NUTRITIONAL ASSESSMENT OF CHILDREN UNDER THE AGE 6-59 MONTHS OF CHEPANG COMMUNITY RESIDING IN KUSUM KHOLA AREA.

by

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Approval Letter

This *dissertation* entitled Study of *nutritional assessment of children under the age 6-59 months of chepang community residing in kusum khola* by Anuska Lamichhane has been accepted as the partial fulfillment of the requirement for the B.Sc. degree in Nutrition and Dietetics

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Abstract

Nutritional status of children is a proxy indicator for assessing the entire population health status and one of the major predictors of child survival. Despite the various efforts, malnutrition among children is remaining as a major public health problem in Nepal. A community based cross sectional study was conducted on 117 children aged 6-59 months for assessing the nutritional status of under-five children and factors associated with it, of chepang children in kusum khola area. All the children of that area were taken as sample on census sampling. Anthropometric measurements and structured questioners were used. Anthropometric measurement was then used to determine whether the children were underweight (weight-for-age), wasting (weight-for-height) and stunting (height-for-age) based on WHO reference. Statistical Package for the Social Sciences (SPSS) 20 version and World Health Organization (WHO) Anthro 3.2.2 version were used for analyzing the data. Chi-square test was used to identify the associated factors of malnutrition.

The analysis of this study revealed that, 34.2%, 29.1% and 23.9% of children were stunted, underweight and wasted, respectively. The main associated factors of stunting were found to be calorie intake and deworming tablets and vitamin A consumption. Underweight was also found associated with mother's education, deworming tablet and vitamin A consumption, calorie intake, continuation of breastfeeding and annual income and continuation of breastfeeding was found associated with wasting. From the findings of this study, it is concluded that malnutrition is still an important problem among children aged 6-59 months. Therefore, especial attention should be given on intervention of malnutrition.

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List of abbreviations

Abbreviation	Full form
FAO	Food and Agriculture Organization
FCHV	Female Community Health Volunteer
HAZ	Height for Age z score
IDA	Iron Deficiency Anemia
IDD	Iodine Deficiency Disorder
MDG	Millennium Development Goal
MOHP	Ministry of Health and Population
MUAC	Mid Upper Arm Circumference
NDHS	Nepal Demographic and Health Survey
NMISC	Nepal Multiple Indicator Cluster Survey
PEM	Protein Energy Malnutrition
UNDP	United Nations Development Program
UNICEF	United Nations International Emergency Fund
WAZ	Weight for Age Z Score
WHO	World Health Organization
WHZ	Weight for Height Z Score

Part I

Introduction

1.1 Background to the study

Adequate nutrition is fundamental right of every human being. Problems related to poor nutrition affect the entire population; women and children are especially vulnerable because of their unique physiology and socioeconomic characteristics. Poor nutrition is cited as the major factor in more than half of all child deaths in Nepal a significantly higher proportion than those claimed but other infectious disease (World Bank, 1993).

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

As based on their mythology, the name 'Chepang' consist of the two words 'Che' and 'Bang', which is also becomes proof as their ancestral occupations. According to their myth the first word 'Che' meaning 'tips of the rock' and 'Bang' meaning 'stone/curse', so the etymological meaning of the tribe becomes they live in the tips of the rock/stone due to curse of God. As based on the view of Ganesh Man Singh, it is proved that they were the tribal group and as an occupation they were mostly dependent on hunting and gathering (Sagar, 2012).

The Chepang are an indigenous Tibeto-Burman people group numbering around fifty-two thousand mainly inhabiting the rugged ridges of the Mahabharat mountain range of central Nepal. According to 2011 Nepal census; there are 68,399 chepang in the country. Where 1.655 lives in urban area and 66,744 lives in rural region; on the basis of ecological belt 11 lives in mountain region, 38,506 in hill & 29,882 in terai; however, 319 lives in eastern region, 63,765 in central region, 4208 in western region, 105 in mid-western region and 2 in far-western region. According to sex, there are 33,779 female and 34,620 male in Nepal

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(CBS, 2011). They are mostly located in Dhading District, Chitwan District, Gorkha District, Makwanpur District, and Tanahu District.

Over the past two or three generations the Chepang have begun to slowly shift from a semi-nomadic (slash-and-burn) lifestyle to a more settled way of life, relying increasingly upon the produce of permanent fields of maize, millet and bananas. The severe topography, however, has made permanent farming difficult (and usually insufficient) and the forest has remained an important (although decreasingly so) source of food for the Chepang. Historically, the collection of wild yams and tubers, fish caught from nearby rivers, bats and wild birds, and periodically wild deer hunted from nearby forests, have supplemented their need for carbohydrates and protein. With increasing population, lack of arable land and few irrigation options, despite forest supplements, malnutrition has been an historic problem for the Chepang who have often been characterized as the poorest of Nepal's poor (Ghimire, 2014).

The Chepang are one of Nepal's most disadvantaged indigenous groups and are classified under the 'highly marginalized' category on the basis of a set of socioeconomic indicators, such as population size, language literacy rate, house type, landownership, occupation and access to higher education. Although no longer a nomadic tribe, the Chepangs have largely preserved their unique tribal identity by maintaining their traditional knowledge system and continuing to practice animism (UN Resident and Humanitarian Coordinator, 2012). The language is also known as Chepang but is called Chyo-bang by the people themselves. Some Bahun Chettri castes call these people the "Praja" meaning "political subjects". The people speak 3 different dialects of this Tibeto-Burman language that is closely related to Raute and Raji, two undocumented languages spoken in western Nepal. Chepang language is one of the few languages which uses a duodecimal counting system rather than the decimal(Limbu and Thapa, 2011).

1.2 Problems of statement

Malnutrition refers to a pathological state resulting from a relative or absolute deficiency or excess of one or more essential nutrients. It is a state of nutrition where the weight for age, height for age and weight for height indices are below -2 Z-score of the NCHS reference.

Malnutrition continues to be a major public health problem in developing countries. It is the most important risk factor for the burden of disease causing about 300,000 deaths per

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year directly and indirectly responsible for more than half of all deaths in children. Health and physical consequences of prolonged states of malnourishment among children are: delay in their physical growth and motor development; lower intellectual quotient (IQ), greater behavioral problems and deficient social skills; susceptibility to contracting diseases. Major types of nutritional disorders which are resulting from inadequate food intake both in quality and quantity; particularly of calories, proteins, vitamins and minerals and parasitic infection and disease (Black *et al.*, 2003). Chepang are found back in health seeking practices than the other communities. The Chepang settlement is often on very steep land, unfertile and not easily accessible (Ghimire, 2014).

Chepang people are well known for shifting cultivation practice which is the main source of livelihood for almost all of them. Shifting cultivation practice is known as *khoriya kheti* in Nepali. There is a common saying that if you find a Chepang household, there must be *khoriya* nearby. Farming alone is not enough to sustain their family food requirements for the whole months in a year.

The reasons for the study of Chepang community are as follows:-

1. They are the one of the native community in Chitwan.
2. They are still isolated from other community and live near the forest area or rural area.
3. Their economic status still not lies on the average. Most of them are poor.
4. Most of them are illiterate so, they are not much aware of food habits and the nutrition.
5. There are not much researches carried out about them.

1.3 Objectives

1.3.1   General Objectives

The main objective of this work is to assess the nutritional condition of the chepang children in kusum khola and the factors that directly or indirectly influence them.

1.3.2   Specific Objectives

1. To assess the nutritional status of preschool (6-59 month) children in the population.
2. To assess the risk group of the community.
3. To identify the factors that directly or indirectly responsible for malnutrition.

1.4 Research question

The purpose of this study is to determine the nutritional status and factor that influences the nutritional status of 6 month to 59 month of children of chepang community residing in kusum khola area. This thesis addresses the following questions:

1. What is nutritional status of under five year children of Chepang community in kusum khola village, Chitwan?
2. What are the underline factors that cause malnutrition on the children in these living areas   and what parameters are responsible to induce low food availability in household level to cause malnutrition in child.

1.5 Significance

The results and findings of this study may be helpful to:-

1. Give the pictorial view of the condition of children and prevalence and degree of malnutrition in the community.
2. Serve as a helpful guide to make the nutritional plan and program to combat the nutritional problem in that community as well as for other similar types of communities.
3. Provide information to organizations who are working in the field of nutrition to intervene proper solution for the current prevailing problem.
4. Identify the individual or group of people who are at the risk of being malnourished.
5. Encourage people for the improvement of their existing nutritional status by improving dietary pattern of the pre-school children.
6. Encourage the government and other concerned authorities such as NGOs and INGOs for the development of an adequate system of nutritional Programme.

1.6 Limitations

1. Difficulties may be encountered in assessing socio-economic information like family income, family property, expenditure on food and non-food items, food consumption pattern etc. as they are considered to be related with the family prestige.
2. This study is conducted with limited resources it makes impossible to include many important question and many other clinical, biochemical and dietary assessment.

Part II

Literature review

2.1 Nutritional status

Nutritional status is the condition of the body in those respects influenced by the diet; the levels of nutrients in the body and the ability of those levels to maintain normal metabolic integrity (BENDER, 2005).The nutritional status of children is important as it determines their health, physical growth and development, academic performance and progress in life. All children have the right to adequate nutrition, which is essential for attainment of the highest standard of health. Children's nutritional status is a reflection of their overall health. When children have access to an adequate food supply, are not exposed to repeated illness, and are well cared for, they reach their growth potential and are considered well nourished. Malnutrition is associated with more than half of all child deaths worldwide. Undernourished children are more likely to die from common childhood ailments and, for those who survive, have recurring sicknesses and faltering growth. Three quarters of the children who die from causes related to malnutrition are only mildly or moderately malnourished—showing no outward sign of their vulnerability. One of the MDGs is to halve the proportion of people who suffer from hunger between 1990 and 2015. A reduction in the prevalence of malnutrition will also assist the MDG on reducing child mortality (NMICS, 2012).

Under nutrition among children remains common in many parts of the world. According WHO(2011), about 178 million children under five years worldwide are too short for their age groups; while 115 million are underweight. The same report showed that stunting rate among children is higher in Africa and Asia than elsewhere. In Kenya, 35% of children under five are stunted, while the proportion severely stunted was 14%; 16% are underweight (low weight-for-age) and 4% are severely underweight (Badake *et al.*, 2014). According to NDHS, 37.4% are stunted, 11.2% are wasted and 29.5% are underweight in Terai belt of Nepal among them 14.9%, 3.2% and 7.8% are severely stunted, wasted and underweight respectively (MoHP, 2011). The study of nutritional status of under five years children from Padampur VDC; Chitwan shows that the prevalence of malnutrition rate of stunting, wasting and underweight as 37.3%, 25.7% and 22.7% respectively (Ruwali, 2011).

For assessment of nutritional status of children, weight and height for age are compared with standard data for adequately nourished children. The increase in the circumference of the head and the development of bones may also be measured. And for adults nutritional status can be assessed by looking at the person(clinical examinations), general adequacy is assessed by measuring weight and height; the result is commonly expressed as the body mass index, the ratio of weight(kg) to height(m), body fat may also be estimated, by measuring skinfold thickness, and muscle diameter is also measured(anthropometric measurements). Status with respect to individual vitamins and minerals is normally determined by laboratory tests, either measuring the blood and urine concentrations of the nutrients and their metabolites, or by testing for specific metabolic responses i.e. biochemical examinations (BENDER, 2005).

Moreover, good nutrition has been reported to be the corner stone for survival, health and development in the current and succeeding generations. Among children in developing countries, malnutrition is an important factor contributing to illness and death. Malnutrition during childhood can also affect growth potential and the risk of morbidity and mortality in later years of life. About half of all children deaths are associated with malnutrition, of which three quarters are linked to mild and moderate forms.

Nutritional status of children is a proxy indicator for assessing the entire population health status and one of the major predictors of child survival. Despite the various efforts, malnutrition among children is remaining as a major public health problem in Nepal. Socio-cultural practices such as less consideration for supplementary child feedings, late weaning and poverty are major casual factors of malnutrition among under-five children (Tulsi and Muniraj, 2013).

The major types of nutritional problems in developing countries are under nutrition and malnutrition which result from inadequate food intake both in quality and quantity, particularly calories and protein, specific nutrients (e.g. vitamin A, iron, iodine) and parasitic infections(Burk, 1984). The vulnerable groups such as babies, adolescent of the poor and uneducated, pregnant and lactating are badly affected. The prevalence of poor nutritional status in developing countries is mainly due to the low income, low production of food, low productivity of crops and livestock, unequal distribution of food, low literacy, socio culture or environmental sanitation (Naborro, 1984).

2.1.1 Factor affecting nutritional status

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

The factors affecting nutritional status are mother's food security, breast feeding practices, types of food given to young children, feeding frequency, status of women and child nutrition and last but not the least who feeds the child and how the child eats(NMICS, 2010).

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

2.1.2 Food availability and the nutritional status

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

Seasonal variation in food availability has long been recognized as a contribution to nutrition and health problems in many third world countries. The extent and duration of the

seasonal hardships has been related to a number of climatic characteristics, such as rainfall modality, the distinctness of the season and length of period (Wandel and Holmboe-Ottesen, 1992).

Food plays a primary role in nutritional status; information on the composition of the foods incorporated in the diet is considered essential background material. Today the great contribution of the science of nutrition to the health and welfare of all the people are facts accepted without question by the professional and lay groups. Nutrition is vital, not only in the growth and development of humans and animals but also in the prevention and treatment of disease. Nutrition is also fundamental to the maintenance of good health and functionality (Ohlhorst *et al.*, 2013).

