development. In infants and young children, it results in impaired psycho-motor development, coordination and scholastic achievement, and decreased physical activity levels. In adults of both sexes, iron deficiency reduces work capacity and decreases resistance to fatigue. In pregnant women, iron deficiency reduces work capacity and decreases resistance to fatigue. In pregnant women, iron deficiency leads to anaemia that is associated with an increased risk of maternal mortality and morbidity, foetal morbidity and mortality, and intrauterine growth retardation (WHO, 2000).

It is an important public health problem affecting people from all walks of life. Anaemia is very widespread, more among females than males and higher among infants and children than adults. Severe anaemia (with haemoglobin levels < 8 g/dl) is more frequently seen in severely undernourished children who also exhibit signs associated with deficiencies of calories, proteins, vitamins and minerals (SriLakshmi, 2014). In Nepal its

incidence in pregnant women is 46 per cent, 41 per cent in women age 15-49 and 53 per cent in preschool-aged children (MoH, 2017).

Iodine Deficiency Disorder (IDD): Iodine is a mineral that is part of the hormones produced by the thyroid gland located in the front of the neck. When iodine intake falls below recommended levels, the thyroid may no longer be able to synthesize sufficient amounts of thyroid hormones in the blood is responsible for the damage done to the developing brain and the other harmful effects known collectively as the iodine deficiency disorders (WFP, 2005).

Iodine deficiency disorders (IDD) constitute the single greatest cause of preventable brain damage in the foetus and infant, and of retarded psychomotor development in young children. IDD remains a major threat to the health and development of populations worldwide, but particularly among preschool children and pregnant women in low-income countries. It results in goitre, stillbirth, and miscarriages, but the most devastating toll involves mental retardation, deaf-mutism and impaired educability. While cretinism is the most extreme manifestation, of considerably greater significance are the more subtle degrees of mental impairment that lead to poor school performance, reduced intellectual ability, and impaired work capacity (WHO, 2000). In Nepal, eight in ten households have adequately iodized salt. 73% of children live in households using adequately iodized salt. Adequately iodized salt is more commonly found in urban (94%) then rural households (78%) (MoHP, 2012).

Vitamin A deficiency (VAD): Vitamin A is a fat-soluble vitamin required for normal growth and development. It is involved in the functioning of the eyes as well as the immune and reproductive systems, while also helping to keep skin healthy. The most vulnerable to VAD are preschool children and pregnant women in low income countries. For children, lack of vitamin A may cause severe visual impairment and blindness. Clinical signs (night blindness and other xeropthalmia) present the tip of the iceberg of VAD. Many more children, not suffering from clinical signs of VAD, have low circulating levels of vitamin A and hence suffer consequences of higher risk of morbidity and mortality. VAD significantly increases the risk of severe illness, and even death, from such common childhood infections as diarrheal disease and measles. Eliminating vitamin A deficiency would cut child deaths due to measles alone by 50 per cent (WFP, 2005).

In woman, VAD may be an important factor contributing to maternal mortality and to poor pregnancy and lactation outcomes, as well as night blindness (WHO, 2000). Pregnant women are particularly vulnerable to VAD, particularly during the last trimester of pregnancy when demand by both the foetus and the mother is highest. Among pregnant women in high- risk areas (where food containing vitamin A is rare), the prevalence of night blindness often increases during the last trimester. Night blindness during pregnancy is highly associated with malnutrition, anaemia and increased morbidity in women and their infants (WFP, 2005).

2.2 Nutritional status

Nutritional status is 'equilibrium of the intake of a diet sufficient to meet or exceed the needs of the individual which will keep the composition and function of the otherwise healthy individual within the normal range'(Joshi, 2008). The nutritional status reflects the degree to which physiologic needs for nutrients are being met. The national nutrition policies for overcoming malnutrition in different countries should be based on knowledge of the nutritional status and pattern of diets consumed by the population, available food resources and socio-economic factors (Swaminathan, 2014). The nutritional status can be assessed in various ways: by looking at the person (clinical examination), by taking measurements of the body weight and height etc. (anthropometry) and by examining the blood for the concentration of nutrients, haemoglobin etc. (biochemical examination) (Adhikari and Krantz, 2013).

2.2.1 Nutritional status of under-five children in Nepal

The nutritional status of children is important as it determines their health, physical growth and development, academic performance and progress in life (Ruwali, 2011). Nepal Demographic and Health Survey (NDHS) 2017 reports, 36% of children are stunted, 27% underweight and 10% wasted. The percentage of prevalence of malnutrition below 5 years of age is illustrated in given diagram

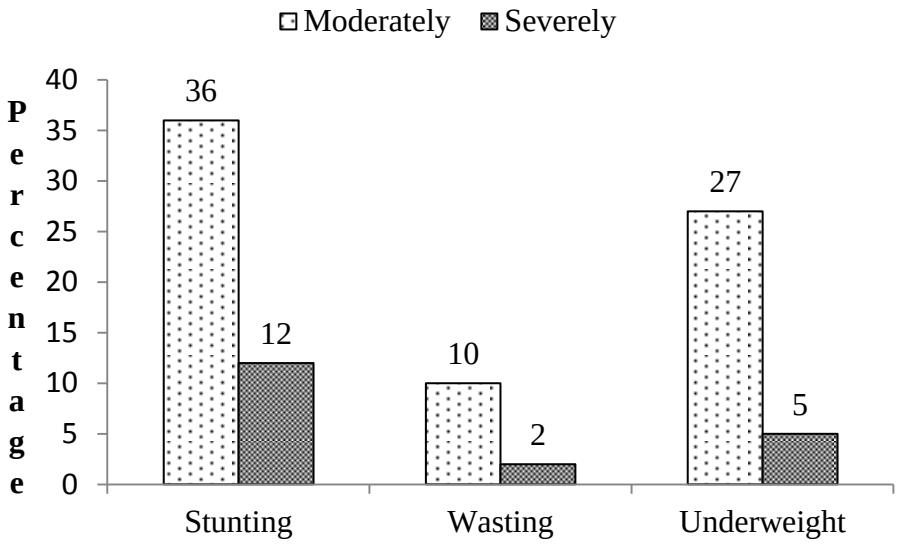

Fig 2.2 Detail Prevalence of Malnutrition (MoH, 2017)

Trends in the nutritional status of children for the period 2006 to 2016 are shown in Figure 2.3

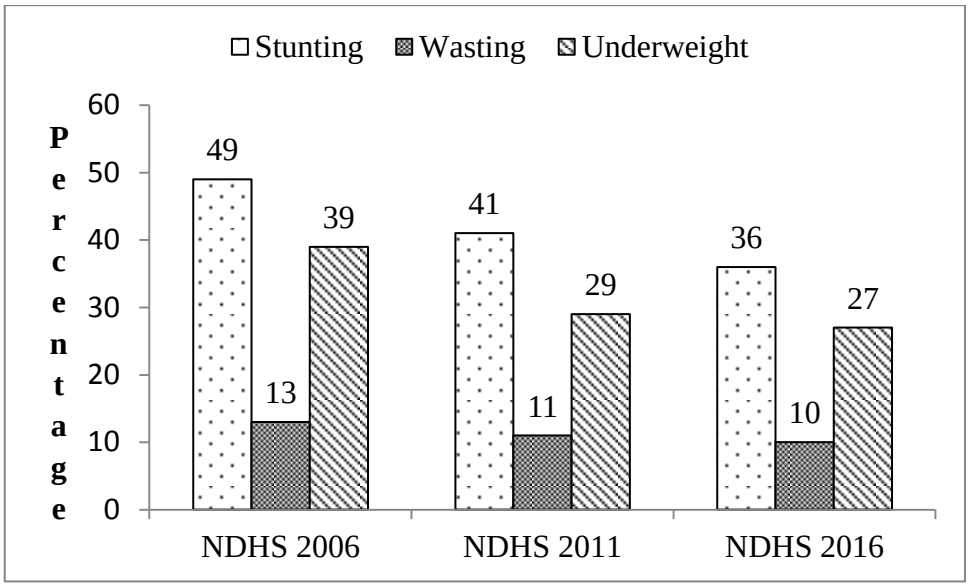

Fig 2.3 Trends in nutritional status of children under five years (MoH, 2017)

Nepal has demonstrated significant reductions in stunting among children under five, declining 14 percentage points between 2001 and 2006, declined by additional 16% between 2006 and 2011, and dropped by 12% between 2011 and 2016. However, 36 percent of children under 5 remain stunted or too short for their age. This indicates chronic malnutrition. Stunting is more common in rural areas (40%) than urban areas (32%).

Stunting is least common among children of more educated mothers. Among the lowest wealth quintile, 49% are stunted compared to 17% in the highest. Stunting increases with age, peaking at 45% among children age 24-35 months. Similarly, children in the mountain zone are more likely to be stunted than other children. Wasting (too thin for height) is a sign of acute malnutrition. Wasting prevalence has stayed essentially the same in the last decade. Around 10% of children are wasted. Underweight, or too thin for age, is more common – 27% of Nepalese children under age five are underweight. Thirty three per cent of children in the lowest wealth quintile are under weight, as compared with 12% of children in the highest quintile. More than half (53%) of Nepalese children age 6-59 months are anaemic. Twenty six per cent of children were classified as mildly anaemic, 26% were moderately anaemic, and less than 1% were severely anaemic. The prevalence of anaemia decreases with age, ranging from a high of 74% among children age 12-17 months to a low of 36% among children age 48-59 months. Anaemia prevalence varies by states, from a low of 43% in State 3 to a high of 59% in State 2 (MoH, 2017).

2.2.2 Nutritional status of women in Nepal

Adequate maternal nutrition, health and physical status are crucial to prevent child under nutrition. Pregnancy increases nutrient needs, and protein, energy, vitamin and mineral deficiencies are common during pregnancy. Deficiencies are not solely the result of inadequate dietary intake: Disease can impair absorption of nutrients and reduce appetite, and environmental and psychosocial stress affecting the mother can contribute to child under nutrition. Poor maternal nutrition impairs foetal development and contributes to low birth weight, subsequent stunting and other forms of under nutrition (UNICEF, 2013).

Undernourished girls have a greater likelihood of becoming undernourished mothers who in turn have a greater chance of giving birth to low birth weight babies, perpetuating an intergenerational cycle. This cycle can be compounded further in young mothers, especially adolescent girls who begin childbearing before attaining adequate growth and development. Short intervals between pregnancies and having several children may accumulate or exacerbate nutrition deficits, passing these deficiencies on to the children (UNICEF, 2013).

According to the Nepal Demographic and Health Survey (NDHS 2011), 14% of women surveyed had a height of less than 145cms. Similarly, 17% of women have Body Mass

Index (BMI) of less than 18.5 kg/m^2 (MoH, 2017). A BMI of less than 18.5 kg/m^2 is an indication of chronic energy deficiency. Women measuring less than 145cms in height and with a BMI of less than 18.5 kg/m^2 are considered at a higher risk of suffering from complications of pregnancy and more likely to deliver babies with low birth weight. The subsequent surveys since 1996 has consistently shown that a significant proportion of women in Nepal suffer from short stature and chronic energy deficiency. Women's nutritional status has shown a very small improvement with a BMI of less than 18.5 kg/m^2 has declined from 28% in 1996 survey to 24% in 2006. Similarly, the percentage of women with a height of less than 145cms has declined from 15% to 14% over the same period (Adhikari and Krantz, 2013). Forty-one per cent of women age 15-49 are anaemic. The majority of these women are mildly anaemic (34%), 7% are moderately anaemic, and less than 1% are severely anaemic. Pregnant women and breastfeeding women (each 46%) are more likely to be anaemic than other women (39%). The prevalence of anaemia among women has increased in the past 5 years from 35% in 2011 to 41% in 2016. However, the prevalence of anaemia among pregnant women has declined slightly from 48% in 2011 to 46% in 2016 (MoH, 2017).

