STUDY ON NUTRITIONAL STATUS OF 6-59 MONTHS CHILDREN IN INARUWA-7, SUNSARI

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Approval Letter

This *dissertation* entitled *Study on nutritional status of 6-59 month children in Inaruwa-7, Sunsari* presented by Biplove Shrestha 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 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 in Inaruwa-7, Sunsari district to study the nutritional status of 6-59 months children. A total of 89 children residing in Inaruwa-7 were taken for the study. Data was collected using pre tested, semi-structured questionnaire to obtain information on subject socio-economic status, hygiene practices and breastfeeding practices. Anthropometric measurement was used to determine if the children were underweight, wasted or stunted based on WHO reference. Statistical Package for Social Sciences (SPSS) version 20 and Anthro version 3.2.2 were used for analyzing the data. Chi- square test was used to identify the factors associated with malnutrition.

The major occupation of people in the study area was business (30.3%). 70.8% of people had annual income between NRs 100,000 and 300,000 while 22.5% had annual income less than NRs. 100,000 and 6.7% had annual income more than NRs. 300,000. Regarding weaning practices, about 13.5% of children were introduced to solid or semi-solid foods before six months of age. 86.5% of children were weaned after six months of age. Almost 100% of the households in the study area used adequately iodized salt. 41.6% of the households used to purify water for drinking purposes while the rest 58.4% did not. The largest percentage of the households used LP gas (59.5%) as a source of fuel for cooking purposes. The prevalence of stunting, wasting and underweight was found to be 28.1%, 8.9% and 13.5% respectively. 6.8% of them were severely stunted, 2.2% were found to be severely wasted and 2.3% were severely underweight. The study shows that wasting and stunting was higher in boys than girls while in case of underweight, the prevalence was found higher in girls. Mother occupation ($P = 0.02$) was found statistically significant with wasting. From the findings of the study, it is concluded that malnutrition is still a major public health problem among children aged 6-59 months. Therefore special 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
NMICS	Nepal Multiple Indicator Cluster Survey
PEM	Protein Energy Malnutrition
UNDP	United Nations Development Program
UNICEF	United Nations International Children Emergency Fund
WAZ	Weight for Age Z Score
WHO	World Health Organization
WHZ	Weight for Height Z Score

Part I

Introduction

1.1 Background

Nutrition is defined as the science of food and its relationship with health. It is concerned primarily with the parts played by the nutrients in body growth, development and maintenance. Nutrition is one of the essential functions of living beings necessary for the utilization of food. Human beings need to have adequate nutrition to attain normal physical growth and for a healthy life. Adequate nutrition is a fundamental right for every human being. If people fail to consume sufficient quality and quantity of nutrients, they will suffer from hunger and malnutrition. The common types of malnutrition in Nepal are: protein energy malnutrition, iodine deficiency disorder, iron deficiency anemia and vitamin A deficiency (MOHP, 2008).

Nutrition is an important determinant of immunological status; and under nutrition can impair immune competence and increase susceptibility and vulnerability to infections. The immediate cause of over half South Asia's under five mortality is the synergistic effect if inadequate dietary intake and frequent episodes of diseases. Not only severe malnutrition but also mild to moderate malnutrition, increases the risk of a child dying due to common infections by over 50%. Nearly 50% of the under-five mortality results from the episodes of diarrhea or acute respiratory infection; which are curable in the first stages with simple home remedies when nutritional status is good (UNICEF, 1996). Fifty percent of child deaths in developing countries are related to malnutrition's potentiated effects and 83% of those deaths are attributed to mild and moderate forms (WHO, 2000).

Children constitute the most vulnerable segment of any community. Their nutritional status is a sensitive indicator of community health and nutrition. Under nutrition among them is one of the greatest public health problems in developing countries. Attempts to reduce child mortality in developing countries through selective primary health care have focused primarily on the prevention and control of specific infectious disease, with less effort being directed to improving children's underlying nutritional status (Rao *et al.*, 2005).