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

2.2 Nutrient requirement

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

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

specific suggestions for adjustments based on climate, abnormal demographic distributions and specific nutritional needs of the beneficiary population (WFP, 2011a).

The recommended daily allowance of nutrients for pre-school children (1-6 years) is shown in the table below:

Table 2.1: ICMR Recommended Dietary Allowance for pre-school children-2010

	Year	
Nutrients	1-3	4-6
Body weight (kg)	12.9	18
Energy (kcl)	1060	1350
Protein (g)	16.7	20.1
Visible Fat (g)	27	25
Calcium (mg)	600	600
Iron (mg)	9	13
Retinol	400	400
β - Carotene	3200	3200
Thiamine (mg)	0.5	0.7
Riboflavin (mg)	0.6	0.8
Niacin equivalent(mg)	8	11
Pyridoxine (mg)	0.9	0.9
Ascorbic acid (mg)	40	40
Dietary folate	80	100
Vitamin B12	0.2-1	0.2-1
Magnesium(mg)	50	70
Zinc (mg)	5	7

2.3 Malnutrition

According to 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 (Shubhangini A Joshi, 2016).

Malnutrition is the state in which a prolonged lack of one or more nutrients retards physical development or causes specific clinical disorders, e.g. iron deficiency anemia, goiter, etc. Malnutrition can also be defined as an impairment of health resulting from a deficiency, excess or imbalance of nutrients.

Some characteristics of people suffering from malnutrition are dull lifeless hair, greasy pimpled facial skin, dull eyes, slumped posture; fatigue and depression are easily evident by their spiritless expression and behavior, and lack of interest in their surroundings. Such persons may be underweight and overweight. Sleep may be affected and the elimination habits. Constipation may be common problem. The problem of malnutrition cannot be taken lightly as it may sometimes prove fatal. It may also cripple a person for the whole life, e.g. deficiency of vitamin A in children leads to blindness. A disease which results from lack of certain nutrients is known as a deficiency disease, e.g. iron deficiency anemia, is a very common deficiency disease in women and young girls (Shubhangini A Joshi, 2016).

Persons prone to malnutrition are infants, pre-school children, adolescents, pregnant women and elderly people. Pregnant women are especially prone to malnutrition if they are adolescents and not matured enough to their children. Infants and preschool children are depended on their mother for nourishment and if their selection of food for them is incorrect, they may suffer from malnutrition. The period of infancy, i.e. from birth to 18 month is a very crucial period and thus protein quality and quantity in the diet should be taken care of (B. Srilakshmi, 2014).

Malnutrition results in most of us since we do not heed to our body's daily requirement. Also malnourished people are prone to continuous bouts of some illness or the other which affects their work very often. This condition can be easily set right if we eat the right food in right amount daily, i.e. if we consume a balanced diet every day, and develop good eating habits for good health (S.A. Joshi, 2016).

According to duration of deficiency, malnutrition may be acute or chronic.

a) Acute malnutrition: This relates to present state of nutrition and indicator of acute malnutrition is weight for height (Wasting). It may results in sudden reduction in weight due to illness, high fever, bleeding or dehydration. Such type of malnutrition can be prevented by providing sufficient of amount of deficient nutrients and weight can be recovered soon after treatment.

b) Chronic malnutrition: Chronic malnutrition relates to the past states of nutrition. It results from the long deficiency of nutrients and the deficiency problem cannot be eradicated suddenly. Some such acute malnutrition problem persists for long period or affects the whole life, i.e., dwarfism, night blindness, goiter, mental retardation etc. The indicator of this nutrition is height for age (stunting).
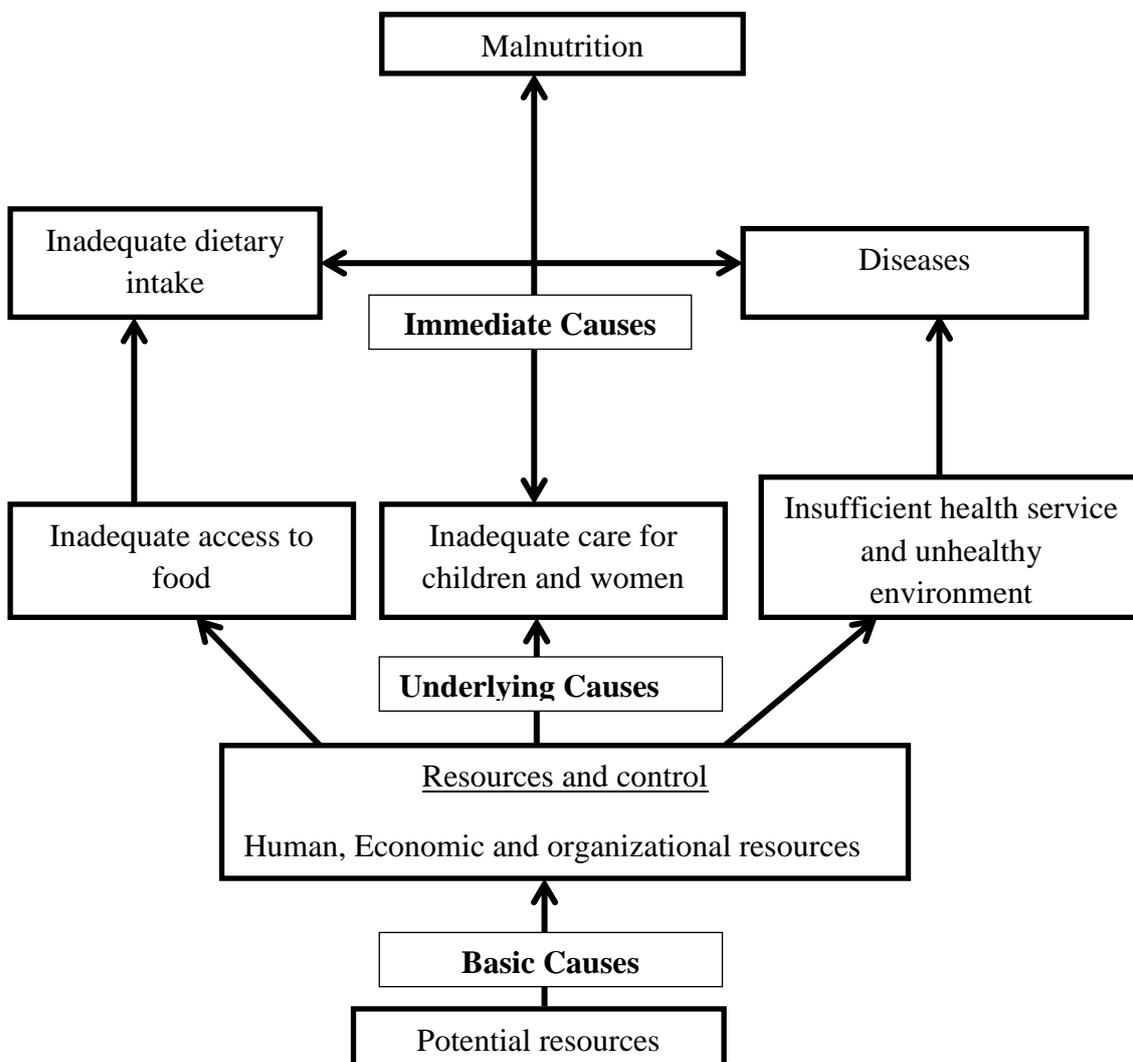
Figure 1: - Conceptual framework of malnutrition by UNICEF(Adel *et al.*, 2006).

Control in the resources plays role in the distribution of the food in family and the community, care for women and children, facilities of health services and environmental condition also depends upon the type of community. Inadequacy of the food supply, care facilities and the care practices can result inadequate dietary intake and diseases. The insufficient intake means unfulfilled nutritional requirement and this leads to malnutrition. Also, insufficient care leads to disease. Disease cause insufficient intake and improper use of nutrients. Thus causes malnutrition.

2.3.1 Forms of malnutrition:

2.3.1.1 Under nutrition:

The pathological state resulting from the consumption of an inadequate quantity of food over an extended period of time is called under nutrition. Under nutrition usually affects the balance of all the nutrients in the body. Nonetheless, problems relating to a deficiency in carbohydrates and fats will manifest first and most acutely. Initially, the body starts using its glycogen or sugar reserves, stored water and body protein. Then, your body consumes stored fatty acids and lean muscle. These two effects of under nutrition result in a dramatic decreases in body weight (Naomi, 2015).

2.3.1.2 Over nutrition:

Over nutrition is frequent or habitual overconsumption of nutrients by eating too much food to the point that it becomes dangerous to your health. Nutrients are all compounds necessary for bodily function, including minerals, vitamins, fats, carbohydrates and proteins. Although most nutrients can be harmful in excess, the danger of over nutrition relates mostly to carbohydrates and fats. Overeating differs conceptually from over nutrition, although they are essentially the same thing in action; whereas overeating is a compulsion considered a psychological disorder, over nutrition is volitionally choosing to eat more food than you need, even if you don't realize it (Naomi, 2015).

2.3.1.3 Specific deficiency:

It is pathological state resulting from relative or absolute lack of an individual nutrient. The body requires many different vitamins and minerals that are crucial for both development and preventing disease. These vitamins and minerals are often referred to as micronutrients. They aren't produced naturally in the body, so you have to get them from your diet. A

nutritional deficiency occurs when the body doesn't absorb the necessary amount a nutrient. Deficiencies can lead to a variety of health problems. These can include problems of digestion, skin problems, stunted or defective bone growth, and even dementia. The amount of each nutrient you should consume depends on your age. In United States, many foods that you buy in the grocery store (such as cereals, bread and milk) are fortified with nutrients that are necessary to prevent nutritional deficiency. But sometimes your body is unable to absorb certain nutrient even if you are consuming them. Some of common types of nutrient deficiency are iodine deficiency, vitamin A deficiency, calcium deficiency, vitamin B_1 and vitamin B_3 deficiency and so on (Uauy and Hertrampf).

2.3.1.4 Imbalance:

It is the pathological state resulting from a disproportion among essential nutrient with or without the absolute deficiency of any nutrient. An imbalance between dietary protein and energy intake is associated with relatively high insulin and low plasma cortisol levels, which impede mobilization of muscle protein from the peripheral to the visceral compartments. The resulting protein deficit primarily compromises protein synthesis in the liver. The related low level of serum proteins, especially albumin (edema), ferritin (anemia), ceruloplasmin (hair depigmentation), retinol-binding protein (xeropthalmia) and lipoproteins (fatty infiltration of the liver) may explain the clinical features of kwashiorkor best. Despite this florid symptomatology, which might suggest multiple specific nutrient deficiencies, kwashiorkor responds well to protein supplementation of the diet (Uauy and Hertrampf).

2.4 Protein Energy Malnutrition

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

PEM is a range of pathological condition arising out of coincident lack of protein and energy in varying proportion of protein and calorie, occurring most frequently seen in infants and young children and usually associated with infections (WHO). It is not one disease but a spectrum of conditions arising from an inadequate diet. Although it affects the

people of all ages, the results are most drastic in childhood (weaning infants and preschool children) due to highest requirement of nutrient at that period. Actually PEM is a condition primarily due to a deficiency of total dietary energy; the protein deficiency being only secondary (B. Srilakshmi, 2014).

Classification of PEM

a) Kwashiorkor: The word kwashiorkor is a Ghanian word that describes the "evil spirits which infects the first child when the second child is born. It refers to the observation that the first child develops when second child is born and replaces the first child at breast. When it does, the first baby is weaned from the nutritious breast milk and placed on water down versions of the family's diet. In the areas of poverty, this diet is often low in protein or the protein is not absorbed properly.
The symptom of kwashiorkor that sets it apart from marasmus is edema or swelling of body tissue, usually in the leg and feet. It is characterized by the symptoms of lethargy, retarded growth, lack of proper development of the muscles, absence of muscle tone, enlargement of liver, mental deficiency, increased susceptibility to infections, poor appetite, diarrhea, dermatitis and changes in the skin(the skin is dry, pigmented and flabby). Hair becomes reddish. Hemoglobin is low (Bansal, 2014).

b) Marasmus: It occurs due to the deficiency of protein. It is most predominant form of PEM in developing countries (Swaminathan, 2008). It is characterized by wasting of subcutaneous fat and muscles with retardation of growth and loss of weight. The eyes are sunken. Old man faces (monkey faces) develops. The skin is dry and there are loose folds of skin, especially on the buttocks and thighs. Abdomen is distended (pot belly) due to wasting, hypotonia of the muscles and gaseous distension. Mental retardation occurs(Bansal, 2014).

c) Marasmic Kwashiorkor: Children suffering from this type of PEM exhibit a mixture of some of the features of both marasmus and kwashiorkor.

d) Nutritional dwarfing: Retardation of growth is observed in the children who are deprived of food for prolonged period of time. Weight and height are both reduced resembling children a year and more younger.

e) Underweight Child: These children are growing up smaller than their genetic potential

and of greater importance as they are at risk of gastrointestinal, respiratory and other infections, which can precipitate frank malnutrition (B. Srilakshmi, 2014).

2.5 Vitamin A deficiency

Vitamin A is an essential nutrient for children. Many studies in Nepal have shown that deficiency of Vitamin a is a common problem of significant importance. Besides causing night blindness and changes in the eye causing blindness, deficiency of vitamin A has been proven to cause more illness and death in children. This information has been found to be conclusive enough to motivate the government to start a National Vitamin A Supplementation Programme (NVASP) in Nepal since 1997 (R. K. Adhikari and M. E. Krantz, 2013).