2.2.3 Causes of maternal and child malnutrition in Nepal

The immediate and underlying causes are:

- Maternal malnutrition and low birth weight
- Suboptimal infant feeding, particularly:
    - Delayed initiation of breastfeeding
    - Shorter than optimal duration of exclusive breastfeeding
    - Low dietary diversity of complementary food
    - Delayed introduction of solid/semi-solid/soft foods
- Low-intake of micronutrient-rich food (vitamin-A and iron) among children
- Inadequate sanitation and hygiene practices, specifically access to hygienic toilets/latrines and hand washing practices
- Infectious disease burden (among women and children); particularly diarrhoea, intestinal parasites, and malaria
- Food insecurity, particularly due to insufficient food access caused by high levels of poverty

- Inadequate caretaking practices during childhood illnesses such as acute respiratory infections, diarrhoea and fever (Chaparro *et al.*, 2014).

The basic causes of maternal and child malnutrition are (Chaparro *et al.*, 2014):

- Poverty as well as women's low social status and lack of education, which limits control over their own income and restricts access to health services, adversely affecting caregiving and nutrition practices
- Marriage and childbearing during adolescence, leading to poor birth outcomes (e.g., low birth weight) as well as worsened nutritional status among adolescent mothers
- Intra-household food distribution practices that discriminate against women in particular, as well as cultural practices restricting intake of certain foods during pregnancy/lactation.

2.2.4 Feeding practice in Nepal

After birth, a number of practices can directly lead to poor growth: inadequate breast feeding practices such as non-exclusive breastfeeding; inappropriate complementary feeding, such as starting at the wrong age; poor access to or use of diverse types of food and inadequate intake of micronutrients. Poor growth can be aggravated further by frequent incidence of infectious diseases like diarrhoea, malaria or infestation with intestinal worms (UNICEF, 2013).

Breastfeeding is very common in Nepal, with 98% of children ever breastfed. Almost every mother starts with breast feeding her baby but there are indications that other modes of feeding are started very early (Adhikari and Krantz, 2013). According to latest Nepal Demographic and Health Survey 2011, 88% of the children less than 2 months of age are exclusively breastfed. Overall 70% of Nepalese children under six months are exclusively breastfed. This is a remarkable improvement since 2006 when only 53% of children of the same age were exclusively breastfed. The median duration of any breastfeeding among children 0-35 months is 33.6 months while the median duration of exclusively breastfeeding is 4.2 months (NDHS, 2011). Higher level of education and being wealthier were two characteristics associated with shorter duration of exclusive breastfeeding. Of the mothers with only primary education, 2 in 5 were found exclusively breastfeeding their babies till 6 months of age whereas of the mothers with S.L.C or higher education only one

in three were doing so. Similarly among the wealthiest mothers 30% and among the poorest mothers 67% were exclusively breast feeding at 6 months of age (Adhikari and Krantz, 2013).

Infants beyond 6 months of age need food in addition to breast milk. As this food is in complement to breast feeding, it is termed as 'complementary food'. Ideally, during the age between 6 months and 2 years a gradual change from exclusive breastfeeding to an appropriately modified adult mixed diet takes place (Adhikari and Krantz, 2013).

Traditionally in many Nepali families a girl at five months or a boy at six months of age is introduced to solid food (symbolically at least) at a rice feeding ceremony. If the rice is refused at this time the mother may wait to give solid foods until the infant shows interest in eating or 'asks' for such foods. A delay of more than two months could be quite harmful (Adhikari and Krantz, 2013).

Complementary foods should be introduced when a child is six months old to reduce the risk of malnutrition. In Nepal, 70% of children ages 6-9 months are breastfeeding and eating complementary foods. The Infant and Young Child Feeding (IYCF) practices recommend that breastfed children age 6-23 months also be fed food from four or more other food groups and be fed a minimum number of times per day. Only one-quarter of breastfed children in Nepal meet this recommendation (NDHS, 2011).

2.3 Appropriate infant and young child feeding practices

"Breastfeeding is an unequalled way of providing ideal food for the healthy growth and development of infants; it is also an integral part of the reproductive process with important implications for the health of mothers. As a global public health recommendation, infants should be exclusively breastfed for the first six months of life to achieve optimal growth, development and health. Thereafter, to meet their evolving nutritional requirements, infants should receive nutritionally adequate and safe complementary foods while breastfeeding continues for upto two years of age or beyond" (WHO, 2002).

2.3.1 Breastfeeding

Nutritional superiority of breast milk: Breast feeding is the best, safest, and only natural method for feeding an infant and is the least expensive. It is the oldest yet the most modern way to feed an infant and is healthy for the infant and the mother (Adhikari and Krantz, 2013). The exceptional nutritional quality of human milk has been recognised for a long time. Mother's milk is designed for easy digestion and assimilation. Protein in mother's milk is in a more soluble form which is easily digested and absorbed by the baby. Same is the case with regard to fat and calcium in human milk which is also easily absorbable. The milk sugar – lactose in mother's milk provides ready energy. In addition, a part of it is converted into lactic acid in the intestines which destroys harmful bacteria present there and helps in absorption of calcium and other minerals. The amount of vitamins such as thiamine, vitamin A and vitamin C found in mother's milk depends on the diet of the mother. Under normal conditions, breast milk provides reasonable amounts of these vitamins. The human milk has inherent anti-infective properties which no other milk has. This protective function of human milk is particularly important in developing countries where there is much exposure to infection (MoHRD, 2004).

Early initiation of breastfeeding: Early initiation of breastfeeding is extremely important for establishing successful lactation as well as for providing 'Colostrum' (mother's first milk) to the baby. Ideally, the baby should receive the first breastfeed as soon as possible and preferably within half an hour of birth. The new born baby is very active during the first half an hour and if the baby is kept with the mother and effort is made to breastfeed, the infant learns suckling very fast. This early suckling by the infant starts the process of milk formation in the mother and helps in early secretion of breast milk. In case of caesarean deliveries, new born infants can be started with breastfeeding within 4-6 hours with support to the mother. New-born babies should be kept close to their mothers to provide warmth and ensure frequent feeding. This also helps in early secretion of breast milk and better milk flow. Breastfeeds should be given as often as the baby desires and each feed should continue for as long as the infant wants to suckle. It is essential that the baby gets the first breast-milk called colostrum which is thicker and yellowish than later milk and comes only in small amounts in the first few days. Colostrum is all the food and fluid needed at this time – no supplements are necessary, not even water. During this period and later, the new-borns should not be given any other fluid or food like honey,

ghee, animal or powdered milk, tea, water or glucose water, since these are potentially harmful (MoHRD, 2004).

Exclusive breastfeeding: Exclusive breastfeeding means that babies are given only breast milk and nothing else – no other milk, food, drinks and not even water. During the first six months exclusive breastfeeding should be practiced. Breast milk provides best and complete nourishment to the baby during the first six months. The babies who are exclusively breastfed do not require anything else namely additional food or fluid, herbal water, glucose water, fruit drinks or water during the first six months. It is important to ensure exclusive breastfeeding of all babies as it saves babies from diarrhoea and pneumonia. It also helps in reducing specially the ear infections and risk of attacks of asthma and allergies (MoHRD, 2004).

Addition of even a single feed of the animal or powder milk, any other food or even water has two disadvantages, firstly it depresses lactation as child will suck less and hence less breast milk will be produced, and secondly addition of any other food or water increases the chances of infections particularly diarrhoea. Recent WHO studies estimate that death rate in babies can go down four times if they are exclusively breastfed for the first six months (MoHRD, 2004).

2.3.2 Complementary feeding

Breast milk is an excellent food and meets all nutritional requirements of the baby for the first six months. However, after six months of age, breast milk alone is not enough to make an infant grow well, other foods are also needed. This is because the infant is growing in size and its activities are also increasing. As a result the nutritional needs of the infant increases significantly at this age (MoHRD, 2004).

Complementary feeding should be started at six months of age. The purpose of complementary feeding is to complement the breast milk and make certain that the young child continues to have enough energy, protein and other nutrients to grow normally. It is important that breastfeeding is continued up to the age of two years or beyond as it provides useful amounts of energy, good quality protein and other nutrients (MoHRD, 2004).

Adequate complementary feeding from six months of age while continuing breastfeeding is extremely important for sustaining growth and development of the infant. Active feeding styles for complementary feeding are also important. Appropriate feeding styles can provide significant learning opportunities through responsive caregiver interaction, enhancing brain development in the most crucial first three years (MoHRD, 2004).

Table 2.1 Suggested feeding pattern for infants and young children

Birth to 6 months (180 days)	**Colostrum**	**Breast milk on demand.**
6 to 9 months	Breast milk	Cereal – pulse based porridge, 2-3 times (e.g. "Sarbottam pitho" porridge) Pureed/mashed vegetables (including green leaves). Soft fruit (without seeds and skins)
9 – 15 months	Breast milk	Cereal-pulse based porridge, 2-3 times Soft family foods, 3 times. Potato, soft vegetables (including green leaves). If available: Fruit, egg, meat.
15 months to 2 -3 years	Breast milk	Modified adult diet (adapted to age), 3 times Cereal – pulse based porridge/rotis, 2 times. Green leafy and other vegetables. If available: Fruit, egg, meat, milk products. Nutritious homemade snacks.
3 to 5 years	Milk products	Family meal, 3 times. Fruit, egg, meat, at least weekly. Green and yellow vegetables. Cereal – pulse based porridge or rotis, 2 times. Nutritious homemade snacks.

Source: (Adhikari and Krantz, 2013)

2.4 Nutritional requirement

The establishment of human nutrient requirement is the common foundation for all countries to develop food-based dietary guidelines for their populations. Establishing requirements means that the public health and clinical significance of intake levels – both deficiency and excess – associated disease patterns for each nutrient, need to be thoroughly reviewed for all age groups (WHO, 2000). Nutritional requirements can be defined as the minimum amount of the absorbed nutrient that is necessary for maintaining the normal physiological functions of the body (SriLakshmi, 2014). The amount of the nutrients needed by individuals vary with different ages, activities and sex (Joshi, 2008). The recommended daily allowance (RDA) of nutrients for infants and pre-school children (1-6) years as recommended by ICMR is shown in Table 2.2

Table 2.2 RDA for pre-school children

Nutrients	**Age (in months)**		**Age (in years)**	
	0 to 6	**6 to 12**	**1 to 3**	**4 to 6**
Calories (Kcal)	92	80	1060	1350
Protein (g)	1.16	1.69	16.7	20.1
Fat (g)	..	19	27	25
Calcium (mg)	500	500	600	600
Iron (mg)	46 ug/kg	5	9	13
Vitamin A (µg)				
Retinol (µg)	350	350	400	400
β- carotene (µg)	2800	2800	3200	3200
Thiamine (mg)	0.2	0.3	0.5	0.7
Riboflavin (mg)	0.3	0.4	0.6	0.8
Niacin Equivalent (mg)	710	650	8	11
Pyridoxine (mg)	0.1	0.4	0.9	0.9
Ascorbic acid (mg)	25	25	40	40
Folic acid (µg)	25	25	80	100
Vitamin B12 (µg)	0.2	0.2	0.2-1	0.2-1
Magnesium (mg)	30	45	50	70
Zinc (mg)	.	.	5	7

Source: (SriLakshmi, 2014)

2.5 Assessment of nutritional status

Nutritional assessment is the process of evaluating the nutritional status of an individual. Nutritional assessment systems utilize basically four types of methods, which are used either alone or in combination. The methods used are anthropometric assessment, biochemical assessments, clinical assessments and dietary intake assessment. For the assessment of nutritional status in a community, basically Dietary and Anthropometric measurements are used (Joshi, 2008).