Nepal is one of the least developed countries in South-East Asia Region (SEAR), which was ranked 157 among 187 countries in the Human Development Index (UNDP, 2011). It has

a total land area of 147,181 Sq. Km. According to 2011 census, the total population of Neal is 26.6 million. More than 83% of the population resides in rural area. The population growth rate in 2011 is 1.41% (MOHP, 2011).

According to Nepal Demographic and Health Survey, 2001, the percent prevalence for underweight and wasted children of under five years of age are 48.3 and 10 percent. Around 50 percent of under five children were stunted. Children in rural areas are more likely to be stunted (52%) than in urban areas (37%). Nepal Micronutrient Status Survey, 1998 (6-59 months) indicate that 54.1% were stunted, 6.7% showed wasting and 47.1% were underweight. National Family Health Survey (NFHS, 1996) in a nationally representative sample of children (6-36 months) showed that overall, 54.8% were stunted, 12.7% showed wasting and 54.2% were underweight. The first national survey in 1975 also showed similar findings of 48.1% stunted, 2.8% wasted and 50% underweight. The data suggest that there is no improvement in the nutritional status in the country, although per capita energy consumption showed an upward trend of 2270 kcal per day (WHO, 2000).

NDHS 2006 states that 49% of children below 5 years of age are stunted and 20% are severely stunted. The survey also showed that 13% of the children are wasted and 3% are severely wasted, 39% of children under five years of age are underweight and 11% are severely underweight. Similarly, MOHP 2011 shows that 41% of children under 5 years of age are stunted and 16% are severely stunted. It also shows that 11% of children are wasted and 3% are severely wasted, 29% of children below 5 years of age are underweight and 8% are severely underweight (MOHP, 2011).

There is an abundant literature detailing the cause of child malnutrition, especially under nutrition, and the means of reducing it. Poor availability of food both in terms of quality and quantity, poor dietary diversification and high rates of infections are the major determinants of under nutrition in majority of developing countries (Mason *et al.,* 1999). But research suggests that apart from the poor composition of the diet, inappropriate caregiver-feeding behaviors may put an important role in child nutrition and development. These include mixed feeding and early cessation of breastfeeding, the untimely introduction of complementary foods, low physiological stimulation of children, poor food preparation and food hygiene practices, and inappropriate care for children during illness, among others (Pollitt *et al.,* 1995). The quality and quantity of food available to a household are not the only factors explaining the determinants of malnutrition in infants and young children. Care and feeding

practices of the caregivers are the key factors that lead to undernourishment in young children (Bentley *et al.*, 1991).

1.2 Justification

Malnutrition refers to a pathological state resulting from a relative or absolute deficiency or excess of one or more 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. 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 (Black *et al.*, 2003).

Adequate nutrition is critical to children's growth and development. The period from birth to age of two is especially important for optimal physical, mental, and cognitive growth, health, and development. Unfortunately this period is marked by protein-energy and micronutrient deficiencies that interfere with optimal growth. Childhood illness such as diarrhea and acute respiratory infections are also common. Nepal suffers from extensive malnutrition ranking in the top 10 countries with the highest prevalence of stunting (less than -2 S.D. scores) and the top 20 countries by the number of stunted children less than 5 years of age worldwide (UNICEF, 2009).

PEM is a very common problem in children under five years of age in Nepal and is a significant contributor to mortality and morbidity accounting for more than half of all child deaths. NDHS 2006 reports that 46 percent of children under five years of age were stunted, 13 percent were wasted, and 39% were underweight. It also reports that the distribution of problems is not uniform. Rural populations are most affected with stunting, wasting, and underweight. While stunting is major problem in the mountainous areas, wasting is more significant in terai. The study also shows that western areas are most affected by stunting (Acharya *et al.*, 2013).

NDHS 2011 shows that forty one percent of children under-five years of age are stunted, eleven percent are wasted and twenty nine percent are underweight. Forty six percent of children aged 6-59 months are anemic, 27 percent are mildly anemic, 18 percent are moderately anemic, and less than 1 percent are severely anemic. Complementary foods are not introduced in a timely fashion for all children. Seventy percent of breastfed children have

been given complementary foods by age 6-9 months. Overall, only one- fourth of children aged 6-23 months are fed appropriately based on recommended infant and young child feeding practices (IYCF practices) (MOHP, 2011).