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

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

Consumption of diet poor in vitamin A or carotene, children suffering from diarrhea and massive infestation by round worm are main causes of Vitamin A deficiency. Measles is also an important cause of vitamin A deficiency (R. K. Adhikari and M. E. Krantz, 2013).

Xeropthalmia (xerosis: dryness, opthalmia: eyes) is one of the main features of vitamin A deficiency. Xeropthalmia has been classified by WHO as follows: (R. K. Adhikari and M. E. Krantz, 2013)

Table 2.2: WHO classification of Xeropthalmia

Category	Features
X1A	Conjuctival xerosis
X1B	Bitot's spot
X2	Corneal xerosis
X3A	Corneal ulceration/ keatomalacia involving less than one third of cornea
X3B	Corneal ulceration/ keratomalacia involving less than one third of corneal
XN	Night blindness
XS	Corneal scar
XF	Xerosis fundi(dryness of fundus)

More than 250 million of the world's children suffer from vitamin A deficiency. Nepal is one of 60 countries in which this deficiency constitutes a significant public health problem. Each year in Nepal, vitamin A deficiency is responsible for the deaths of 9000 children and for 2500 children becoming permanently blind. The Nepal National Vitamin A Program (NVAP) was begun in 1993 in eight of the country's 75 districts. By the end of 1997, the programme covered 32 districts, and by 2003 its coverage will be nationwide. The Nepal NVAP is considered by many to be a highly successful, model programme. It consists primarily of distributing high-dose vitamin A capsules to all children 6 to 60 months of age during twice-yearly campaigns. The capsule distribution is carried out by a previously existing network of Female Community Health Volunteers (FCHVs) that has been reinvigorated by the highly visible and universally acclaimed success of the NVAP (JL, 2000).

2.6 Iron Deficiency

Iron is one of the most important elements for human nutrition. Common foods such as green leafy vegetables, whole grains, pulses and nuts are good sources of iron. Iron deficiency leading to anemia is very common among women and children in Nepal. The

most recent demographic health survey conducted in 2011 had found almost half of the children less than 5 years of age suffering from anemia.

Deficiencies of iron make the children less active, irritable, easily tried and with decreased appetite. The children with iron deficiency look pale; their lips, eyes look pale and sometimes in severe forms the nail may be flattened and may look like a spoon (R. K. Adhikari and M. E. Krantz, 2013).

Nutritional anemia may be defined as the condition that results from the inability of the erythropoietic tissue to maintain normal hemoglobin concentration on accounting of inadequate supply of one or more nutrients leading to reduction in total circulating hemoglobin. Nutritional anemia is caused by the absence of any dietary essential that is involved in hemoglobin formation or by poor absorption of these dietary essentials. Some anemia's are caused by lack of either dietary iron or high quality protein; by lack of pyridoxine (vitamin B_6) which catalyzes the synthesis of the haem portion of the hemoglobin molecules; by lack of vitamin C which influences the rate of iron absorption into the tissues; or by a lack of vitamin E which affects the stability of the red blood cell membrane. Copper is not part of the haemoglobin molecules but aids in its synthesis by influencing the absorption of iron, its release from the liver or its incorporation into haemoglobin molecules (B. Srilakshmi, 2014).

Prevalence of anemia was higher in preschool children (78%) than in women (67%). An astonishingly high rate of 905 was found in infants, 6-11 months old. Among women, there is distinct variation between ecological zones, with highest levels in the Terai, followed by the Mountains. Only 32% of pre-school children and29% of pregnant women consumed an adequate amount of iron to fulfill their daily requirements. Prevalence of anemia was also high (64%)in high school adolescents who attended the Government Girl's high school in Kathmandu valley (CHD *et al.*, 2004a).

2.7 Iodine deficiency

Iodine is essential for the normal functioning of the thyroid gland. If iodine intake is inadequate, the thyroid gland enlarges (goiter). In some children, iodine deficiency may cause delay in mental development resulting in mental development resulting in condition known as cretinism. The consequences of iodine deficiency disorder are Cretinism, Goiter,

Impaired cognitive function, increased prenatal morbidity and mortality, reduced productivity.

Till recently Nepal used to have a very high prevalence of iodine deficiency disorders. However with continued efforts to supply the total population with iodized salt becoming successful, goiter is almost non-existent in the country the latest health surveys show that almost 80% of the households in Nepal consume iodized salt thus reducing the possibility of suffering from IDD (R. K. Adhikari and M. E. Krantz, 2013).

Currently only 63% of households in Nepal are using adequately iodized salt. The proportion of low UIE values (<100μg/l) was 39.1% (adult women and school-aged children). The prevalence of low UIE is highest among women in the Terai zone. It is still high as a public health problem in that group. Only 35% of the respondents had heard educational messages about iodized salt and very few of the respondents (19%) knew about the importance of iodized salt for health (CHD *et al.*, 2004b).

2.8 Zinc deficiency

Zinc is an essential trace element with a key role in numerous basic cellular functions in humans. It is crucial to the normal function of the immune system and is involved in DNA synthesis, cellular division, proliferation, and growth. Zinc is also required during pregnancy for optimal growth and development of the fetus and for maternal tissue expansion (Chandyo *et al.*, 2009a).

The mineral zinc is necessary for proper function of your immune system. Zinc also helps cells divide and grow and assists the body in healing wounds. Deficiency symptoms include frequent infections, hair loss, poor appetite, problems in tasting and smelling and long healing times for wounds. Zinc deficiency can be stopped or prevented by eating nuts, legumes, yeast and whole grains. Zinc is also found in beef, pork and lamb (WFP, 2011a).

Zinc deficiency is a major public health problem in many developing countries. However, its prevalence is still unknown in most populations. Women of reproductive age in developing countries are highly vulnerable to nutritional deficiencies, including that of zinc (Chandyo *et al.*, 2009b).

Data on zinc deficiency based on population surveys are still lacking from many developing countries. Less precise estimates, such as those based on national food balance

sheets and on the prevalence of clinical manifestations of zinc deficiency, like stunting and diarrhea in children, have been used instead. However, these proxies are influenced by several factors and are rather unspecific markers of zinc deficiency (Chandyo *et al.*, 2009a).

2.9 Nutritional situation

2.9.1 Incidence of under-nutrition

A recent United Nations Children Fund(UNICEF) report shows that Nepal is among 10 countries in the world with the highest stunting prevalence, and one of the top 20 countries with the highest number of stunted children (Aryal).

Malnutrition is a major public health & nutrition problem in Nepal. It is associated with many risk factors like low birth weight, multiple birth, short spaced birth, extra diet, and iron supplementation in pregnancy etc. (Niraula *et al.*, 2013).

Nationally, 41% of children under age 5 are stunted (height for age), and 16% are severely stunted. 53% in age 36-47 months and 14% in age 9-11 month are stunted. 23% of age 36-47 month and 4% in 6-11 months are severely stunted. According to the sexes 41% of males are stunted and 40% of females. Nationally, 11% of children under age 5 are wasted (weight for height) and 3% are severely wasted. At the age of 9-11 months 25% are wasted and 7% are wasted at the age of 36-47 months. 12% of male child are likely to be wasted where as 10% of female children are likely to be wasted. Among the children under age 5; 9% children are underweight (weight for age) and 8% are severely underweight nationally. 37% of children in age of 18-23 months and 18% in age of below 6 month are found to be underweight. 30% of male child were found to be underweight however only 28% of females are underweight (MoHP, 2011).
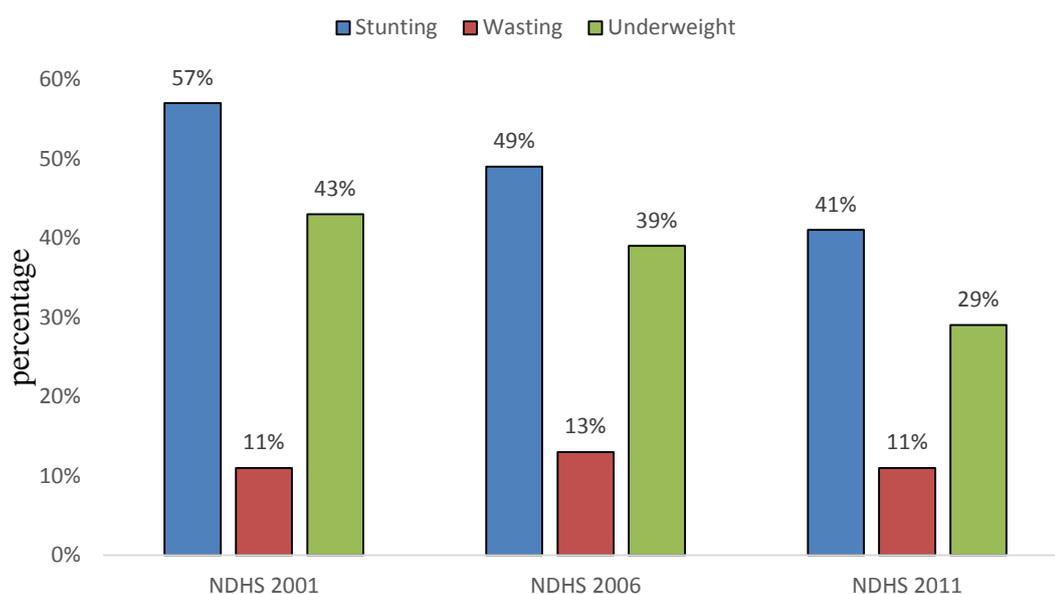
Figure 2: Trend of malnutrition in of children under 5 years of age (MoHP, 2011).

2.9.2 Infant mortality, Life expectancy and birth weight

Infant and child mortality rates are important indicators of a country's socio-economic development and quality of life, as well as health status. Measures of childhood mortality also contribute to a better understanding of the progress of population and health programs and policies. Infant and under-five mortality rates in the past five years are 46 and 54 deaths per 1,000live births, respectively. At these mortality levels, one in every 22 Nepalese children diesbefore reaching age 1, and one in every 19 does not survive to his or her fifth birthday. Infant mortality has declined by 42 percent over the last 15 years, while under-five mortality has declined by 54 percent over the same period. Childhood mortality is relatively higher in the mountain ecological zone than in the terai and hill zone and is highest in the Far-western region. The neonatal mortality rate in the past five years is 33 deaths per 1,000 live births, which is two and a half times the post neonatal rate. The perinatal mortality rate is 37 per 1,000 pregnant.

The characteristics of both mother and child play an important role in the survival probability of children. The relationship between maternal age at birth and childhood mortality is generally U shaped, being relatively higher among children born to mothers under age 20 and over age 30 than among children born to mothers in the 20-29 age group. This pattern is especially obvious in the case of under-five mortality. In general, mortality

rates are also significantly higher among first births and births of order seven or above than among births of order two or three. For example, 1 in 17 first births do not survive to the first year, compared with 1 in 20 births of order two or three (MoHP, 2011).

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, 2011).

2.9.3 Nutritional Status in Nepal

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

Forty-one percent of children under five years of age are stunted, 11 percent are wasted, and 29 percent are underweight. Forty-six percent of children age 6-59 months is anemic, 27 percent are mildly anemic, 18percent are moderately anemic, and less than 1 percent is severely anemic. Eighteen percent of women are malnourished, that is, they fall below the body mass index (BMI) cutoff of 18.5. Fourteen percent of women are overweight or obese. Women's nutritional status has improved only slightly over the years. Thirty-five percent of women age 15-49 are anemic, 29 percent are mildly anemic, 6percent are moderately anemic, and less than 1 percent is severely anemic.

Various surveys conducted in Nepal shows that there is a decreasing trend of malnutrition in past few years. Although there has been a great reduction in malnutrition problems but still the data shows that the prevalence is much higher than that of developed countries. The Nepal Demographic Health Survey 2011 has provided the data on prevalence of malnutrition under 5 years of child. The percentage of prevalence of malnutrition below 5 years of age is illustrated in given diagram.

Forms of malnutrition
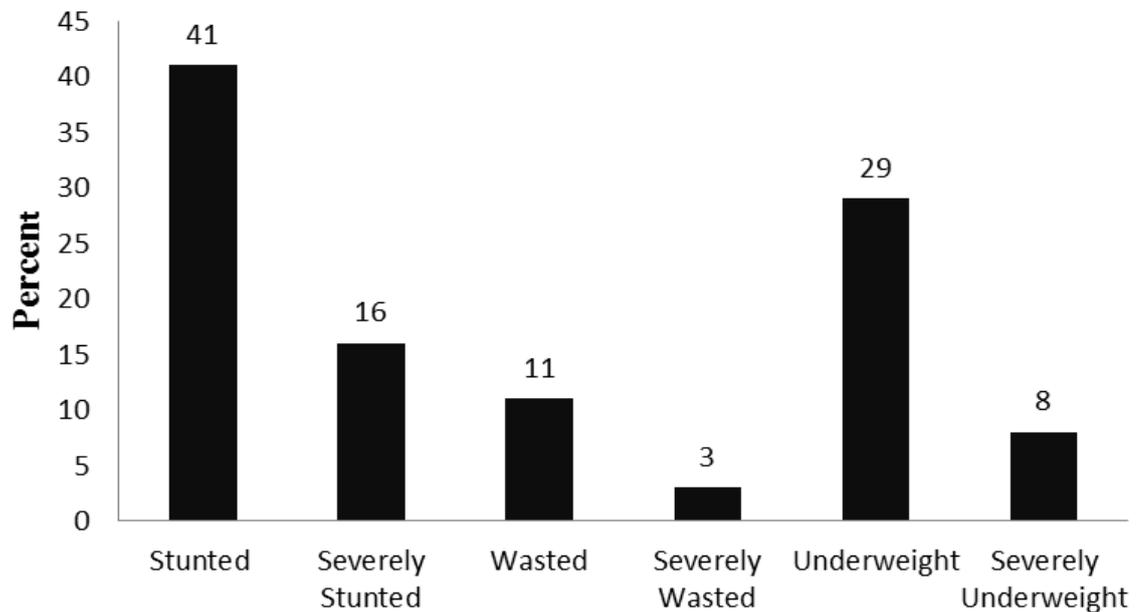
Figure 3: Prevalence of Malnutrition in Nepal (MoHP, 2011)

2.10 Breastfeeding and Weaning Process in Nepal

Feeding practices play a critical role in child development. Poor feeding practices can adversely impact the health and nutritional status of children, which in turn has dire consequences for their mental and physical development (MoHP, 2011).