2.6 Anthropometry

Anthropometrics assessment means physical measurements of body weight and dimensions. Body composition may be estimated from anthropometrics measurements. The measurements vary with age and degree of nutrition and as a result are useful in assessing imbalances of protein and energy. They can be used to detect moderate as well as severe degree of malnutrition in children as well as adults. The measurements commonly used are weight, height, mid upper arm circumference (MUAC), Body Mass Index (BMI) and oedema (FSAU, 2005).

The body measurements of weight, height and age are converted into nutritional indices. To generate the indicators, any of the two variables measured are related. That is, weight, height and age as weight for age, height for age and weight for height (FSAU, 2005).

Weight for age (W/A): It is a measure of underweight. It conveys the weight of a child in relation to the child's age. Both stunted and wasted children do not weight as much normal children of the same age. Weight for age is thus a composite index, which reflects both wasting and stunting, or any combination of both. WH index is a useful index for monitoring growth and development of children. Moderate underweight is defined as the percentage of children aged 0-59 months whose weight for age is below minus two standard deviations and severe underweight is below minus three standard deviations from the median of the WHO Child Growth Standards (UNICEF, 2013). When used in growth monitoring at health facilities, a child's W/A is commonly plotted on the Road to Health growth chart. This allows for better understanding of the child's positive or negative growth. At population level, the measurement indicates the total proportion of underweight children (FSAU, 2005).

Height for age (H/A): It is a measure of chronic malnutrition. That is, long-term and persistent malnutrition normally associated with long-term factors such as poverty and frequent illness (FSAU, 2005). A child's height is compared to the median height of the reference population of same age and sex to give H/A index. Children falling below the cut-off point of minus two standard deviations are classified too short for their age or stunted. And children falling below minus three standard deviations are considered severely stunted. The disadvantage of using height as an indicator is that the deficit in height takes some time to occur and it may not be manifested in malnourished infants. When found in infants or young children, it may be the consequence of small size at birth rather than an indication of post natal nutrition. Genetically determined differences are partly responsible for the variation in height in any age group in any population (Joshi, 2008).

Stunting, which is caused by long-term nutrition deprivation early in a child's life, often begins before birth and is associated with increased risk of mortality from infectious diseases such as diarrhoea, pneumonia and measles in childhood. It also leads to irreversible physical and cognitive damage and poorer educational outcomes later in childhood and adolescence, with economic consequence for the individual, household and community levels. Stunted children who experience rapid weight gain after 2 years of age have increased risk of becoming overweight or obese later in life, with associated higher risk of non-communicable diseases like coronary heart diseases, stroke, hypertension and type II diabetes (Devkota *et al.*, 2016).

Weight for Height: It measures 'wasting' or 'acute' malnutrition. It expresses the weight of the child in relation to the height. Moderate wasting is the percentage of children aged 0-59 months whose weight for height is below minus two standard deviations and severe wasting is below minus three standard deviations from the median of the WHO Child Growth Standards. This is the most useful index for screening and targeting vulnerable groups in emergencies. It is a useful indicator for admissions and discharge in and out of feeding programs (FSAU, 2005).

Severe acute malnutrition is the percentage of children aged 6 to 59 months whose weight for height is below minus three standard deviations from the median of the WHO Child Growth Standards, or by a mid-upper-arm circumference less than 115mm, with or without nutritional oedema (UNICEF, 2013).

Overweight is the percentage of children aged 0-59 months whose weight for height is above two standard deviations or above three standard deviations is called obese from the median of the WHO Child Growth Standards (UNICEF, 2013).

Mid Upper Arm Circumference (MUAC): MUAC measures the muscle mass of the upper arm. A flexible measuring tape wrapped around the mid-upper arm (between the shoulder and elbow) to measure its circumference. MUAC should be measured to the nearest 0.1cm. MUAC is a rapid and effective predictor of death in children aged 6 to 59 months and is increasingly being used to assess adult nutritional status. MUAC is an important measure of nutritional status. MUAC is not an index by itself. The indices of MUAC combined with age, sex and/or height are not commonly used in emergencies, but MUAC alone identifies wasting and is a globally endorsed selection criteria for entry into selective feeding programmes (UNICEF and ENN, 2010).

2.7 Dietary assessment

Dietary assessment constitute an essential part of any complete study of nutritional status of individuals or groups, providing essential information on nutrient intake levels, sources of nutrients, food habits and attitudes. Dietary assessment encompasses food supply and production at the national level, food purchases at the household level, and food consumption at the individual level (Coulston *et al.*, 2013). Dietary assessment of communities will yield information regarding the extent of dietary deficiencies and the quantity and type of foods required for overcoming them. The assessment will also yield information regarding the economic and social factors influencing food production and consumption (Swaminathan, 2014). Dietary intake may be collected at the national, household or the individual level (FAO, 2009).

Household survey: Food accounts, inventories and household recall are the principal methods of assessment at the household level. Data generated by these methods are useful for comparing food availability among different communities, geographic areas and socioeconomic groups, and for tracking dietary changes in the total population and within population subgroups. However, these data do not provide information on the distribution of foods among individual members of the household (FAO, 2009).

a) Food account method

In food account method household members keep a detailed record of the quantities of food entering the household, including purchases, home produced food, gifts, and from other sources. No account of stock of foods is taken before or after the study period (FAO, 2009).

b) Food inventory method

The inventory method aims to record acquisitions and changes in food inventory of the household, generally over a period of one week. An inventory is made of food in the house at the beginning and end of this period, and all foods brought into the house during this period are recorded as well. Thus, the only difference between this and the food account method is that changes in the food reserves or stores of individual households are taken into account (Hartog *et al.*).

c) Household record method

In the household record method, the foods presented for consumption to household member are weighed or estimated in household measures. This is done by the caretaker or during daily visits by field investigators. Preparation waste and waste after eating are deducted, as well as the food consumed by visitors should also be deducted (FAO 2009). Survey subjects may individually record foods eaten outside the household. The total amounts of all the foods eaten should give a complete account of the food consumption for all subjects during the survey period (Hartog *et al.*).

Individual survey: Dietary surveys among individuals provide information that can be used to describe differences in intake of food and nutrients between subgroups. Main methods for assessing present or recent diet include records, 24-hours (or 48-hours) recall, and food frequency questionnaires. In order to quantify the intake of foods, some estimate of the weight of consumed food is required. To convert food intake into nutrient intake, the availability of a food composition database/food table is essential. By combining the information of dietary intake and food composition database/table one can determine whether the diet is nutritionally adequate or not (FAO, 2009).

i) Food records method: Food intake is measured at the time of eating. Food intake is quantified by weighing and using household measures. Household members themselves usually record their food intake, although a fieldworker might keep the record. The data collection and processing are time consuming and expensive. These methods require a high

degree of cooperation from the subjects, which can lead to poor response rates. Also, the need to weigh and record food, or the act of being observed, may alter the intake (FAO, 2009).

ii) 24-hour recall: This widely used method involves asking subjects to recall and describe all intakes of foods and drinks in the previous 24 hours. This method usually requires a trained fieldworker/dietician/nutritionist to interview subjects, to assess portion weights and make appropriate enquires about types of food and drinks consumed. It is a much used dietary assessment method because it is simple, quick and inexpensive, but it is prone to reporting errors, including biased or inaccurate recalls of food intake and portion sizes. It requires a good methodological knowledge in order to transform the interview data of the dietary intake to nutrients. Applied once, it yields no information on day-to-day variation on food or nutrient intake (FAO, 2009).

iii) Food frequency questionnaires (FFQ): These questionnaires provide information about how often certain foods or foods from given food groups, were eaten during a time interval in the past, usually day, by either the household or an individual. The questionnaire can be self-administered or be administered through a short personal interview. The food list may range from a few questions to capture intake of selected foods and nutrients, to a comprehensive list to assess the total diet. The frequency responses can be open-ended or multiple choice, ranging from several times per day to number of times per year, depending on the type of food (FAO, 2009).

iv) Dietary Diversity: Dietary diversification is a recommended approach to alleviate nutritional problems resulting from food insecurity and inadequate intake of micronutrients. Dietary diversity is a key element of high quality diets and the recommendation to consume a variety of foods appears in many nutritional guidelines. Monotonous diets, based mainly on grains, roots and tubers are common in areas of high food insecurity and to the burden of malnutrition. Dietary diversification is an element of diet based strategies that can be used to increase intake of multiple micronutrient needs. Consuming a diverse diet is a recommended approach to achieving nutritional requirements (Kennedy, 2009).

Dietary diversity, is considered an outcome measure of food security mainly at the level of individual or household food access, but also can provide information about food availability in the community and reflect seasonal changes in dietary patterns, an aspect of

the sustainability of the food supply. Dietary diversity is appealing for use as measures of household and individual dietary intake. When measured at household level, dietary diversity scores reflect the economic ability of a household to consume a variety of foods and are considered good proxy measures of household energy availability. When measured at the level of an individual, the scores reflect of energy and other nutrients (Kennedy, 2009).

Dietary diversity is seen as a key component of healthy diets (Hartog *et al.*). Diversity in daily diet is thought to be necessary for adequate nutrient intakes, to lessen the chances of deficient or excessive intake of a single nutrient, and to diminish exposure to food contaminants. Past studies have shown that nutrient intakes and children's nutritional status are positively related to the number of different foods consumed (FAO, 2009).

2.7 Literature review from previous study

Nepal is among ten countries in the world with the highest stunting prevalence, a measure of chronic under-nutrition, and one of the top twenty countries with the largest number of stunted children (MSNP, 2013). According to NDHS 2017, this problem affects 36 per cent of its preschool children (MoH, 2017). The process of stunting in Nepal begins right from conception and leads to inadequate foetal as well as infant and young child growth. Twelve per cent of babies are born with low birth weight, and after two years of age, four out of ten children are stunted. Teenage marriages and pregnancies are common. Maternal care practices are very poor and almost a quarter of mothers (23 per cent) give birth before the age of eighteen, while about half have given birth by age of 20. In terms of both pre-natal and post-natal care, mothers are not provided for as much as they should (MSNP, 2013).

A qualitative study was conducted to investigate the situation of complementary feeding practices and its impact on nutritional status of under 2 years old children in urban areas of the Kathmandu valley. A total of 150 households were sampled and findings of the study indicated that traditional about 92 per cent households were found practising traditionally complementary feeding practices (TCFP) and 8 per cent households were found practicing Commercial Complementary Feeding Practicing (CCFP). Traditional complementary foods given to the children was found lacking in macronutrient carbohydrate and protein severely, therefore, not fulfilling the nutritional requirement of the children. Among

traditional complementary food fed children, 63 per cent of children were found suffering from mild to severe form or malnutrition whereas among commercial food fed, only 41 per cent of children were found suffering from such form of malnutrition. About 33 per cent of children suffering from severe form of malnutrition were from the household of employees. Nutritional status of children from Kathmandu district found better compared to young children from other district. Children from *Newar* ethnicicity of Lalitpur district were found more severely malnourished compared to other ethnic group. In addition baby boys were found suffering more from severe type of malnutrition compared to baby girls (Malla and Shrestha, 2004).