Breastfeeding is almost universal in Nepal. However, even though there have been improvements on optimal breastfeeding over the last five years, there is still room for more progress. On the other hand, there has been very limited improvement on appropriate complementary feeding, which is a major concern. Existing evidence has shown that these non-optimal feeding practices are resulting in impaired growth among infant and young children of Nepal, which will in turn limit their possibility of attaining their full potential later in life (MoHP *et al.*, 2015).

After six months, a child requires adequate complementary foods for normal growth. Lack of appropriate complementary feeding may lead to malnutrition and frequent illnesses, which in turn may lead to death. However, even with complementary feeding, the child should continue to be breastfed for two years or more. Early initiation of breastfeeding is important for both the mother and the child. Ninety-eight percent of children have been

breastfed at some time, with negligible differences by background characteristics. Less than half of children (45 percent) are breastfed within one hour of birth. The vast majority (85 percent) of children are breastfed within one day of birth. Results from the 2006 NDHS showed that 35 percent of last-born children who were breastfed in the five years preceding the survey were breastfed within one hour of birth. Initiation of breastfeeding within one hour and within one day of birth varies by background characteristics (MoHP, 2011).

Breastfeeding within one hour of birth was more common in urban areas (51 percent) than in rural areas (44 percent). Notable variations can be seen by region. Fifty-five percent of children in the Far-western region were breastfed within one hour of birth, compared with 34 percent of children in the Central region. Initiation of breastfeeding within one hour of birth was highest in the Western mountain, Far-western hill, and Far-western terai sub-regions (54 percent each). Children born in a health facility were more likely to start breastfeeding within one hour of birth (56 percent) than children delivered at home (36 percent). Fifty-eight percent of children born to mothers with some secondary education started breastfeeding within one hour of birth, compared with 35 percent of children of mothers with no education. Early breastfeeding increased with increasing wealth, from 40 percent among children in the lowest wealth quintile to 52 percent among children in the fourth and fifth quintiles (MoHP, 2011).

WHO/UNICEF provide the following feeding recommendations:

a) Exclusive breastfeeding for first six months of life.
b) Continued breastfeeding for two years or more Safe, appropriate and adequate complementary foods beginning at six months of age.
c) Frequency of complementary feeding: two times per day for 6–8-month-olds; three times per day for 9–11-month-olds.
d) It is also recommended that breastfeeding be initiated within one hour of birth (NMICS, 2010).

Reasons for breast milk feeding are:-

1. Any milk other than breast milk has no anti-infective properties to protect the infant in the early months.

2. Bottle feeds are often too difficult. The mother makes the expensive milk lost as long as possible and often is unable to follow written instructions on the can or container (Cameron and Hofvander, 1993).

2.10.1 Weaning practice

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

During the weaning period good food source of energy, protein calcium and iron are particularly important. On the basis of body weight, children required twice as much as protein calcium and iron as do adults (Vaidya, 1987).

Common traditional weaning foods include:

1. Porridge (*lito*), made from roasted rice flour (occasionally maize or millet), ghee (clarified butter) and sugar
2. *jaulo*, made from rice and turmeric or rice and salt
3. *dhindo*, made from maize flour (or millet or wheat)
4. *maar*, made in lowland areas by cooking rice, cracked maize and soybeans together
5. *khichari*, a mix of rice, pulses and vegetables.

2.11 Nutritional status of women in Nepal

The nutritional status of women in Nepal is very poor during the beginning of childhood. Because of son preference country the women who gives a female birth gets less care and so is the situation for new born female child (Dhakal, 1995).

12 percent of women are shorter than 145 cm. Adolescent women (age 15-19) are slightly less likely to be below 145 cm (10 percent) than older women. Women in rural areas are more likely to be below 145 cm (12 percent) than women in urban areas (8 percent). Women in the Western region are more likely to be shorter than145 cm (14 percent) while

women in Far western region are less likely (7 percent). Similarly the highest proportion of women below 145 cm is in the Eastern mountain sub region (16 percent), while women from Far western and Mid-western terai are least likely(5 percent and 7 percent respectively) to be below 145 cm (MoHP, 2011).

The mean BMI among women age 15-49 years is 21 kg/ m^2. Mean BMI generally increases with age. Urban women have slightly higher mean BMI (23kg/m^2) than rural women (21 kg/m^2). There are only small differences in mean BMI among women living in mountain, hill and terai ecological zones. Eighteen percent of women of women of reproductive age are thin or malnourished (BMI < 18.5 kg/ m^2). The proportion of mild thinness (17-18.4 kg/m^2) and moderate and severe thinness (< 17 kg/ m^2) are 12 percent and 17 percent respectively. Rural women are more likely to be thin (19 percent) than urban women (14 percent). The proportion of women in terai who are (23 percent) is almost double the proportion in the hill zone (14 percent). A notably higher percentage of women in the Far-western development region (24 percent) than in the Western region (14 percent) are thin. Among sub regions, the highest proportion of thinness is in the Central terai sub region (26 percent) and the lowest is in the Western hill sub region (8 percent). Thinness is more common among women with no education (23 percent) than among women with an SLC and higher level of education (15 percent). Women in the lowest quintile are more likely to be thin (23 percent) than women in the highest wealth quintile 12 percent (MoHP, 2011).

Eleven percent of women are overweight (BMI 25-29 kg/m^2), and 2 percent are obese (BMI 30 kg/m^2 or above). The prevalence of overweight/obesity has increased by 5 percentage points since 2006. Younger women are less likely to be overweight/obese than older women .i.e. 3 percent of women age 15-19 are overweight or obese, compared to 22 percent of women of age 40-49. Urban women are more likely to be overweight /obese (26 percent) than rural women (11 percent). Ecologically, the proportion of overweight/obese women is higher in terai and hill zones (14 percent) each than in mountain zones 8 percent (MoHP, 2011).

2.12 Assessment of nutritional status

A state of the human body resulting from the balance between intake of food and expenditure of energy is known as the nutritional status (R. K. Adhikari and E. M. Krantz, 2013). The nutritional status reflects the degree to which physiologic needs for nutrients are

being met. Appropriate techniques of assessment can detect nutritional deficiency in the early stages of development so that dietary intake can be improved through proper counseling and nutritional support before more severe condition appears (Joshi, 2008).

Nutritional assessment can be defined as the interpretation of information's obtained from anthropometric, dietary, biochemical and clinical studies. The information obtained is used to determine the health status of individual or population groups as influenced by their intake and utilization of nutrients. Nutritional assessment is done for survey, surveillance, screening and monitoring (Joshi, 2008).

Nutrition assessment is the best way to determine whether or not people's nutritional needs are effectively being met, once food is available and easily accessible. Nutrition assessment provides timely, high-quality and evidence-based information for setting targets, planning, monitoring and evaluating programmes aiming at eradicating hunger and reducing the burden of malnutrition (FAO).

Nutritional assessment is essential in order to:

a) Identify the undernourished or over-nourished state of an individual or a community and estimating the optimum energy and nutrient intake to promote growth and well-being.

b) To gauge the prevalence of malnutrition in the clinical setting, this is found to be high, in the range of 48% to 50%. Also it is associated with suboptimal surgical outcome, increased rate of infection, longer hospital stay, impaired wound healing, frequent hospital stay, impaired wound healing, frequent hospital readmission for the elderly, more frequent post-operative complication and increased risk of death.

c) To plan health programs.

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

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

There are three main aims of nutritional assessment of a community. They are:

1. To judge the magnitude and geographical distribution of malnutrition.
2. To know the effect of ecological factors that may directly or indirectly be responsible.
3. To suggest corrective measures especially with the participation of the affected community.

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

I.   Direct method

Deals with the individual and measures objective criteria

1. Anthropometric methods
2. Biochemical methods
3. Clinical methods
4. Dietary procedures

II. Vital statistics

Use community indices that reflect the community nutritional status or need

1. Dietary intake
2. morbidity and mortality rates
3. as specific mortality
4. vital statistics

III. Ecological factors

1. Socio-economic status
2. housing and environmental hygiene
3. health and education services
4. conditioning infection

2.12.1 Anthropometry

This technique is concerned with the measurement of physical dimension and the gross composition of the human body at different age levels and degrees of nutrition (Shubhangini A Joshi, 2016). Nutritional Anthropometry has most commonly been

conducted on preschool children, the age group in which PEM is usually most prevalent and most severe.

Anthropometric measurements are of two types; single measurements which have to be interpreted in relation to age (e.g. weight, height, head circumference) and a ratio of two measurements which to some extent is independent of age e.g. weight for height ratio, mid upper arm to head circumference ratio (R. K. Adhikari and M. E. Krantz, 2013). It is necessary to select those methods of anthropometry depending on the purpose and objective of the survey. It is necessary for nutritionist to keep in mind that this tool is of greatest value in the assessment of growth failure and malnutrition (Shubhangini A Joshi, 2016).

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 severe degree of malnutrition in children as well as in adults.

The technique also provides information on past nutritional history which cannot be obtained in other assessment techniques. Anthropometric incidences can be derived directly from a single one measurement, i.e. weight for age, height for age, head circumference for age or from combination of raw measurements, such as weight and height, skin fold thickness at various sites or limb circumferences. Some combinations, i.e. triceps skin fold and mid upper arm muscle area and mid upper arm fat area (Joshi, 2008).

Advantages of anthropometric assessment

i. The procedures used are simple, safe and non-invasive and can be used for the large population surveys.
ii. Equipment required is inexpensive.
iii. A semiskilled person can also perform the measurement procedure.
iv. The methods are precise and accurate.
v. Information on past long term nutritional history can be obtained
vi. Mild to moderate malnutrition can be detected.
vii. Changes in nutritional status over time or over time or over the generation changes can be observed (Joshi, 2008).

Limitation of Anthropometry

i.   Relative insensitive to short term nutritional status,

ii. Cannot identifies specific nutrient deficiencies,

iii. Measurements like skin-fold are difficult to carry out in obese people,

iv. There may be ethnic differences in fat deposition

The commonly used anthropometric measurements or indicators of nutritional status for pre scholar children are briefly discussed below:

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

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

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

4. Mid upper arm circumference: children whose mid upper arm circumference is below 12.5cm are considered malnourished. Hence it is significant during the diagnosis of protein energy malnutrition. Measurement should be taken by flexible, non-stretch tape made of fiber glass or steel.

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

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

2.12.2 Biochemical test

Biochemical test is used primarily to detect subclinical deficiency states or to confirm a clinical diagnosis. Some of its examples are hemoglobin estimation, serum protein, urine creatinine, serum retinol etc.

Blood and urine are the two quantitative determinants fairly easily available body fluids, which are used in biochemical assessment of the nutritional status. A wide range of tests can be used for assessing malnutrition but it is necessary to use those tests that are feasible in rural field conditions. Ideally, the sample should be easily collectable, stable during transport, not affected by a recent meal or by water load and capable of giving information which is not already available by non-biochemical techniques (Shubhangini A Joshi, 2016). For biochemical test it must be remembered that knowledge of the unique metabolism of each particular nutrient, including its storage in the body, the possibility of synthesis and the mode of excretion must also be taken into consideration.

Nutrients generally examined biochemically are:

- Proteins
- Vitamin A
- Vitamin D
- Ascorbic acid
- Thiamine
- Riboflavin
- Niacin
- Iron
- Folic acid
- Vitamin B_{12}
- Iodine

2.12.3 Clinical Examinations

Clinical examinations is one of the most practical and important methods used in assessing the nutritional status of the community (Shubhangini A Joshi, 2016). It is least sensitive approach, is used in nutritional surveys of population groups because they involve an assessment of the health of those parts of the body that can be readily observed in a routine

physical examination and do not involve obtaining blood, urine or tissue samples (Joshi, 2008).

External examination of the body for changes in superficial epithelial tissues especially skin, eyes, hair and buccal mucosa may be carried out. Similarly, organs close to the surface of the body may be examined, e.g. the parotid and thyroid glands (Shubhangini A Joshi, 2016).

It may be necessary to supplement these methods by certain physical tests. The main advantages of this method is that since it is based on observation of physical sings, it is relatively inexpensive and does not required any elaborate field equipment or even laboratory. As interpretation is based on observations of signs of deficiency diseases, one must be confused by the identical appearances. Most signs of malnutrition are not specific to lack of one nutrient and can often be produced by various non-nutritional factors. If these signs are associated with bio-chemical or other tests it may help to identify the nutrient/nutrients responsible (Shubhangini A Joshi, 2016).

2.12.4 Dietary Procedures

Various classifications have been devised and suggested for the collection of dietary data. However, there are two major categories of methods. The first is the group methods and the second is based on dietary intakes of an individual. This is determined by record or recall of all foods consumed over a specified period of time. This is the most commonly used methods for the field surveys.

2.13 Indicator of nutritional status

A report by WHO in 1976 listed the lowering nutritional status indicators based on body dimensions, birth weight, weight for height, height for age , weight for age, arm circumference.

The weight/height anthropometric measures are almost always included because they provide very useful information at a relatively low cost. However, a variety of other indicators may be used, including market prices for food, indicators of agricultural production and other livelihood systems, and morbidity and mortality data.

These indicators all involve the direct measurement of a person's height and weight, followed by a comparison with what is normal or acceptable for their sex and age. The comparison is especially important in the case of children under five, since healthy children are still growing rapidly at this stage of their lives. These indicators of nutritional status have a number of advantages:

i. They are a simple and practical way of describing the problem;

ii. They are useful proxies for a number of constraints to human welfare, such as inadequate access to food and/or the presence of infections and other environmental risks;

iii. They are strong predictors of the risk of subsequent morbidity, functional impairment and mortality, whether at the level of the individual, a group or a whole population;

iv. They are appropriate indicators for assessing the success or failure of interventions (FAO, 2001).

The nutritional indicators are used to measure nutritional imbalance resulting in under nutrition (assessed from underweight, wasting and stunting) and overweight. Child growth is internationally recognized as an important indicator of nutritional status and health in populations.

The percentage of children with a low height for age (stunting) reflects the cumulative effects of under nutrition and infections since and even before birth. This measure can therefore be interpreted as an indication of poor environmental conditions or long-term restriction of a child's growth potential. The percentage of children who have low weight for age (underweight)can reflect 'wasting' (i.e. low weight for height), indicating acute weight loss, 'stunting', or both. Thus, 'underweight' is a composite indicator and may therefore be difficult to interpret (WHO, 2010).

Some indicators of nutritional status:

Stunting: It is defined as the percentage of children, aged 0 to 59 months, whose height for age is below minus two standard deviations (moderate and severe stunting) and minus three standard deviations (severe stunting) from the median of the WHO Child Growth Standards. Stunting is associated with an under developed brain, with long-lasting harmful

consequences, including diminished mental ability and learning capacity, poor school performance in childhood, reduced earnings and increased risks of nutrition related chronic diseases, such as diabetes, hypertension, and obesity in future (UNICEF, 2013).

Stunted growth reflects a process of failure to reach linear growth potential as a result of suboptimal health and/or nutritional conditions. On a population basis, high levels of stunting are associated with poor socioeconomic conditions and increased risk of frequent and early exposure to adverse conditions such as illness and/or inappropriate feeding practices (Onis and Blössner, 2003).Stunting starts from pre-conception when an adolescent girl and who later becomes mother is undernourished and anemic; it worsens when infants' diets are poor, and when sanitation and hygiene is inadequate. It is irreversible by the age of two. Child survival and health is inseparably connected to reproductive and, maternal health (UNICEF, 2013).

Wasting: - Wasting is characterized by rapid loss of fat and muscle weight loss. Wasting is classified as either moderate or severe based on body measurements. Wasting or thinness indicates in most cases a recent and severe process of weight loss, which is often associated with acute starvation and/or severe disease. However, wasting may also be the result of a chronic unfavorable condition. Provided there is no severe food shortage, the prevalence of wasting is usually below 5%, even in poor countries (Onis and Blössner, 2003).

Underweight: Weight-for-age reflects body mass relative to chronological age. It is influenced by both the height of the child (height-for-age) and his or her weight (weight-for-height), and its composite nature makes interpretation complex (Onis and Blössner, 2003).

Mid - Upper-Arm Circumference: Measurement of the mid-upper arm appears to be most useful in practice. This reason is easily accessible, even with a young child sitting in front of the examiner on his mother's lap. The arm circumference is measured to the nearest 0.1 cm with a flexible steel or fiber- tape, which must be placed gently, but firmly, round the limb to avoid compression of the soft tissue (WHO, 1966).

PART III

Materials and Methods

3.1 Research instruments

Instruments and equipment used during the survey were:

a) Weighing machine: The weight of the child measured using digital weighing balance. Child weighing capacity of 180 kg (1 piece).

b) Height measuring scale (Standiometer): The height measuring tape of five feet capacity (1 piece). The instrument was designed according to UNICEF standards which were easily transportable and accurate within the limits required (0.1 cm).

c) MUAC tape: Tape was used to measure the MUAC reading. The tape was flexible, non-stretchable and made of fiber glass used to measure to the nearest 0.01 cm.

d) Questionnaire: A well designed and pretested set of questionnaire to collect information on household characteristics, maternal characteristics, child caring practices, hygiene and environmental characteristics, etc.

3.2 Research Method

A community based cross sectional survey was conducted in Kusum khola to study the nutritional status of 6-59 months children and factors associated with it using semi structured questionnaire and measurements of weight, height and mid upper arm circumference.

3.3 Study Area

Study was conducted at Chepang community of Kusum khola village ward no. 12 of Madi municipality, Chitwan district. The people live there are all chepang and the place lies in the terai belt but is very remote. People living there are deprived from electricity and drinking water facility. There is no any school for study more than class 3.

3.4 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) Socioeconomic and demographic variables: head of households, religion, ethnicity, family types, family size, income, occupation and education

b) Child characteristics: Age, sex

c) Child caring practices: Feeding, hygiene, health care seeking

d) Maternal characteristics: extra food during pregnancy/lactation, care during pregnancy/lactation, intake of iron tablets.

e) Environmental health condition: Water supply, sanitation.

3.5 Target population

Children under age 6-59 months of Chepang family were included as target population of the study.

Inclusion and exclusion criteria:

Inclusion criteria: Children aged 6-59 months who live in Kusum khola and belongs to Chepang family were included in the study.

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

3.6 Sampling Techniques

Census sampling was used for the study work. The basic criterion for the selection of household samples was that the household with at least one child of 6-59 months of age was included in the sample.

3.7 Sample size

Method of census sampling was applied in the survey. The sample size was equal to the total number of children between the ages of (6-59) months living in Kusum Khola belonging to Chepang family. Altogether 117 children were selected as sample during the survey.

3.8 Pre testing

The study was conducted among under five year children from selected area under sampling procedure. The pretesting was conducted to establish accuracy of questionnaire, to check for consistency in the interpretation of questions and to identify ambiguous items.

After review of instruments all suggested change was made before being administrated in the actual study.

3.9 Validity and reliability of the Research

For the purpose of ascertaining the degree to which the data collection instruments measure what they were purposed to measure, the instruments were validated by a group of professionals from Central Campus of Technology, Central Department of Nutrition and Dietetics. The questionnaire was also pretested prior to data collection to ascertain content and face validity.

Questionnaire was checked daily for completeness, consistency and clarity. In addition the academic supervisor also checked the collected questionnaire during the process of data entry and analysis.

3.10 Data collection technique

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

Secondary data was obtained from Madi Municipality, School in Kusum Khola, Nepal Demographic Health Survey (2011), Central Bureau of Statistics, and key informants like Female community health volunteers (FCHVs) and local leaders.

There were two sets of tools to gather information. First was the structured interview schedule to generate data pertinent to factors associated with nutritional status of children and second a form consisting of child information regarding anthropometric measurements. Form was developed to record the measurements of height, weight; mid upper arm circumference and structured pre tested information schedule was used to collect information from the respondents. Anthropometric measurements taken for children aged (6-59) months included:

Height/Length: The length of each child aged 6-24 months was 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. The height of the 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, with feet parallel and joined together, with heels and buttocks touching the wall. It was made sure that that the head was erect and hands were hung closely at the sides. The child weight was measured to the nearest one decimal place.

Weight: Measured by weight scale and read to the nearest 0.1 kg with minimum or no clothing. For children who were unable to stand, weight was obtained from the difference between weights of mother as she hold the child and weight of mother alone. The difference in weight made the child weight. For children who were capable of standing, weight was measured by standing on the center of weighing machine without touching anything else. Shoes were removed ad were on minimal cloths.

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

3.11 Data analysis

Data was checked for completeness and consistency. The collected data was organized, coded and entered into Microsoft excel 2007 and then to Statistical Package for Social Sciences (SPSS) version 20.0 and into WHO anthro 3.2.2. The collected data was analyzed by using both descriptive and inferential analysis. Descriptive analysis was done to describe the percentage and number distribution of respondents and the data was presented in the table. The nutritional status was measured by WHO standard and MUAC standards.

Anthropometric indices were calculated using reference medians recommended by WHO and classified according to standard deviations units (z scores) based on the WHO criteria. The chi-square test was applied to test the association between nutritional status and its associated factors.

3.12 Logistical and ethical considerations

Ethical clearance was obtained from Central Campus of Technology, Department of Nutrition and Dietetics. Prior consent to conduct the research was obtained from the parents/caretakers of the respective children. The purpose of data collection was clarify and was also assured that the data was collected jus for study purpose. Privacy and confidentiality of collected information was ensured at all level.

PART IV

Result and discussion

Survey was conducted in Kusum Khola area of Madi municipality, Chitwan to find the prevalence and the factors associated with nutritional status of children under age 6-59 months. The result of the survey was presented in following headings:

4.1 Socio-economic and Demographic characteristics

A total of 117 children of age under 5 were included in the study with the response rate of 100%. The participants were from the nuclear family with the family member number ranging from 3-10.   All 100% of respondents were Christian.

Surveys show that most 92.3% (108) of family are engaged in agriculture. 100% of them have yearly income less than one lakhs. Among them 92.3% had their income less than 50000. Income was not sufficient to all of the family to feed properly.

Table 4.1: Distribution of Socio-economic and Demographic Characteristics of kusum khola

Variables	Frequency	Percentage
Occupation		
Agriculture	108	92.3
Labour	6	5.1
Service	2	1.7
Others	1	0.9
Annual income		
<50000	108	92.3
>=50000	9	7.7

4.2 Mothers Characteristics

Generally, Chepang community is one of backward community of Nepal; they belong to the less educated or illiterate background. The study has shown that mother's from Kusum khola areas are with no official education. The most number of mothers from that Chepang community in the study area conceive 1st child before the age of 20 years which consists of 90.6% (106).

Table 4.2: Maternal Characteristics of kusum khola having 6-59 months age children

Variables	Frequency	Percentage
Mother's education		
Primary(1-5)	16	13.7
secondary(6-10)	1	0.9
Illiterate	100	85.5
Age at first pregnancy		
<20	106	90.6
>20	11	9.4
Iron/Folate consumption		
Yes	64	54.7
No	53	45.3
Knowledge about making lito		
Yes	14	12
No	103	88
Amount of food consumed during pregnancy		
>before	13	11.1
<before	76	65
as before	28	23.9

According to the survey, they have no knowledge about malnutrition and marasmus. They also don't have knowledge about child care practices and making "Sarbottam pitho" only 12% mothers know to make it at household level. Chepang community has very less knowledge about health; most of the women 65% consume less food during pregnancy than before. 54.7% of women only consume iron/folate tablets.

4.3 Child Characteristics

The survey technique was census and all the children of the surveyed area were included where 53% were female and 47% were male. Overall mothers were unknown about child care knowledge and practices. Most 35% of children were initiated breast milk within 1 hour of birth. Among them 32.5% of children were fed colostrum. The children were not fed any kind of pre-lacteal feed after birth. All of the people used to take their children to the nearest health post for the checkups. Even though they have less health education

92.3% children have received their vaccination. 84.6% children have consumed vitamin A and round worm medicine.

The children under study were in total 117 where 12.8% are of age 6-12 months; 14.6% of age 12-23 months, 20.5% are from age group 24-35 months, 26.5% are from age group 36-47 months and remaining 25.6% from 48-60 months.

Table 4.3: Characteristics and Caring practices of children age 6-59 months in kusum khola

Variables	Frequency	Percentage
Gender		
Female	62	53
Male	55	47
initiation of breastmilk		
<1hr	41	35
>1-8hrs	36	30.8
8-24 hrs	28	23.9
>24hrs	12	10.3
Colustrum feeding		
Yes	38	32.5
No	79	67.5
Vaccination given to child		
Yes	108	92.3
No	9	7.7
Vit A/Round worm medicated		
Yes	99	84.6
No	18	15.4
Age of children under study		
6-11(month)	15	12.8
12-23(month)	17	14.6
24-35(month)	24	20.5
36-47(month)	31	26.5
48-60(month)	30	25.6

4.4 Environmental and hygienic Practice of the Household

Survey shows that all people use well (*kuwa*) as source of drinking water. It also shows that none of the family purifies water before drinking. People usually don't use toilet in the survey area. Hygiene and sanitation practice of the locality was very poor. They don't even manage their waste properly.