A prospective study was conducted among 556 children below 60 months of age from Western Nepal. The prevalence of underweight, stunting and wasting was determined by anthropometry. Based on WHO classification, out of 556 children, 20.2% were underweight, 34% were stunted and 15.1% were wasted respectively. Of them, severe underweight were 4.7%, severe stunted were 14.1% and severe wasted were 7.2% respectively (Shrestha, 2014).

A study was conducted among 860 children under age three in Dhanusha, Central Terai of Nepal. The analysis found that older age children whose mothers are illiterate are more likely to be underweight and stunted. Children from families who do not discard rice scum are more advantageous to be well nourished. Colostrum feeding and suffering from diarrhoea have significant effect on underweight but not on stunting (Sah, October 2004).

A descriptive cross-sectional study was conducted among 146 under five children in Bungmati VDC of Lalitpur district, Nepal. Examination of nutritional status of under-five children found that more than half (57%) were underweight, 41% stunted and 20% of them were wasted (Bhandari and Shrestha, 2017).

Part III

Methodology and materials

3.1 Research method

The study was quantitative and based on primary data. A community based cross-sectional survey was conducted in Harisiddhi Municipality, Lalitpur to assess the factors associated with nutritional status of 6-59 months children using semi-structured questionnaire and measurements of weight, height and mid-upper arm circumference.

3.2 Study variables

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

a) Socio-economic and demographic variables: head of household, ethnicity, family size, income, occupation, education.
b) Child characteristics: age, sex, birth order, breastfeeding status and morbidity status.
c) Child care practices: Feeding, hygiene
d) Maternal characteristics: age , iron and folate intake, number of children born,
e) Environmental health condition: water supply, sanitation and housing condition.

3.2 Study area and its justification

This study was conducted in Harisiddhi Municipality, Lalitpur District. According to National Population and Housing Census 2011, Harisiddhi Municipality constituted 3,644 households with 13,606 total populations. Among the total population, there are 909 under five children (Harisiddhi municipality and health post, 2016).

3.4 Target population

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

Inclusion criteria: Children aged 6-59 months living in Harisiddhi Municipality were included in the study.

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

3.5 Sampling techniques

Cross-sectional descriptive study was conducted in Harisiddhi municipality. Simple random sampling method was used to select children from households. From 3 wards, 2 (29 and 30) wards were selected by simple random sampling method. The basic criterion for the selection of household sample was that the household with at least one child of 6-59 months of age was included in the sample. In households with more than one children of age between 6-59 months, one child was chosen by lottery method.

3.6 Sample size

The sample size was determined by using a single proportion formula assuming the prevalence rate of malnutrition to be 26% in the survey area, 95% confidence interval (CI), 7% margin of error and 10% non-response rate was added to the total calculated sample size.

Mathematically,

Sample size (N_0) = $Z^2 \times P\ (1\text{-}P)/d^2$

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

P = estimated prevalence of malnutrition (26%)

d = margin of error (7%)

Here, P (26%) is estimated on the basis of research conducted by Mr. Mahesh Sarki in the Lalitpur district. The reason to select the data from his study is that, it is related to my research work (Sarki *et al.*, 2016).

Now

$N_0 = (1.96)^2 \times 0.26 \times (1\text{-}0.26)/\ (0.07)^2$

= 150.84 ~ 150

According to Health Post of Harisiddhi Municipality, the total population of children aged 6-59 months was 909. Thus, by applying finite population sample formula, new sample size was obtained to conduct survey in this particular Municipality.

Calculation of sample size for finite population.

New SS = n_0/ [1+ {(n_0 – 1) / POP}]

Where,

New SS= New sample size for finite population

n_o= 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 Harisiddhi).

New sample size was obtained to be 129 from the calculation. Thus the actual sample size was determined by adding 10% non-response rate on calculated sample size and was found to be 142.

3.7 Research instruments

Instruments and equipment's used during survey were:

a) Weighing Machine: Weighing machine with the capacity of 100kg and having the least count of 0.1kg (Microlife pvt. Ltd)
b) Height measuring scale (Stadiometer)
c) MUAC Tape: For measuring mid-upper arm circumference.
d) Questionnaire: A well designed and pretested set of questionnaire to collect household information.

3.8 Sampling frame

All the 6-59 months children were included in the sampling frame from the selected wards (29 and 30) of Harisiddhi Municipality.

3.9 Pre-testing the data collection tools

Pre-testing of the developed interview schedule was done to identify the consistency of tools. Pre-testing was performed in few mothers of 6-59 months child of Harisiddhi Municipality.

3.10 Validity and reliability of the research

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

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

3.11 Data collection techniques

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

Secondary data was obtained from Nepal Demographic Health Survey (NDHS 2011), Health post, Central Bureau of Statistics, and key informants like Female Community Health Volunteers (FCHV), local leaders etc.

There were two sets of tools to gather the information. Part I is the structured interview schedule to generate data pertinent to factors associated with nutritional status of children. Part II is a form, consisting of child information anthropometric measurements were recorded in it. Part III is a form for the 24-hour recall. Form was developed to record the measurements of height, weight, Mid Upper Arm Circumference and structured pre-tested interview schedule was used to collect information from the respondents. The questionnaires comprised mainly of details on household profiles like age, sex, education level and occupation of household members and household size. Data on sources of income was also collected. Anthropometric measurements taken for children aged (6-59) months included:

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

Length/height: Stadiometer was used to measure the height of children. The length of children below 2 years was measured by recombinant method i.e. the length of each child aged 6-24 months was measured lying flat and centrally on measuring boards placed on a hard flat surface on the ground. The length was read to the nearest 0.1 cm (head and feet against the base of the board and foot piece respectively) (Rockenbach *et al.,* 2010).The height of children aged above 24 months was measured standing straight on measuring board placed on hard flat surface with line of sight perpendicular to the horizontal surface. Children were made to stand bare foot on height board and with feet parallel and joined together and with heels and buttock touching the wall. It was made sure that the head was held erect and hands were hung closely at the sides. The child's height was measured to the nearest one decimal place.

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

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

3.12 Data management

Collected data was managed carefully. The collected data was coded by giving numbers starting from 001 and end at 144 then these were stored safely for the purpose of further analysis.

3.13 Data analysis

The data was checked for completeness and consistency. The collected data was first edited, organized, coded and entered into Microsoft excel 2007 and then into statistical package for social science (SPSS) version 20.0 and into WHO Anthro version 3.2.2. The collected data was analysed by using both descriptive and inferential statistics. Descriptive

analysis was used to describe the percentages and number distributions of the respondents by socio-demographic characteristics and other relevant variables in the study. The data were presented in different table. The nutritional status was measured by WHO Standards and Mid Upper Arm Circumference (MUAC).

Anthropometric indices were calculated using reference medians recommended by the World Health Organization (WHO) and classified according to standard deviation units (z-scores), based on the WHO criteria. Wasting (weight-for-height z-score-WHZ) indicates thinness. It is usually the result of recent nutritional deficiency and is affected by seasonal shifts associated with availability of foods and / or prevalence of disease. A WHZ of <-2 defines the presence of acute malnutrition (wasting). Stunting, represented by low height-for-age z-score (HAZ), results from extended periods of inadequate food intake, poor dietary quality, morbidity, or a combination of these factors. A HAZ of <-2 defines chronic malnutrition (Stunting). Weight-for-age z-score (WAZ) is essentially a composite of weight-for-height and height-for-age, thus a measure of both acute and chronic malnutrition. A WAZ of <-2 is used for defining a child as underweight. A z-score of <-3 defines severe levels of each of the indices (Tamiru *et al.*, 2015). The fisher exact test was applied to test the association between the nutrition status and its associated factors.

3.14 Logistic and ethical considerations

Permission to conduct survey in Harisiddhi Municipality was obtained from Central Campus of Technology. Verbal consent from parents/ care taker of the study subjects was obtained and the objective of the study was explained lucidly to them. Privacy and confidentiality of collected information was ensured at all level.

PART IV

Results and discussions

The survey was conducted to find the nutritional status of 6-59 month children in Harisiddhi municipality and factor associated with it. The total household population was 144. One child was taken from each household. The results obtained are shown in following headings. The results of the study have 100% of response rate.

4.1 Demographic and socio-economic characteristics

Out of 144 households, 9% were *Brahmins,* 7.6% *Chhetri,* 71.5% *Janajati,* 6.9% *Madhesi* and 4.9% were of other caste like *Banu* etc. Majority (81.3%) of the family was nuclear whereas only 18.8% was joint family. The mean of the family members was 4. Family with minimum number of member was 3 and the maximum number of member was 10. Most of the household had 3 family members as shown in Table 4.1.

Table 4.1 Frequency distribution of family members (n=144)

	Total family member
Mean	4.0
Mode	3.0
Minimum	3.0
Maximum	10.0

Table 4.2 shows that the major occupation of the household as service with the highest percentage of 41.7%, the second main occupation was found to be labour with 23.6%, followed by business (22.2%), foreign employment (10.4%) and agriculture (2.1%). Considering the estimated annual income depicted in Table 4.2, of all respondents, those with annual income between NRs one to three lakh had the highest percentage (59.7%) and the household that earn more than 3 lakh and below 3 lakh annually were 35.4% and 4.9% respectively.

Table 4.2 Economic characteristics of study population (n=144)

Variables	Frequency	Percent
Annual Income (NRs.)		
Less than 1 lakh	7	4.9
1 to 3 lakh	86	59.7
More than 3 lakh	51	35.4
Occupation		
Agriculture	3	2.1
Business	32	22.2
Foreign employment	15	10.4
Service	60	41.7
Labour	34	23.6

About 74% of respondents were living in rented house while 26% were living in their own house. Nine per cent fathers were illiterate, fathers having primary level education were 30.6%, fathers having secondary level education were 25.7% and fathers who had studied higher secondary level and above were 29.2% which is shown in Table 4.3

Table 4.3 Socio-demographic characteristics of study population (n=144)

Variables	Frequency	Percent
Family type		
Joint	27	18.8
Nuclear	117	81.3
Household type		
Permanent	38	26.4
Temporary	106	73.6
Father's educational status		
Higher secondary and above	42	29.2
Illiterate	13	9.0
None response	8	5.6
Primary	44	30.6
Secondary	37	25.7

4.2 Child characteristics

Out of 144 children of age group 6-59 months taken in study, 54.9% (79) were males 45.1% (65) were females. The mean age of the children was 27.48 $\pm$ 14.28 months. Majority of children fall between 12 – 23 (30.6%) months age group followed by 24 – 35 (21.5%), 36 – 47 (18.8%), 6 – 11 (16%) and 48 – 59 (13.2%). Almost 7% of children had low birth weight (less than 2.5kg), 86.8% of children had normal birth weight (2.5 kg and above) and 3.5% of respondents didn't know the birth weight of their children. More than half (59.7%) of children under study were eldest child of the household. 32.6% of children were second child, 6.3% of children were third child and the rest of them were fourth and above.