4.5 Prevalence of Malnutrition

NDHS shows 41%, 11% and 29% of children in Nepal are found to have stunting, wasting and underweight. In the study the prevalence of stunting, wasting and under-weight of chepang children in kusum khola was found to be 34.2%, 23.9% and 29.1% respectively. The result of this study revealed that the prevalence of stunting was lower and wasting was higher and underweight is approximately similar to the NDHS result. The prevalence of wasting was found higher than the national data but the prevalence according to the age group was higher in younger children than in older children which was similar to the national data. The prevalence of wasting in study community is 12.9% higher than the national prevalence and 12.7% higher than wasting prevalence in Terai region (MoHP, 2011). This may be because wasting, which is an indicator of acute nutritional deficiency, reportedly occurs due to recent illness (e.g. diarrhea, febrile illness, etc.).
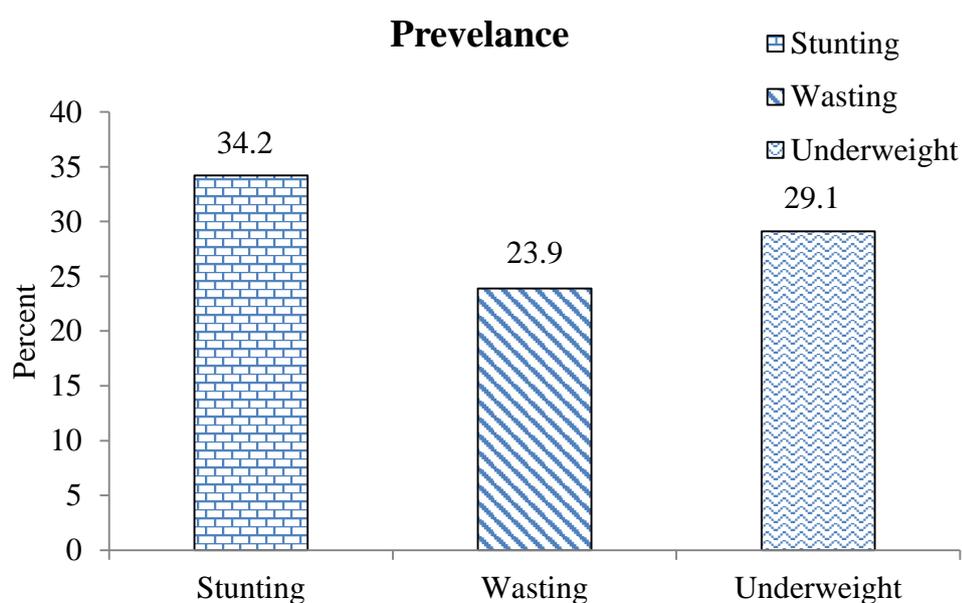
Figure 4: Prevalence of Under Nutrition among under-five children, based in z-score of WHO in Chepang community (n=117)

Our result shows that according to the Z-score 34.2% were stunted where 16.2% are severely stunted and 18% are moderately stunted; among 23.9% wasted 11.1% are severely wasted and 12.8% are moderately wasted and among 29.1% underweight 12.8% are severely underweight and 16.3% are moderately underweight which is shown in bar diagram below:
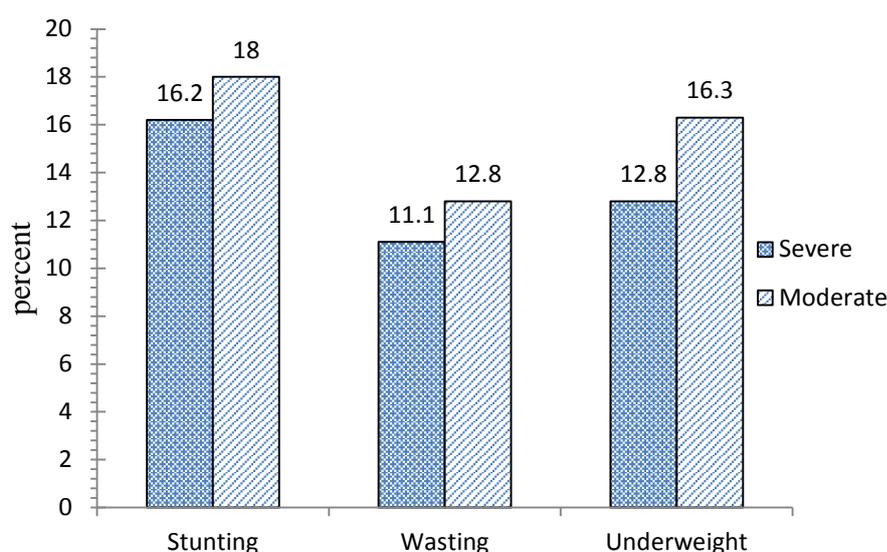
Figure 5: Prevalence of malnutrition of chepang community of kusum khola.

Gender-wise Distribution of malnutrition

Table 4.4: Distribution of Nutritional situation of 6-59 months of children in chepang community

	<-3Z score Count(%)	<-2Z score Count(%)	>-2Z score Count(%)	Percent(%) malnourished
Wasting				
Female	8(12.9%)	8(12.9%)	46(74.2%)	25.80%
Male	5(9.1%)	7(12.7%)	43(78.2%)	21.80%
Stunting				
Female	11(17.75%)	11(17.75%)	40(64.5%)	35.50%
Male	8(14.5%)	10(18.2%)	37(67.3%)	32.70%
Underweight				
Female	7(11.3%)	12(19.3%)	43(69.4%)	30.60%
Male	8(14.5%)	7(12.7%)	40(72.8%)	27.20%

The result of prevalence of malnutrition on chepang community in kusum khola area is shown in table 4.4. Among total of 117 children, 62 were female and 55 were male where 34.2% children are stunted, 23.9% are wasted and 29.1% are underweight. The magnitude of under nutrition among 6-59 months children in that area was seen higher in females than in males. According to the WHO growth standards of under-nutrition indicator; 32.7% of males are stunted, 21.8% are wasted, 27.2% are underweight and among them 14.5% are severely stunted, 9.1% are severely wasted and 14.5% are severely underweight which comprises of 8, 5 and 8 number respectively. In females 35.5% are stunted, 25.8% are wasted, 30.6% are underweight and among them 17.7% are severely stunted, 12.9% are severely wasted and 11.3% are severely underweight which comprises of 11, 8 and 7 number respectively.

4.5.1 Prevalence of wasting (weight for height) of under-five year children residing in kusum khola village

Table 4.5: prevalence percentage of weight for length (wasting)

Age(month)	N	WHZ %	
		<-3 SD	<-2 SD
6-11	15	40	60
12-23	17	17.6	41.2
24-35	24	8.3	12.5
36-47	31	6.5	19.4
48-59	30	Nil	10

From the study 23.9% children were found to be wasted among them 11.1% were severely wasted. The prevalence of wasting was higher in age group 6-11 months and lowest in 48-59 months. Younger children are more likely to be wasted than older children. This might be due to the increased susceptibility of younger children to illness/infection such as diarrheal disease (Yalew *et al.*, 2014). A study carried out in Nairobi, Kenya also shows the prevalence of wasting in age group of 6-11 months (Olack *et al.*, 2011). NDHS report also shows that the higher prevalence of wasting is in age group of 9-11 months children nationally.

The median weight for height z-score of survey children was found to be -0.99 which is less by 0.99 with the reference to WHO standard. This cause the curve slightly skewed to

the left side of WHO standard curve showing the prevalence of wasting among study population. The wasting was more in the study area than national data. The inappropriate time of initiation of complementary feeding, outbreaks of diarrhea and other disease may be the reason behind this. This may be due to poor hygiene and sanitation in the shelters which may cause disease outbreak and parasitic infection in children causing wasting in children. The other causes may be inadequate amount of diversified food consumption result in calorie and protein deficit. The similar high prevalence rate of wasting was also found in the assessment of Malnutrition Status among Under 5 Children in Padampur VDC, Chitwan. Study conducted in Padampur VDC found 25.7% wasting among under-5 children. The NDHS report 2011 in Terai region also reported low percentage of wasting (11.2%). That study found that wasting was the result of maternal, socio-economic and child individual factors and so on (Ruwali, 2011).
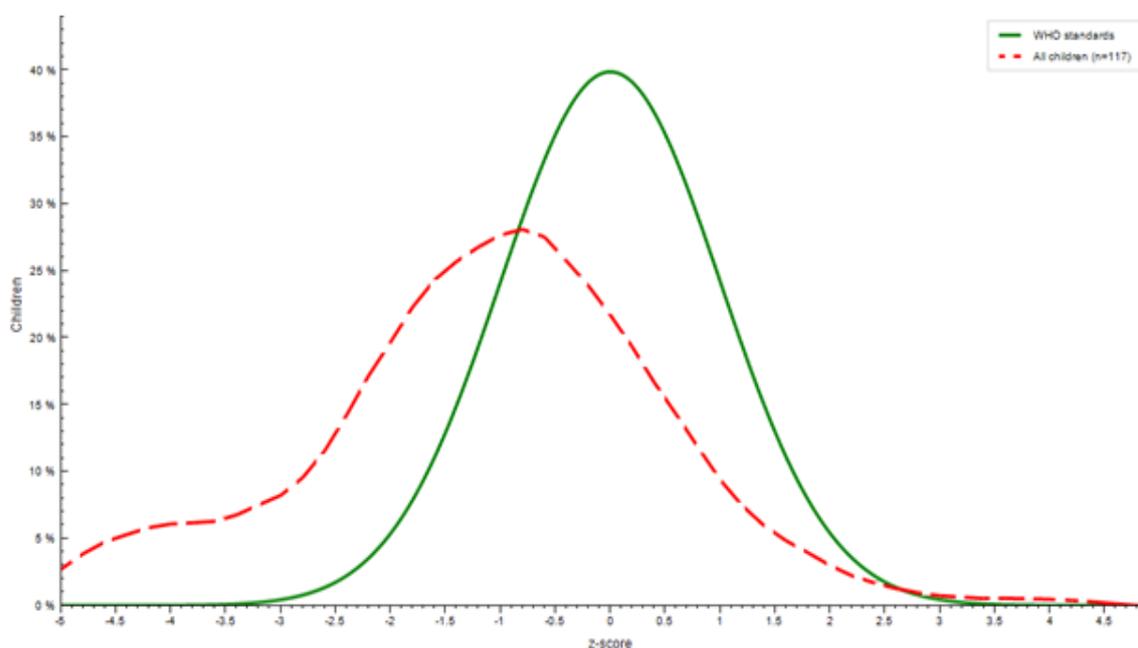

Figure 6: Distribution of Weight for height.

4.5.2 Prevalence of stunting (height for age) of under-five year children residing in kusum khola village

The study shows that 34.2% children were stunted among them 16.2% was severely stunted. Comparing with the age group highest prevalence of stunting was found in the group 36-47 months and lower in 6-11 months.

The trend of the study indicates the risk of stunting increases with age which is consistent with other studies. A research conducted in Belahara in Dhankuta; for prevalence and predicts of underweight, stunting and wasting in under five children, shows the prevalence of stunting higher in older children than in younger children; prevalence as 58.8% in 48-60 months children, 50% in children in age group 12-24 months, 40.9% in age 36-48 months, 36.7% in 24-36 months and lowest 31.1% in 0-12 months children (Sapkota and Gurung, 2009). It is likely that nursing during early life is protective and that stunting become more likely as the child becomes more dependent for caloric intake of food that have to be grown or brought. In a study conducted Kenya, children aged 36-47 months had the highest prevalence (58.0%) of stunting compared to other aged group. This may be due to children become more responsible for feeding themselves but often do not have access to adequate amount of solid food (Barmrah *et al.*, 2011).

Table 4.6: prevalence percentage of height for age (stunting)

Age(month)	N	HAZ %	
		<-3 SD	<-2 SD
6-11	15	Nil	26.7
12-23	17	23.5	35.3
24-35	24	16.7	33.3
36-47	31	20.6	38.7
48-59	30	13.3	33.3

The median height for age z-score of survey children was found to be -1.31 which is less by 1.31 with reference to WHO standard. This cause the curve slightly skewed to the left side of WHO standard curve showing the prevalence of stunting among study population. The stunting was less in the study area than national data. In the study area there was poor knowledge about nutrition among mothers and poor feeding practices was found. Hence long term inappropriate feeding behavior causes nutrient deficiency in children leading them towards malnutrition. Due to very low income family couldn't invest enough amounts for food, quality of food might not be maintained, and there was a poor healthcare service which may be the reason of stunting in child. The similar lower prevalence of stunting was found in the study for assessing nutritional status of under-five children conducted in Padampur VDC, Chitwan. Study conducted in Padampur found 22.7% children stunted

among study population. The NDHS report 2011 in Terai region also reported low percentage of stunting (37.4%). That study found that stunting was the result of maternal, socio-economic and child individual factors and so on (Ruwali, 2011).
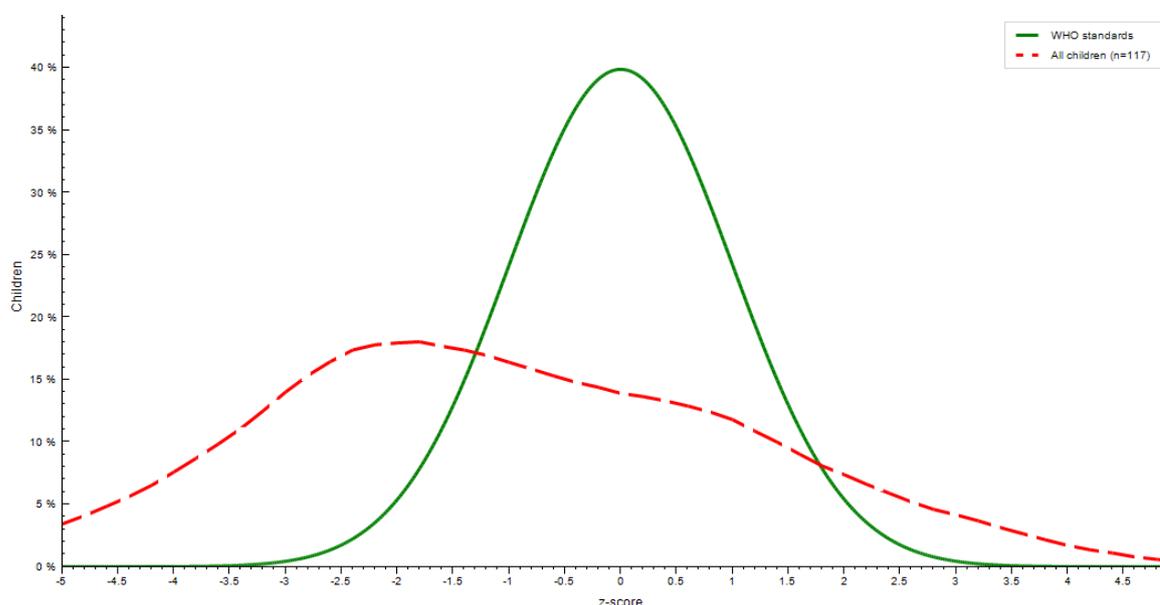
Figure 7: Distribution of height for age.

4.5.3 Prevalence of underweight (weight for age) of under-five year children residing in kusum khola village

The study shows that 29.1% children are underweight among them 12.8% are severely underweight. The prevalence of underweight was found higher in age group of 6-11 months and lower in 36-47 months.

Table 4.7: prevalence percentage of weight for age (underweight)

Age(month)	N	WAZ %	
		<-3	<-2
6-11	15	26.7	46.7
12-23	17	29.4	35.3
24-35	24	4.2	29.2
36-47	31	9.7	22.6
48-59	30	6.7	23.3

The trend of the study indicates that the risk of underweight decreases with age which is consistent with other studies. A research conducted in belahara in Dhankuta; for prevalence and predicts of underweight, stunting and wasting in under five children, shows that mean z-score for weight for age was found to be decreasing with age(Sapkota and Gurung,

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2009). Whereas, NDHS shows highest prevalence of underweight in the age group 18- 23 months with 37% (MoHP, 2011). The prevalence of under nutrition in younger age may be due to poor hygiene and sanitation practice, poor socio-economic status and poor breastfeeding practices.

The median Weight for Age z-score of survey children was found to be -1.25 which is less by 1.25 with the reference to WHO standard. This cause the curve slightly skewed to the left side of WHO standard curve showing the prevalence of underweight among study population. The underweight rate is still very high there but equal to NDHS data 29% nationally. The cause may be consumption of poor quality food, poor feeding practices, infection, poor hygiene and sanitation, delayed and non-exclusive breastfeeding practices, food insecurity and so on. The approximately similar rate of prevalence of underweight was found in the study for prevalence and predictors of underweight, stunting and wasting in under-five children in Belehara, Dhankuta. Study conducted in Belehara found 27.3% children underweight among study population (Sapkota and Gurung, 2009). The NDHS report 2011 in Terai region also reported similar percentage of underweight (29.5%). That study found that stunting was the result of maternal, socio-economic and child individual factors and so on.
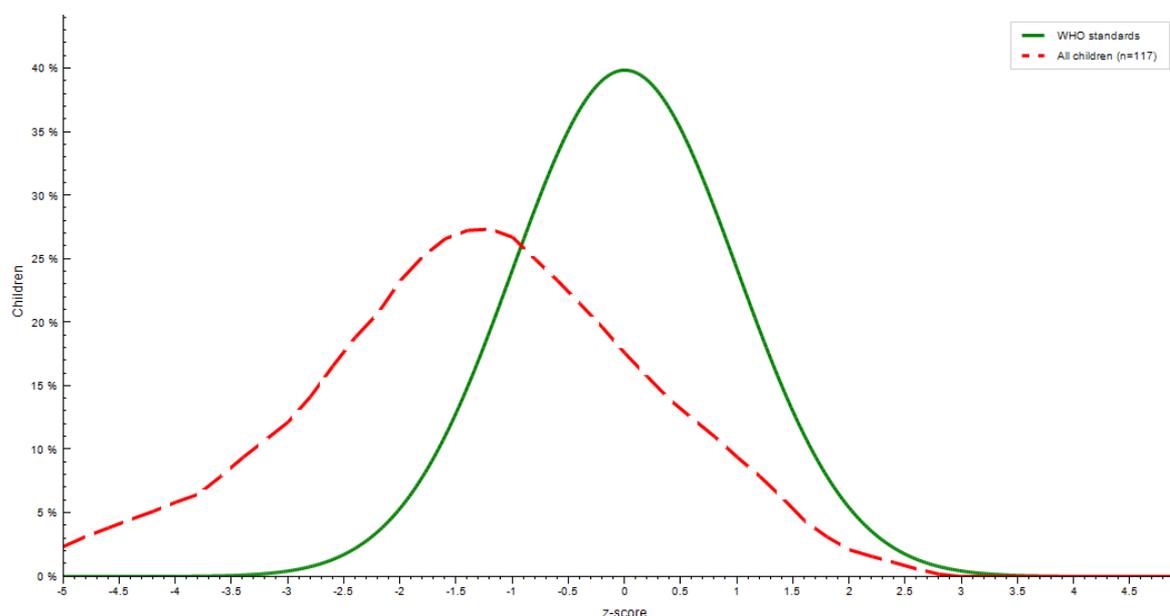

Figure 8: Distribution of Weight-for-Age.

4.5.4 Prevalence of malnutrition by MUAC of under-five year children residing in kusum khola village

Table 4.8: Prevalence of Nutritional Status of survey children based on MUAC

mid upper arm circumference		
	Frequency	**Percent**
Severe(<11.5)	8	6.8
Moderate(≥11.5-<12.5)	23	19.7
Normal(>12.5)	94	80.3

On the basis of mid-upper arm circumference measurement 19.7% children are found malnourished and 6.8% are severely malnourished. Similar type of study carried out in Chitwan; for prevalence of protein-calorie malnutrition among Tharu and Bote (fisherman) children: A case study of Chitwan district shows that the prevalence of malnutrition based on MUAC as 48.3% of mild malnutrition and severe malnutrition is 30.9% (Bhandari, 1985) in which prevalence is higher than our study.
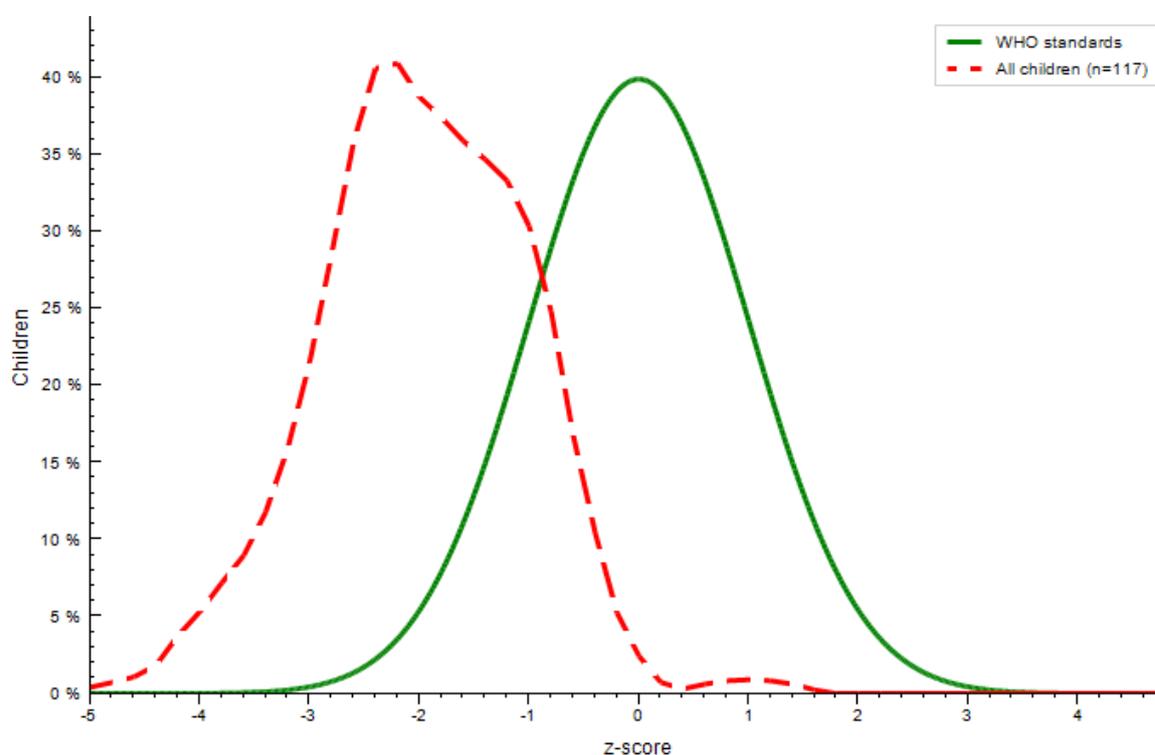
Figure 9: Distribution of MUAC-for-Age.

The median MUAC for Age z-score of survey children was found to be -2.04 which is less by 2.04 with the reference to WHO standard. This cause the curve slightly skewed to the

left side of WHO standard curve showing the prevalence of Protein energy malnutrition among study population. The MUAC shows the wasting of the child although national data have not specified the percentage of children malnourished on the basis of MUAC measurement our data shows the higher prevalence of malnutrition. The cause may be consumption of poor quality food, poor feeding practices, infection, poor hygiene and sanitation, delayed and non-exclusive breastfeeding practices, food insecurity and so on. The similar type of study carried out in Siraha District for prevalence of under nutrition among Musahar children aged between 12 To 59 months shows the prevalence of malnutrition by MUAC as 14% severely malnourished and 6% are moderately malnourished (Shah *et al.*, 2016).

4.6 Factors associated with Under nutrition

In order to successfully tackle the malnutrition problem in Chepang community, there appears a need to investigate the contribution of a number of factors influencing malnutrition. Accordingly, this study has tried to look into factors associated with malnutrition in the study area by incorporating as many risk factors as possible.

### 4.6.1 Factor associated with stunting

Table shows Chi-square test analysis results of factors associated with stunting. The Chi-square test revealed that there is significant association for stunting with vitamin A and round worm medicine supplementation (0.009) and calorie intake (0.017).

As shown by the results children who got vitamin A and round worm medicine supplement at regular basis, had lower risk of being stunted than those who had not got supplemented. Round worm infestation could have significant effects with the physical fitness of the children, physical development of the children would typically be subtle and chronic, and manifesting as longstanding anemia reduced physical fitness and somewhat constrained growth. A research in India on effects on deworming on malnourished children shows that albendazole treated children were observed with height gain in final follow up (S Awasthi *et al.*, 2008). A study done in Indonesia shows that Vitamin A is associated with stunting and wasting; it shows that vitamin A helps in linear growth of children and weight gain (Hadi *et al.*, 2000). A study done in Lalibela Town, Northern Ethiopia shows Children age 6-59 months who had not getting deworming service were about 2.2 times

more likely to be affected by stunting compared to those who were getting deworming service (p-value= <0.001) (Yalew *et al.*, 2014).

Table 4.9: Factors associated with stunting among 6-59 months children in chepang community.

	Factor	Stunted N(%)	Normal N(%)	chi-square	P-value
mothers education	primary(1-5)	8(50%)	8(50%)	4.291	0.117
	secondary(6-10)	1(100%)	Nil		
	Illiterate	31(31%)	69(69%)		
vitA/round worm medicated	Yes	29(29.30%)	70(70.7%)	6.853	0.009*
	No	11(61.1%)	7(38.9%)		
Calorie intake	adequate	13(23.2%)	43(76.8%)	5.749	0.017*
	inadequate	27(44.3%)	34(55.7%)		
continued breastfeeding	upto 6mnth	1(16.7%)	5(83.3%)	5.716	0.221
	upto 12mnth	6(19.4%)	25(80.6%)		
	upto 18mnth	13(43.3%)	17(56.7%)		
	upto 24mnth	10(40%)	15(60%)		
	Still	10(40%)	15(60%)		
annual income	<50000	34(31.5%)	74(68.5%)	3.141	0.076
	>=50000	6(66.7%0	3(33.3%)		
vaccination of child	Yes	34(31.5%)	74(68.5%)	3.141	0.076
	No	6(66.7%)	3(33.3%)		

The result shows that who did not consume adequate calorie on daily basis were more likely to be stunted than who consume adequate calorie. Similar study conducted in Mbeere, Kenya shows that the prevalence of stunting was highest among children 12-35months. This could be attributed to poor weaning and complementary feeding practices resulting into inadequate energy and protein intake. The poor feeding practices may be due to either lack of knowledge by the mother or lack of adequate food (Badake *et al.*, 2014).

4.6.2 Factor associated with wasting

Table 4.10: Factors associated with wasting among 6-59 months children in chepang community.

	Factors	wasted	Normal	chi-square	p-value
mothers education	primary(1-5)	3(18.8%)	13(81.2%)	3.11	0.211
	secondary(6-10)	1(100%)	0		
	Illiterate	24(24%)	76(76%)		
vitA/round worm medicated	Yes	26(26.3%)	73(73.7%)	1.179	0.278
	No	2(11.1%)	16(88.9%)		
Calorie intake	adequate	9(16.1%)	47(83.9%)	3.645	0.056
	inadequate	19(31.1%)	42(68.9%)		
continued breastfeeding	upto 6mnth	1(16.7%)	5(83.3%)	18.158	0.001*
	upto 12mnth	5(16.1%)	26(83.9%)		
	upto 18mnth	5(16.7%)	25(83.3%)		
	upto 24mnth	3(12%)	22(88%)		
	Still	14(56%)	11(44%)		
annual income	<50000	24(22.2%)	84(77.8%)	1.198	0.274
	>=50000	4(44.4%)	5(55.60%)		
vaccination of child	Yes	26(24.1%)	82(75.9%)	0	1
	No	2(22.2%)	7(77.8%)		
age of children(month)	6-11	9(60%)	6(40%)	17.595	0.001*
	12-23	7(41.2%)	10(58.8%)		
	24-35	3(12.5%)	21(87.5%)		
	36-47	6(19.4%)	25(80.6%)		
	48-60	3(10%)	27(90%)		

Table shows Chi-square test analysis results of factors associated with stunting. The Chi-square test revealed that there is significant association for wasting with continuation of breastfeeding (0.001) and age of child (0.001).