Table 4.4 Child characteristics of study population (n=144)

Variables	Frequency	Percent
Gender		
Female	65	45.1
Male	79	54.9
Weight of child during birth		
Less than 2.5kg	10	6.9
2.5kg or more than 2.5kg	129	89.6
None response	5	3.5
Age group (months)		
6-11	23	16.0
12-23	44	30.6
24-35	31	21.5
36-47	27	18.8
48-59	19	13.2
Birth order		
First	86	59.7
Second	47	32.6
Third	9	6.3
Other	2	1.4

4.3 Child caring practices

Out of total respondents, 79.9% (115) of respondents revealed that breast feeding to their child was initiated from the day of birth. Sixty one children (42.4%) were initiated for breast feeding within the first hour after delivery, 9.7% (14) within 8 hours, 27.8% (40) within 24 hour, 20.1% (29) didn't reveal about the time of initiation of breast feeding. Among them, 65.3% were exclusively breastfed for six months while 34.7% of children were not exclusively breastfed. Nearly 94% of the mothers in survey fed colostrum to their children while 6.3% of mother didn't feed colostrum milk to their children. Almost 81% of children were fed nothing before initiation of breast milk while 11.1% and 4.2% were fed lactogen and cow's milk respectively. About 2 % of children were fed honey, 1.4% was fed ghee and 0.7% fed other food stuff. The age at which complementary diet was given was 4 months in 9.0%, 5 months in 11.8%, 6 months in 48.6%, 7 months in 26.4% and above 7 months in 4.2%. Almost 100% of household use packaged iodized salt. This finding is similar to that of National Demographic and Health Survey (2011) which revealed that more than 95% of households were using iodised salt (NDHS, 2011). Almost 90% of total children consumed Vitamin A and deworming tablet, while 9.7% were deprived from consumption of Vitamin A and deworming tablet. The preference of health services for treatment of children during acute illness was highest 48.6% to both hospital and traditional healer, followed by 44.4% to hospital, 4.2% to traditional healer, and 2.8% to pharmacy.

Breastfeeding is very common in Nepal, with 98% of children ever breastfed. Overall 70% of Nepalese children under six months are exclusively breastfed. In this survey, 93% of children have been breastfed at some time and 65.3% of children were exclusively breastfed which is comparatively lower than NDHS (2011). Initiation of breastfeeding within one hour of birth was found to be 42.4% which is higher than 34.3% of children in Central Development Region (CDR) and only slightly higher than 40.3% of children in the Central hill. The initiation of breastfeeding within one day of birth is higher (80%) in this present study than NDHS 2011 findings in CDR (71.8%) and lower than the findings in Central hill (87.9%). Similarly initiation of complementary food at six months of age is lower (48.6%) than NDHS 2011 findings (66%). The percentage of children who were fed complementary food at early age was found to be 20.8% and 30.6% of children were fed lately.

Dietary Pattern of Children: The 7 foods groups used includes grains, roots and tubers; legumes and nuts; dairy products (milk, yogurt, cheese); flesh foods (meat, fish, poultry and liver/organ meats); eggs; vitamin-A rich fruits and vegetables and other fruits and vegetables. Among 7 food groups, 13.2% (19) of children received food from less than 4 food group and 86.8% (125) of children received food from 4 or more than 4 food group.

Table 4.5 Child caring practices of study population (n=144)

Variables	Frequency	Percent
Breastfeeding on first day of birth		
No	29	20.1
Yes	115	79.9
Time of initiation of breastfeeding		
Within 1hr	61	42.4
Within 8hr	14	9.7
Within 24hr	40	27.8
No	29	20.1
Exclusive breastfeeding		
No	50	34.7
Yes	94	65.3
Colostrum feeding		
No	9	6.3
Yes	135	93.8
Prelacteals		
Cow's milk	6	4.2
Honey	3	2.1
Other food stuff	1	.7
Ghee	2	1.4
None	116	80.6
Lactogen	16	11.1
Appropriate time for initiation of weaning food		
4 month	13	9.0
5 month	17	11.8
6 month	70	48.6

Variables	Frequency	Percent
7 month	38	26.4
> 7 month	6	4.2
Diversity of food		
Less than 4 food group	19	13.2
4 or more than 4 food group	125	86.8
Iodised salt consumption		
Iodised	144	100.0
Treatment centre		
Hospital	64	44.4
Pharmacy	4	2.8
Dhami	6	4.2
Hospital and dhami	70	48.6
Vitamin A and deworming		
No	14	9.7
Yes	130	90.3

4.4 Maternal characteristics

Seventy one per cent of respondent had secondary level education, 25% had higher secondary and above, 21% (31) were illiterate, 20.8% (30) were educated to primary level, and 1.4% (2) did not reveal their educational status. Most of the mothers were housewife with highest percentage of 71.3%, 28.5% of mothers were working. The minimum and maximum age of mother at their marriage was 15 and 38year while the mean age at marriage was 20.25 ± 4 year. More than half (62.5%) of mother had their first pregnancy above 20 years of age while 37.5% (54) were pregnant for the first time below 20 years of age. About 95% of mothers had taken iron tablet during pregnancy. Almost half (50.7%) of mothers did not know how to prepare supper flour (Sarbottam pitho) at home and 49.3% were well known about Sarbottam pitho. More than half (56.9%) of mothers were unknown about malnutrition and 43.1% were well known about it. More than half (56.9%) of mothers answered the cause of malnutrition to be lack of food while 43.1% of mothers answered, they didn't know the cause of malnutrition. About 43% of mothers did not know about malnutrition and its causes. Among 144 mother respondents, 61.8% (89) mentioned

that having more food than usual during pregnancy, 21.5% (31) of mothers answered they had less food than usual and 16.7% (24) of mothers had food as usual during pregnancy.

Table 4.6 Maternal characteristics of study population (n=144)

Variables	Frequency	Percent
Mother's educational status		
Higher secondary and above	36	25.0
Illiterate	31	21.5
None response	2	1.4
Primary	45	31.3
Secondary	30	20.8
Mother's educational status		
Housewife	103	71.5
Working	41	28.5
Age at first pregnancy		
Less than 20	54	37.5
More than 20	90	62.5
Iron supplementation		
No	6	4.2
Yes	138	95.8
Knowledge about Sarbottam pitho		
No	73	50.7
Yes	71	49.3
Knowledge about malnutrition		
No	82	56.9
Yes	62	43.1
Cause of under nutrition		
Lack of food	82	56.9
Don't know	62	43.1
Management of nutrients for pregnant women		
Give more than usual	89	61.8
Give less than usual	31	21.5
Give as usual	24	16.7

4.5 Environmental characteristics

The main source of drinking water used in almost all i.e. 100% of the household was tap water. Almost 42% of the household purified drinking water by filtration method, 25.7% of households boiled water before drinking, 2.1% of household used chlorination method and 29.9% of household drink water without purifying. Every household had toilet facilities of their own with 100%. About 45% of household burned their household waste, management of 31.9% of household waste was done by municipality, 18.1% of household buried their household waste and 4.9% of household managed waste by other methods.

Table 4.7 Environmental characteristics of study population (n=144)

Variables	Frequency	Percent
Source of water		
Tap	144	100.0
Water purification		
Boiling	37	25.7
Chlorination	3	2.1
Filtration	61	42.4
None	43	29.9
Toilet facilities		
Yes	144	100.0
Waste management		
Burying	26	18.1
Burning	65	45.1
Management by municipality	46	31.9
Others	7	4.9

4.6 Prevalence of malnutrition

There are several ways of measuring nutritional status, anthropometry is especially important during childhood because growth may be sensitive to nutritional shortage and surplus; and it provides indicators of nutritional status and health risk. Three anthropometric measurements are often used to assess nutritional status during childhood

stage: underweight (weight-for age), stunting (height-for age) and wasting (weight-for-height) (Mansur *et al.*, 2015).

Among 6-59 months children, the overall magnitude of malnutrition in Harisiddhi municipality were 6.3%, 19.4%, 11.1% for wasting, stunting and underweight respectively as shown in Figure 4.6.a. Similarly, the study showed that the rate of severe and moderate malnutrition among the children was stunting 4.9% and 14.5%, wasting 2.1% and 4.2% and for underweight was 2.8% and 8.3% respectively where severe and moderate malnutrition is defined as less than minus 3 Z-Score and less than minus 2 and greater or equals to minus 3 Z-score respectively. In the survey population, overall 6.9 % were found to be overweight, whereas the gender wise distribution of overweight was 8.9% male and 4.6% female. Children falling above the cut-off point of +2 SD from the median of the reference population are classified as overweight.

A study conducted in Bungmati VDC of Lalitpur district revealed that there was high prevalence of Stunting (41%), underweight (57%) and wasting (20%) among the under five children (Bhandari and Shrestha, 2017). Compared to above data, the result of the current study was found to be lower.

A study conducted in Lalitpur district revealed that the prevalence of stunting was 26% which is higher compared to the above data (Sarki *et al.*, 2016). The prevalence of underweight and overweight was 10% and 6.6%, which was found to be similar to the present study.

In the present study, the prevalence of stunting, wasting and underweight was found to be 19.4%, 6.3% and 11.1% respectively. Nepal Demographic and Health Survey 2017 reported that about 36% was stunted, 10% was wasted and 27% was underweight among the under five years of age (MoH, 2017). The prevalence of malnutrition in Central Hill is 31.3% stunted, 15% wasted and 22.5% underweight (MoHP, 2012). The prevalence of all wasting, stunting and underweight was found better than the national data as well as than that of Central hill. Also from the survey result, it was concluded that overweight (6.9%) was greater than findings of overweight in Central Hill (1.9%).

Table 4.8 Prevalence of malnutrition in children of Harisiddhi

Nutritional Indicator	Percent
Stunting	19.4
Wasting	6.3
Underweight	11.1
Overweight	6.9

Table 4.9 Prevalence of malnutrition in terms of severity

Nutritional Indicator	Severe (%)	Moderate (%)
Stunting	4.9	14.5
Wasting	2.1	4.2
Underweight	2.8	8.3

Fig 4.1 shows that the prevalence of wasting was almost equal in both male (6.3%) and female (6.2%). Prevalence of both stunting and underweight was found higher in male than in female. Prevalence of stunting was 21.5% in male and 16.9% in females. Prevalence of underweight was found greater in males with 16.5% while 6.1% of females were underweight.

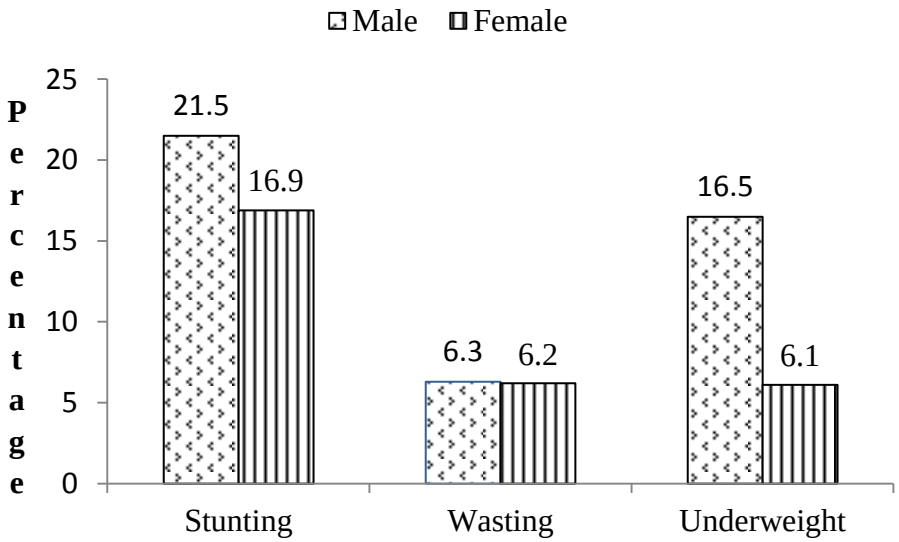

Fig 4.1 Gender wise distribution of malnutrition in children of Harisiddhi Municipality

Table 4.10 Gender wise distribution of wasting, stunting and underweight (n=144)

	Characteristics	Male (%)	Female (%)	All (%)
WHZ	Severely wasted (<-3)	2.5	1.5	2.1
	Moderately wasted (≥ -3 and <-2)	3.8	4.7	4.2
	Normal	84.8	89.2	86.8
	Overweight (> +2)	8.9	4.6	6.9
HAZ	Severely stunted (<-3)	6.3	3.1	4.9
	Moderately stunted (≥ -3 and <-2)	15.2	13.8	14.5
	Normal	78.5	83.1	80.6
WAZ	Severely underweight (<-3)	3.8	1.5	2.8
	Moderately underweight (≥ -3 and <-2)	12.7	4.6	8.3
	Normal	83.5	93.9	88.9

There was high prevalence of wasting in children of age group 48-59 months and there was low prevalence of wasting in children of age group 24 – 35 months. Stunting was highly prevalent in children of age groups 36 – 47 months and there was low prevalence of stunting in children of age group 6 – 11 months. During the survey, highest prevalence of stunting was found in children who were 24 months and above. Stunting in children age 24 months and above were resulted from poor nutritional status of mother's at pregnancy, inappropriate infant and young child feeding practices and other related factors which were needed to be undergone beginning from conception, through a mother's pregnancy and up until the age of two which is the most critical period in a child's development.