The study have shown that continuation of breastfeeding have significant association on wasting of children. The children who are still consuming breastmilk has higher rate of being wasted than others children; higher percentage of prevalence in this group may be due to mothers have less nutritional education and they do not feed their child properly. The child consumes breast milk and show less interest towards other food items. The children who are continued breastfeeding till 6 months have higher prevalence of wasting than those who have continued more than 6 months. Similar study carried out in ethopia shows that who were continued breastfeeding for less time periods were likely to be wasted than who are continued breastfeeding for longer time (Yalew *et al.*, 2014).

Similar study carried out in Sindh Pakistan, for prevalence and associated factors of malnutrition among under five children shows that age of the children is associated with malnutrition which shows higher prevalence in age 24-35 months but in this study higher prevalence is seen in 6-11 months (Khan *et al.*, 2016). But it is supported by NDHS data which shows that highest prevalence of wasting is in age group of 9-11 months of children (MoHP, 2011).

4.6.3 Factors associated with underweight

Table below shows Chi-square test analysis results of factors associated with underweight. The Chi-square test revealed that there is significant association for underweight with mother's education (0.041), vitamin A and roundworm medicine supplementation (0.033), calorie intake (0.011), continuation of breastfeeding (0.006) and annual income (0.028).

In this study most of the mothers are uneducated and the prevalence rate of underweight is seen higher in mothers with the secondary level education. This may be due to only less number of mothers has secondary level education or they have very low level of secondary level education. Low education level also can affect mother's ability to take care of their child in appropriate way. And according to the frequency children's of mothers with lower education are more underweight than mother with other level of education. Similar type of study were carried out as Rwanda Demographic Health Survey (RDHS), which states children of mothers with lower education are at high risk of being underweight than the

mother with higher education (Mukabutera *et al.*, 2016). As shown by the results children who got vitamin A and round worm medicine supplement at regular basis, had lower risk of being underweight than those who had not got supplemented. The study carried out as Six-monthly de-worming in infants to study effects on growth has shown significant association of vitamin A and deworming tablet consumption with underweight where they have observed gain in weight in children who have received vitamin A and deworming tablet (S. Awasthi and Pande, 2001).

Table 4.11: Factors associated with underweight among 6-59 months children in chepang community.

	Factors	Underweight N(%)	Normal N(%)	Chi square	p-value
mothers education	primary(1-5)	8(50%)	8(50%)	6.381	0.041*
	secondary(6-10)	1(100%)	0(0%)		
	Illiterate	25(25%)	75(75%)		
vitA/round worm medicated	Yes	25(25.30%)	74(74.70%)	4.525	0.033*
	No	9(50%)	9(50%)		
Calorie intake	Adequate	10(17.90%)	46(82.10%)	6.539	0.011*
	Inadequate	24(39.30%)	37(60.70%)		
continued breastfeeding	upto 6mnth	1(16.70%)	5(83.30%)	14.582	0.006*
	upto 12mnth	5(16.10%)	26(83.90%)		
	upto 18mnth	5(16.70%)	25(83.30%)		
	upto 24mnth	9(36%)	16(64%)		
	Still	14(56%)	11(44%)		
annual income	<50000	28(25.9%)	80(74.1%)	4.859	0.028*
	>=50000	6(66.7%)	3(33.3%)		
vaccination of child	Yes	29(26.90%)	79(73.10%)	3.32	0.068
	No	5(55.60%)	4(44.0%)		

Study have shown that the children who are consuming less calorie than the RDA according to ICMR; i.e. inadequate calorie are more likely to be underweight than the

children who have meet their calorie need. A study done in Bogotá, Colombia shows that food-insecure children were 3 times more likely to be underweight than food-secure children (Isanaka *et al.*, 2007).

In this study result shows significant association between continuations of breastfeeding to the prevalence of underweight. Similar type of study carried out in ethopia shows that who were continued breastfeeding for less time periods were likely to be underweight than who is continued breastfeeding for longer time (Yalew *et al.*, 2014). A study carried out in Kenya shows significant association of continuation of breastfeeding with underweight; that who have breast feeding for more than 12months had less chance of being underweight (Muchina and Waithaka, 2010). However this study showed a contradictory result as child having continued breastfeeding were found to be more prone to underweight. This could be because child who are on breastmilk consume less amount of complementary food.

Chepang community is from the lowest income group of Nepal, almost all the chepang people comes under poverty in Nepal. According to the result all the people comes under poverty and further they are classified in two groups <50,000 and ≥50,000. According, to the frequency higher number of children are underweight in group with income <50,000 but according to the percentage higher rate of prevalence is seen in group with income ≥50,000. Many studies have shown that the prevalence of malnutrition is higher is the group who are under poverty line. Similar type of study shows that there is significant association of underweight of children who are under poorest (Mukabutera *et al.*, 2016).

Part V

Conclusion and Recommendation

5.1 Conclusion

a) There is high prevalence of malnutrition in Kusum khola among children between 6-59 months of age, i.e. 34.2% were stunted, 23.9% were wasted and 29.1% were under weight.

b) The malnutrition rate among children under five years in Kusum khola was found high rate in prevalence of wasting, lower in stunting and equal rate of prevalence in underweight with national data.

c) On the basis of MUAC reading 19.7% were found malnourished among them 6.8% were severely malnourished.

d) There is significant association of stunting with vitamin A and deworming tablet medicine consumption and calorie intake, wasting with continuation of breastfeeding and age of children and underweight with mother's education, vitamin A and deworming tablet consumption, calorie intake, continuation of breast feeding and annual income.

e) The risk group of the study was found to be 6-11 months children as higher prevalence of malnutrition is shown in them.

f) The study point out the need of making a comprehensive, integrated and multi sectorial plan for addressing the problem of malnutrition in long term.

5.2 Recommendation

a) There is need for intervening nutritional and health education as educated mother is most   likely to provide better care in terms of good nutrition and better hygiene which in turn improve the nutritional status.

b) Timely introduction of complementary foods and feeding/food behaviors should be advocated.

c) The nutritional status of children should be periodically assessed using suitable nutritional indicators by respective stakeholders.

d) Appropriate intervention programs like supplementary feeding programs should be implemented to improve the nutritional status of severely acute malnourished children.

e) Although available interventions can make a clear difference in the short term, elimination of stunting will also require long-terms investments to improve education, economic status and empowerment of women.

f) Public awareness programs should be launched in the area in regard to improve the antenatal and post natal care of mother which is important for the better nutritional status of children.

g) Furthermore, further studies should be done to see unexplored variables (dietary diversity, seasonal factors and household food security) which were not included in this study.

Part VI

Summary

Nutritional status of children is a proxy indicator for assessing the entire population health status and one of the major predictors of child survival. Despite the various efforts, malnutrition among children is remaining as a major public health problem in Nepal. This study was conducted to assess the nutritional status of under-five year children and to find out the factors associated with childhood malnutrition.

Nutritional survey was conducted among the 6 – 59 months of chepang children residing in kusum khola area. Anthropometrics measurements were carried to find out the level of malnutrition among the preschooler. Household survey was conducted with the help of questionnaire to collect various kinds of information about the factors that are directly or indirectly related to the cause of nutritional problems. The data and information obtained from the nutritional survey could be used by the governmental and non-governmental agencies working in the related field to take initiative steps in uplifting the status in the population.

Census method was done to select the sample. 117 children were studied to monitor the nutritional status. The data collected were analyzed by using SPSS version 20 and WHO anthro 3.2.2 version. According to weight-for height, 23.9% were found to be wasted out of which 11.1% were found to be severely wasted and remaining were found to be normal. The highest prevalence of wasting was found in the age group 6-11 months. According to length/height-for-age, 34.2% were found to be stunted out of which 16.2% were found to severely stunted and remaining were found to be normal. The highest prevalence of stunting was found in the age group 36-47 months. According to weight-for-age, 29.1% of the children were found to be underweight, out of which 12.8% were severely underweight. The prevalence of underweight was found to be highest in the age group 6-11 months.

Majority of children surveyed were female (53%). Most (85.5%) of the mothers have not gone to school and 88% of mothers have no any knowledge of making super flour. Majority of mothers (90.6%) mothers have delivered their first child before the age 20 yrs. Even though being deprived from education majority (35%) of child were initiated breast milk before 1 hour after birth. And 92.3% have vaccinated their child properly.

This survey result concluded that the stunting of chepang children residing in that area is lower than the national data while wasting was higher and underweight was equal to the national data. This difference may also be probable due study period, study area, socioeconomic characteristic, health service delivery, and geographical characteristics of study area.

There was significant association of stunting with Vitamin A/deworming tablets medicine consumption (P=0.009) and calorie intake (P=0.017). The survey shows that there was significant association of wasting with continuation of breast feeding (P=0.001) and age of children (0.001). There was significant association of underweight with mother's education (0.041), Vitamin A/deworming tablets medicine consumption (0.033), calorie intake (0.011) continuation of breastfeeding (0.006), and annual income (0.028). Factors like age at first pregnancy, family occupation, gender, educational status of mother considered to be important for nutritional status of under five years children were not statistically significant in the study.

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Appendices

Appendix-A

<div align="center">Consent letter</div>

Namaste!

I Miss. Anuska Lamichhane, graduate student in Department of Nutrition and Dietetics conducting a dissertation work for award of bachelor's degree in Nutrition and Dietetics.

The topic for the study is "NUTRITIONAL ASSESSMENT OF CHILDREN UNDER THE AGE 6-59 MONTHS OF CHEPANG COMMUNITY RESIDING IN KUSUM KHOLA AREA."

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 the and the son/daughter's participation is voluntary and he/she reserve the full right to withdraw from the study at the 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 the/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 the participation in the study.

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

Appendix B

Survey questionnaire

Nutrition Survey Form

Nutrition and Dietetics Department

Central campus of Technology, T.U.

Hattisar, Dharan, Nepal

Code no.		Date	
Child Name:			
Date of birth: ………………		Sex: ………………………………..	
Address		VDC		Ward no:	

General information

Family member's description:

S.no.	Members name	Relation to child	Sex	Age	S.no.	Name of under 5-year child	Sex	Age
1								
2								
3								
4								
5								

Family Size: _____

Type of family?   Nuclear/ Joint

What's your occupation? (Mother)	Business/ Agriculture/ Job/ Labor/ Other
What's your occupation? (Father)	Business/ Agriculture/ Job/ Labor/ Other
Father's education	Primary (1 – 5)/ Secondary (6 – 10) / Campus / None
Mother's education	Primary (1 – 5)/ Secondary (6 – 10) / Campus / None
Annual income of the family?	_____
Is your annual income enough to eat?	Yes/ No
Household type	Permanent / Temporary
Child order:	
Birth weight:	_____
Under 5 year child death?	Yes / No
If yes, how many?	_____

Child caring practice:

Did you breastfeed your child right after birth?	Yes / No
If yes, for how many hours?	1/ 8/ 24
When did you stop breastfeeding?	_____
Did you exclusively breastfeed?	Yes / No
Did you feed colostrum to your baby?	Yes / No
Did you introduce any prelacteal feeds to your child?	Milk/ honey/ jaggery/ ghee/ herbal paste/ None
Do you know supplementary food?	_____

If yes, when did you initiate?   4/ 5/ 6/ 7/ none

What types of supplementary food are fed?

    Cereals product (*jaulo, dhiro*)/ egg, meat, milk/ vegetables, fruits/ processed food *(cerelac, litto, packet milk)*

Do you the preparation of *litto*?   Yes / No

If yes, how?   _____

Do you know the preparation of ORS?   Yes / No

Health and immunization

Did you have your child vaccinated?   Yes / No

Did your child have Vitamin A and deworming   Yes / No
tablets?

Are you vaccinated during pregnancy?   _____

    If yes, which one?   Polio/ B.C.G/ T.T/ None

Where do you take your ill child?   Health center/ Pharmacy/ Jhakri/ None

How do you recognize your ill child?   Lazy/ increased body temperature/ vomiting

Maternal description

At what age, did you get marry?   _____

Age at first pregnancy?   _____

Did you have Iron/ folate tablets?   Yes / No

Do you know malnutrition   _____

If yes, how?   Less food intake/ curse of god/ due to witch /

other/ don't know

Do you know the causes of marasmus?   Yes / No

What amount food did you eat during   More than usual/ less than usual/ as usual
pregnancy?

Which salt is used in your home?   Iodized salt/ Dhikke

Environment and Sanitation

Which water source do use?   Tap water/ Well/ River/ Tube well

How do process drinking water?   Filter/ Piyush / Boil/ None

How do you dispose wastes?   Bury/ Burn/ VDC management/ Other

Do you have toilet facility?   Yes / No

Anthropometric measurement of under five children

Height	2. Weight	3. MUAC	4. OEDEMA (Yes/No)

24-hour dietary recall Children:

Timing	description of food or drink	brand name	Serving	Amount
Breakfast (6:00 -9:00 AM)				
Lunch (9:00 - 11:00 AM)				
Snacks (11:00 AM -5:00 PM)				
Dinner (6:00- 11:00 PM)				

Appendix C

Photo Gallery