There was high prevalence of underweight in children of age group 36 – 47 months and there was low prevalence of underweight in children of age group 12 – 23 months. Underweight in children age 24 months and above might be explained by the fact that food for weaning are typically introduced to children in the older age group, thus increasing their exposure to infections and susceptibility to illness. Micro-nutrient deficiency such as Vitamin A deficiency, zinc deficiency and anemia may also be the factors contributing to child undernutrition in preschool children.

The age wise distribution is given in Table 4.11

Table 4.11 Distribution of wasting, stunting and underweight among different age group (n=144)

Age group (months)	N	WHZ (%)			HAZ (%)		WAZ (%)	
		<-3	<-2	> +2	<-3	<-2	<-3	<-2
(6 – 11)	23	Nil	8.7	4.3	8.7	8.7	4.3	13
(12 – 23)	45	Nil	4.4	2.2	Nil	11.1	Nil	4.4
(24 – 35)	30	3.3	3.3	16.7	6.7	20	3.3	6.7
(36 – 47)	27	Nil	3.7	3.7	11.1	37	Nil	25.9
(48 – 59)	19	10.5	15.8	10.5	Nil	26.3	10.5	10.5

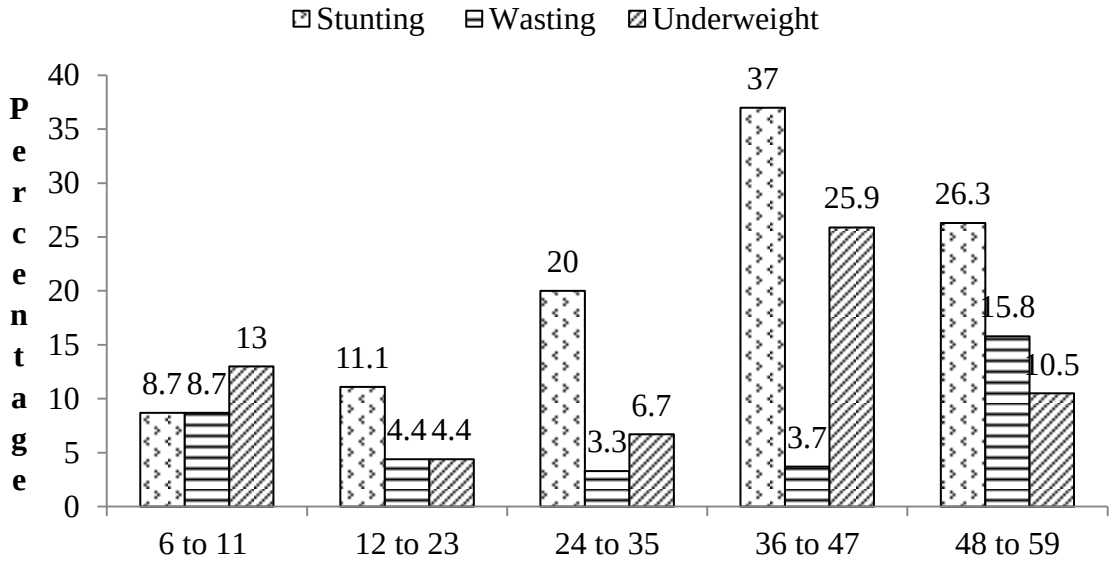

Fig 4.2 Distribution of malnutrition among different age group

On the basis of MUAC, 1.4% of the children fall into severe acute malnutrition criteria and 9.7% of children fall into Moderate acute malnutrition criteria. The rest 88.9 % of the children were normal.

Table 4.12 Prevalence of nutritional status on the basis of MUAC (n=144)

Class	MUAC reading	Frequency	Per cent
Severe Acute Malnutrition	< 115mm	2	1.4
Moderate Acute Malnutrition	115mm – 125mm	14	9.7
Normal	> 125mm	128	88.9

4.3 Nutrition status comparision with WHO standard

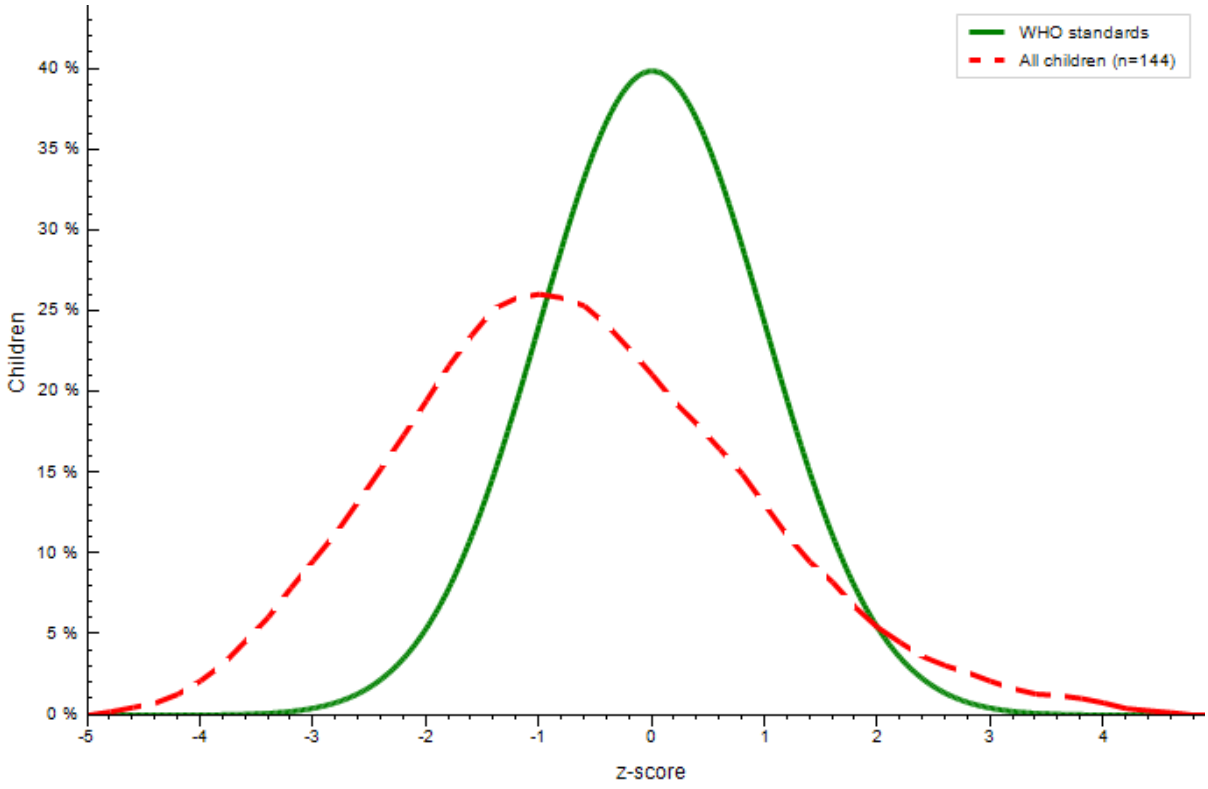

Fig 4.3 Distribution of stunting among 6-59 months children in *Harisiddhi* based on WHO standard (n=144)

Figure shows that the median Height for Age z-score of survey children was found to be -0.81 which is less than the reference to WHO standard. This caused the curve to be skewed to the left side of WHO standard curve showing the prevalence of stunting among study population.

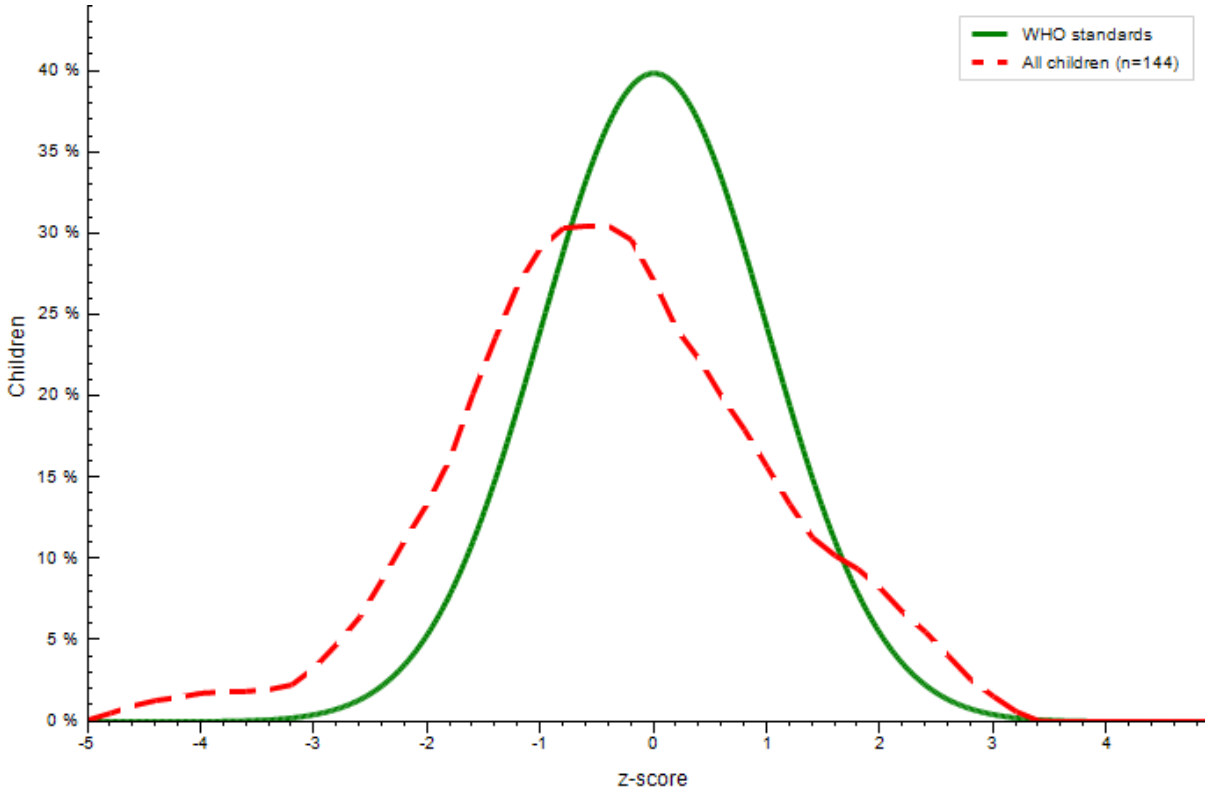

Fig 4.4 Distribution of underweight among 6-59 months children in *Harisiddhi* based on WHO standard (n=144)

Figure shows that the median Weight for Age z-score of survey children was found to be -0.49 which is less than the reference to WHO standard. This caused the curve to be skewed to the left side of WHO standard curve showing the prevalence of underweight among study population. This may be due to poor maternal nutrition, inappropriate or inadequate feeding practice, infectious disease and Vitamin A deficiency. Poor maternal nutrition results in Low birth weight babies which is important determinant of undernutrition and morbidity among children.

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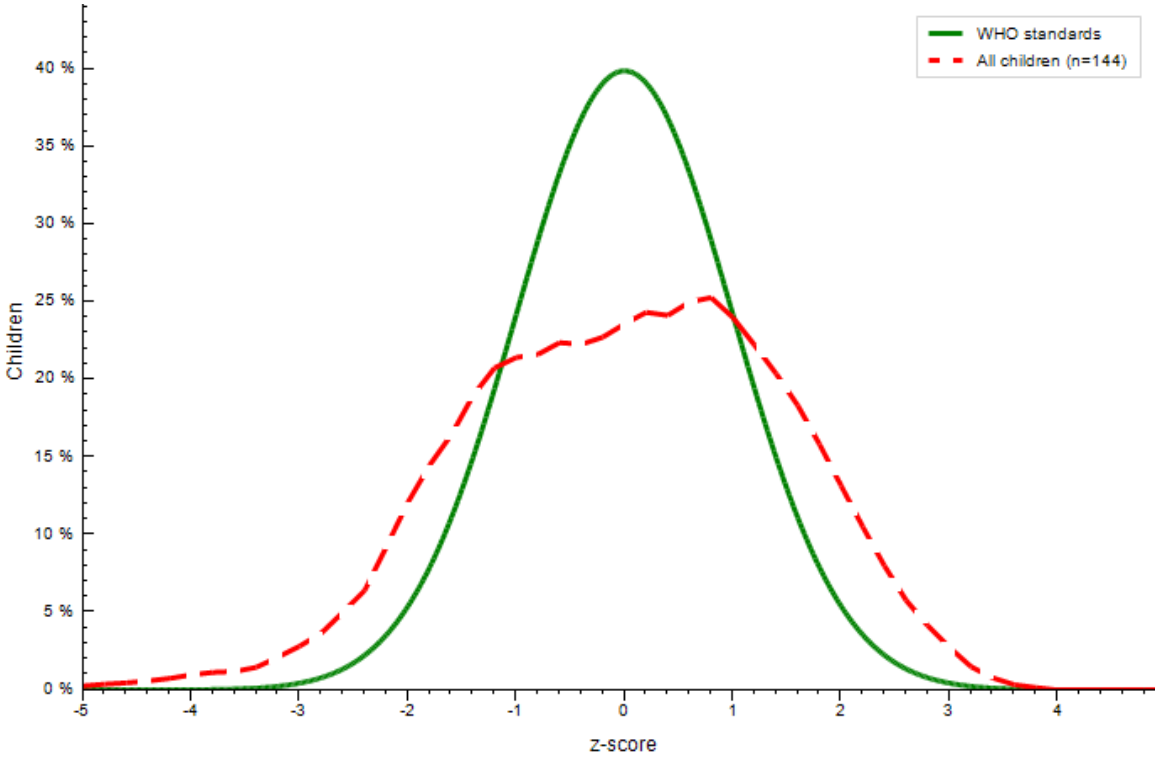

Fig. 4.5 Distribution of wasting among 6-59 months children in *Harisiddhi* based on WHO standard (n=144)

Figure shows that the median Weight for Height z-score of survey children was found to be 0.14 which is slightly more than the reference to WHO standard. So, the curve is skewed a bit to the right side of the WHO standard curve showing the prevalence of overweight among study population. This might by be explained by rapid urbanization, changing dietary patterns, sedentary lifestyles and higher reliance on food produced and processed outside the home are contributing to rise in overweight.

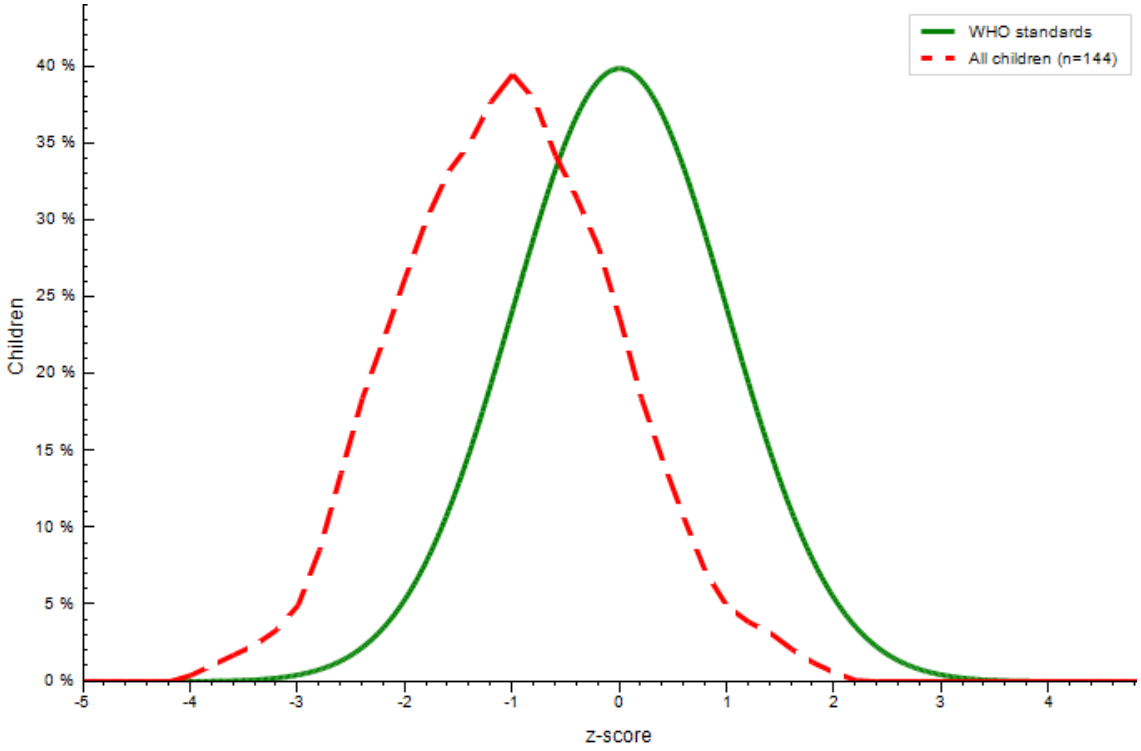

Fig 4.6 Distribution of wasting based on MUAC of 6-59 months children in *Harisiddhi* based on WHO standard (n=144)

4.7 Factors associated with under nutrition of children

Anthropometric results are most widely used for the assessment of under nutrition and it was assessed by stunting, wasting and underweight. Fisher exact test was used to identify the characteristics that were related to nutritional status of children.

4.7.1 Factors associated with wasting

The factors such as gender (p=1.0), family size (p=0.549), annual income (p=0.062), weight at birth (p=0.128), child's age (p=0.208), birth order (p=0.863) and Vitamin A and deworming tablet (p=0.346) had no significant association with wasting as shown in Table 4.13. This may be due to low prevalence of wasting among the children of the community and seasonal variation may be other cause as the season when this study was conducted was after crops harvesting. Greater coverage of health facilities may be another reason for low prevalence of wasting among the children of the community.

Table 4.13 Factors associated with wasting

Factors		Wasting		p-value
		Wasted	Normal	
Gender	Female	4 (6.2%)	61 (93.8%)	1
	Male	5 (6.3%)	74 (93.7%)	
Family size	≤ 4	6 (5.5%)	104 (94.5%)	0.549
	> 4	3 (8.8%)	31(91.2%)	
Annual Income	< 1 lakh	2 (28.6%)	5 (71.4%)	0.062
	> 1 lakh	7 (5.1%)	130 (94.9%)	
Weight at birth	< 2.5kg	2 (20%)	8 (80%)	0.128
	2.5kg or > 2.5kg	7 (5.4%)	122 (94.6%)	
Child's age	24 or < 24 months	4 (5.9%)	64 (94.1%)	0.208
	> 24 months	5 (6.6%)	71 (93.4%)	
Birth order	First child	5 (5.9%)	81 (94.1%)	0.863
	Other child	4 (6.9%)	54 (93.1%)	
Vitamin A and deworming	No	1 (7.1%)	13 (92.9%)	0.346
	Yes	8 (6.2%)	122 (93.8%)	

*Statistically significant ($p<0.05$)

4.7.2 Factors associated with stunting

Table 4.14 shows that there was significant association of stunting with child's age group (p=0.043) and family size (p=0.046). This result also shows that there was no significant association of stunting with gender of child (p=0.678), annual income (p=0.101), weight at birth (p=0.129), birth order (p=0.228) and Vitamin A and deworming tablet (p=0.166). The results of the present study revealed a higher prevalence of stunting in children from family with less than or equal to 4 members than children from family with more than 4 members. The study informed that 23.6% of children from small families were stunted while 5.9% of children from large families were stunted in Harisiddhi municipality. This result is in contradiction with the findings of study conducted in South Ethiopia which revealed that family size was statistically significant with stunting and children from larger families (> 4 family members) were at greater risk of getting stunted than children from smaller families (≤ 4) family members (Fikadu *et al.*, 2014). The finding of the study is consistent with the findings of study conducted in Panchgacchi VDC, Jhapa which revealed higher prevalence of stunting in children from smaller family (Dhakal, 2015). This may be because larger family size may provide an opportunity for the mothers in getting substitute care givers for her child and also in such large families the children may be well cared for.

The present findings depicted that the risk of stunting increases with age. Children in the youngest age group, 6-11 months had a significantly lower risk of being stunted than children in the older age groups. The findings of this study was consistent with the findings of similar study conducted by Ruwali D in 2010 in Padampur VDC, Chitwan which revealed significant association between stunting and child's age (Ruwali, 2011). The low risk of children in the youngest age group being stunted may be due to protective effect of breastfeeding, since breastfeeding is the most common method of feeding new born baby and almost all children in Nepal are breastfed. Also, most of them continue to be breastfed throughout the first year of life. Protective effect of immunization status during the first year of life may also have had a great impact on the health of children.

The result was in agreement with study done Hossana town, Southern Ethopia where child's age was one of the risk factors which significantly associated with stunting (Moges *et al.*, 2015). Comparing with children 6-11 months, children within age group 24-35months, 36-47 months and 48-59 months were more likely to be stunted. This might be due to stunting in children age 24 months and above were resulted from poor nutritional status of mother's at pregnancy, inappropriate infant and young child feeding practices and other related factors which were needed to be undergone beginning from conception, through a mother's pregnancy and up until the age of two which is the most critical period in a child's development. This finding is also in line with study done in Lasta Woreda, North East Ethiopia where children age groups 36-47 months and 24-35 months were strongly associated with stunting (Birhanu *et al.*, 2017).

Table 4.14 Factors associated with stunting

Factors		Stunting		p-value
		Stunted	Normal	
Gender	Female	11 (16.9%)	54 (83.1%)	0.675
	Male	17 (21.5%)	62 (78.5%)	
Family size	≤ 4	26 (23.6%)	84 (76.4%)	0.046*
	> 4	2 (5.9%)	32 (94.1%)	
Annual Income	< 1 lakh	3 (42.9%)	4 (57.1%)	0.101
	> 1 lakh	25 (18.2%)	112 (81.8%)	
Weight at birth	< 2.5kg	4 (40%)	6 (60%)	0.129
	≥2.5kg	22 (17.1%)	107 (82.9%)	
Child's age	≤ 24 months	7 (10.3%)	61 (89.7%)	0.034*
	> 24 months	21 (27.6%)	55 (72.4%)	
Birth Order	First child	14 (16.3%)	72 (83.7%)	0.228
	Other child	14 (24.2%)	44 (75.8%)	
Vitamin A and deworming	No	3 (21.4%)	11 (78.6%)	0.166
	Yes	25 (19.2%)	105 (80.8%)	

*Statistically significant ($p<0.05$)

4.7.3 Factors associated with underweight

Statistically significant association was found between underweight and child's weight at birth (p=0.006) and supplementation of Vitamin A and deworming (p=0.047). While gender (p=0.071), family size (p=0.107), annual income (p=0.095), child's age (p=0.433) and birth order (p=0.834) were statistically insignificant with underweight ($p<0.05$) in this study.

The prevalence of underweight with children whose weight at birth was less than 2.5kg and greater than or equal to 2.5kg was 40% (4) and 9.3% (12) respectively. Children whose weight at birth was less than 2.5kg or who had low birth weight are more likely to be underweight. The finding of the study is consistent with the study conducted by Nguyen Ngoc Hien et.al. in Nghean, Vietnam which revealed that low birth weight infants were 7.7 times more likely than normal-birth-weight infants to be underweight (Hien and Kam, 2008). A study conducted by Israt Rayhan and Sekander Hayat Khan in Bangladesh also identified low birth weight as risk factor for underweight of children (Rayhan and Khan, 2006). Poor maternal nutrition results in low birth weight which is important determinant of under nutrition and morbidity among children. The reason may be that thin or

malnourished mothers cannot provide sufficient breast milk because of their nutritional deficiency. Acute malnutrition of mother could be an impediment for her child's growth.

There was also association between underweight and Vitamin A and deworming supplementation (p=0.013). The children who were not supplemented Vitamin A and deworming tablet in the past one month had greater risk of becoming underweight 2(14.3%) than those children who were supplemented Vitamin A and deworming tablet 14 (10.8%). This result of the study is consistent with the study conducted by Paramita in Ludhiana, India which revealed that children who had suggestive history of worm infestation, increased the risk of being underweight to almost double (Sengupta *et al.*). Also the result in other study conducted by Masako Nakamori et.al in northern mountainous Vietnam showed that factors such as Vitamin A deficiency, zinc deficiency and anaemia continue to be serious problem in the public health of preschool children, particularly in children aged under 2 year in mountainous areas, and contribute to underweight in this population (Nakamori *et al.*, 2010).

Table 4.15 Factors associated with underweight

Factors		Underweight		p-value
		Underweight	Normal	
Gender	Female	3 (4.6%)	62 (95.4%)	0.071
	Male	13 (16.5%)	66 (83.5%)	
Family size	≤ 4	15 (13.6%)	95 (86.4%)	0.107
	> 4	1 (2.9%)	33 (97.1%)	
Annual Income	Less than 1 lakh	2 (28.6%)	5 (71.4%)	0.095
	More than 1 Lakh	14 (10.2%)	123 (89.8%)	
Weight at birth	< 2.5 kg	4 (40%)	6 (60%)	0.006*
	2.5 kg or > 2.5kg	12 (9.3%)	117 (90.7%)	
Child's age	24 or < 24 months	5 (7.4%)	63 (92.6%)	0.433
	> 24 months	11 (14.5%)	65 (85.5%)	
Birth order	First child	10 (11.7%)	76 (88.3%)	0.834
	Other child	6 (10.4%)	52 (89.6%)	
Vitamin A and deworming	No	2 (14.3%)	12 (85.7%)	0.047*
	Yes	14 (10.8%)	116 (10.8%)	

*Statistically significant (p<0.05)

Part V

Conclusions and recommendations

5.1 Conclusions

The aims of the present study were to assess the prevalence of under nutrition and identify causes of under nutrition among children of 6-59 months in Harrisiddhi Municipality, Lalitpur. The followings are the conclusions drawn from this study:

a) Prevalence of malnutrition among 6-59 months children in Harisiddhi municipality were 19.4%, 6.3% and 11.1% for stunting, wasting and underweight respectively.
b) Child's age, family size, low birth weight, Vitamin A and deworming supplementation were the risk factors associated with malnutrition in children.
c) Child age group and family size were the factor for stunting whereas Low birth weight and Vitamin A and deworming supplementation were the factor for underweight.
d) The results of the present study can contribute to communities involved in the design, planning and management of nutrition- related programs

5.2 Recommendations

Based on the results of this study, following recommendations were made:

a) Child age specific attention should be given while feeding.

b) Breast feeding after six months of age needs integration with appropriate complementary feeding.

c) Regular deworming service to children should be strengthened.

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

e) Further study should be done to see other unexplored factors that were not included in the present study.

Part VI

Summary

A community based cross-sectional study was conducted to assess the factors associated with nutritional status of 6-59 months children in Harisiddhi Municipality of Lalitpur District, Nepal. The study included 144 children selected using simple random sampling technique; anthropometric measurements (weight, height, MUAC) were performed to find the nutritional status of children. A structured questionnaire was administered to the mother or caretaker of children to determine the associated factors. Data collected was analysed using WHO Anthro version 3.2.2 and SPSS 20. Fisher exact test was used to analyse the factors associated with nutritional status.

Out of 144 children, 45.1% were female and 54.9% were male. About 71.5% of families were *Janajati* followed by 9% *Brahmins*, 7.6% *Chhetri*, 6.9% *Madhesi* and others 4.9%. Almost 60% of household had annual income between NRs one to three lakh, 35.4% of household earned more than 3 lakh annually and 4.9% of the household had annual income less than 1 lakhs. The major occupation of the household was service 41.7%, followed by labour with 23.6%, the household engaged in business, foreign employment and agriculture were 22.2%, 10.4% and 2.1% respectively. 71% of the mothers studied upto secondary level, 25% of mothers studied up to higher secondary and above, 21% of mothers were illiterate and 20.8% studied up to primary level. 7% of children had low birth weight and the others birth weight were normal. 65.3% of mothers exclusively breastfed their child until 6 months and 48.6% of mothers initiated complimentary feeding at the age of 6 month. Majority of the households use packaged iodized salt. 90.3% of total children were supplemented with Vitamin A and deworming tablet.

According to length/height for age, 19.4% of children were stunted. Among them, 4.9% were severely stunted while 14.5% were moderately stunted. Prevalence of stunting was seen more in male than in female with 21.5% of stunted in male while 16.9% of female were stunted. According to weight for height, 6.3% children were wasted and among them, 2.1% were severely wasted and 4.2% were moderately wasted. Prevalence of wasting was almost equal in both male and female with 6.3% of wasted in male and 6.2% of wasted in female. According to weight for age, 11.1% of children were underweight and among them 2.8% were severely underweight and 8.3% were moderately underweight. Prevalence of

underweight was found greater in males with 16.5% of wasted in males and 6.1% of females were underweight.

Fisher exact test analysis of the determinants of nutritional status indicated that, child age group (p=0.034) and family size (p=0.046) was significantly associated with stunting. The children more than 24 months are more prone to stunting than the child equal or less than 24 months. Higher prevalence of stunting was found among children from small families as compared with children from large families. Weight at birth (p=0.006), and Vitamin A and deworming (p=0.047) were statistically significant with underweight. Higher prevalence of underweight was found among children of low birth weight and in children who were not supplemented with Vitamin A and deworming tablet. Unlike those mentioned above, wasting had no significant association at all.

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APPENDICES

Appendix-A

Questionnaires

Basic Information

S.N	Date:	
Name of child:		
Date of birth:	Gender:	
Address:	Municipality:	Ward no:

Detail of family members

S.N	Name	Relation with child	Sex	Age	S.N	Name of child under 5 years	sex	Age
1								
2								
3								
4								
5								
6								

1. Number of family members:
2. Type of family: single/joint
3. Occupation (of mother) : business/ agriculture/ service/ others
4. Occupation of husband : business/ agriculture/ service/ others
5. Education level of your husband: primary/ secondary/ higher secondary and above/illiterate/don't know

6. Mothers educational level : primary/ secondary/higher secondary and above/ don't know
7. Income per annum : less than 1 lakh/ 1to 3 lakh/ more than 3 lakh
8. Is your income enough for food consumption : yes/no
9. Type of house : temporary/ permanent

Child's Information

10. Which child is this (first, second, third..):
11. Weight at the time of birth:
12. Death of any child under five : (yes/ no)
13. If yes how many:
14. Cause of death:

Child care information

15. Did you breastfeed the child immediately after birth: yes/ no
16. If yes after how many hours? Within 1 hr/ within 8 hr/ within 24 hr/ no
17. When did you stop breast feeding?
18. Did you breastfeed exclusively? Yes/no
19. Did you feed colostrum immediately after birth? Yes/ no
20. Did you give pre-lacteal feed to your baby after birth? Milk/ honey/ molasses / ghee/herbs/ none
21. Do you know about complementary feeding?
22. If yes when did you start? 4 month/ 5 month/6 month/7 month/no
23. Do you know how to prepare lito at home? Yes/ no
24. If yes how?
25. Do you know how to prepare ORS? Yes/no

Health and immunization information

26. Have you vaccinated your child? Yes/ no
27. Have you given vitamin A and deworming tablet? Yes/ no
28. Did you get vaccination during pregnancy? if yes which one? (polio/ BCG/ DPT/ TT/ No)

29. Where do you take your child if he/ she sick? (health centre/ pharmacy/ dhami/ health centre and dhami both)
30. How do you know your child is sick? (laziness/ high temperature/ diarrhoea)

Mother's information

31. At what age did you get married?
32. How old were you during first pregnancy? Less than 20/ more than 20
33. Have you taken iron folate tablet? Yes/ no
34. Do you know about malnutrition? Yes/ no
35. If yes how? Inadequate food/ curse of god/ witch craft/ others/ don't know
36. Do you know what the reasons for marasmus are? Yes/ no
37. How much have you taken food during pregnancy? More than usual/ less than usual/ as usual
38. What type of salt is used in your household? Iodised salt/ non iodised salt

Environment and sanitation information

39. Which source of water do you use? (tap/ well/ river/ borin)
40. How do you clean your drinking water? (filtration/ chlorination/ by boiling/ none)
41. How do you manage household waste and its disposal? (digging/ burning/ managed by municipality/ others)
42. Do you have toilet at your home? Yes/ no

Anthropometric measurement of children under five

S.N.	**Height**	**Weight**	**MUAC**	**Oedema (Yes/No)**

24 hr dietary recall

Children

Timing	**Description of food or drink**
Breakfast (6 to 9 A.M)	
Lunch (9 to 11 A.M)	
Snacks (1 to 5 P.M)	
Dinner (9 to 11 P.M)	

Appendix-B

Consent Letter

Namaste!

I Miss Pritika Shakya, graduate student in Department of Nutrition and Dietetics conducting a dissertation work for award of bachelor's degree in Nutrition and Dietetics. The topic for the study is "**Study on Nutritional Status of 6 to 59 months children in Harisiddhi Municipality Lalitpur and Factor associated with it**".

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

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

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

Signature of parent/guardian:	Sign of Participant:
……..	……
Date:	Date:
Place:	Place:

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

Investigator's sign:

……
Date:
Contact address:

Appendix-C

Map of Harisiddhi

Appendix-D

Photo Gallery