Studies show that malnutrition problem in Nepal can be tackled. There are lack of knowledge related to health, nutrition and economic constraints. The preventive and curative approach to the health of children in Nepal is essential to overcome many of the obstacles. Social and cultural factors need to be addressed properly before developing and implementing any nutrition program in Nepal.

Inaruwa is located in Sunsari district. It is situated in the bank of Sunsari river. This survey is conducted in Inaruwa ward no-7. People from different ethnic groups and socioeconomic status reside here. Mostly *Magars, Maithili, Muslims, Brahman, Chhetri,* etc. live here. Previously no any study was conducted to assess the nutritional status of (6-59 months**)** in Inaruwa-7. Thus, there was a need for determining the current nutritional status of children. Therefore, this study is designed to assess the prevalence of malnutrition among children aged 6-59 months. The scope of the study done will be supporting and informing policy dialogue, strengthen knowledge and support policy development to implement interventions programs for the improvement of nutritional status of (6-59 months) age group children.

1.3 Objectives

1.3.1 General objectives

The main objective of this work is to study the nutritional status of 6-59 months children in Inaruwa-7, Sunsari.

1.3.2 Specific objectives

a) To carry out household survey to find out the socioeconomic status, hygiene practices, care and feeding practices of mother and children with the help of questionnaire.
b) To assess the nutritional status of children between 6-59 months of age in the study area to find out the prevalence of malnutrition.
c) To study the factors associated with nutritional status.

1.4 Research questions

This thesis addresses the following questions:

a) What is the nutritional status of (6-59months) children in Inaruwa-7?
b) What are the factors associated with the nutritional status of (6-59 months) children in Inaruwa-7?

1.5 Significance

The findings of the study will be helpful to:

a) Provide information regarding the nutritional status of children the age of 6-59 months to the governmental and non-governmental organization which will be helpful to initiate corrective measures for the problem.
b) Encourage local people to improve their current nutritional status by improving feeding pattern and habit of children, pregnant and lactating women.
c) Serve as a helpful guide to make proper nutritional program for this community from the facts determined in this work.
d) Discover the problems related to nutrition, care practices, economic condition and feeding behaviors of this community.
e) Identify individual or population group who are at risk of being malnourished and who need special care and attention.

1.6 Limitations

a) Dietary intake during 24 hours of survey, considered as a major determinant of nutritional status was not included in the study.
b) The study is cross sectional in design. It neither represents seasonal variation of nutritional outcomes particularly wasting nor establishes correct temporal causal relationship of predictors and the outcome variables.
c) Information about family income, child weight at birth, child age, breastfeeding, etc. might not be given correctly due to hesitations or memory bias by the respondents.
d) Errors might occur while taking the anthropometric measurements of children.

Part II

Literature review

2.1 Nutritional status

Nutritional status is the condition of the body in those respects influenced by the diet; the level of nutrients in the body and the ability of those levels to maintain normal metabolic integrity. It can be determined through a careful medical and dietary history, through a physical examination, and appropriate laboratory investigation (Robinson, 2000).

Among children in developing countries, malnutrition as an important factor contributing to illness and death. Malnutrition during childhood can also affect growth potential and risk of mortality and morbidity in later years of life. Malnutrition among children is rampant among the South Asian countries. About half of all children deaths are associated with malnutrition, of which three quarters are linked to mild and moderate forms (UNICEF, 2005).

The nutritional status is a powerful indicator of nutrition security and well-being of individual and reflects the nutritional and poverty situation of household. The nutritional status of pre-school children is a sensitive indicator, because children are most vulnerable to nutritional imbalances (Peiris and Wijensinghe, 2010).

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 and or environmental sanitation (Nabarro, 1984).

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

2.1.1 Factors affecting nutritional status

The factors affecting nutritional status are mother's food security, breastfeeding practices, types of food given to young children, feeding frequency, status of women and child nutrition and 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, consumption of food, income source and purchasing power, family size, illiteracy, socio-cultural and religious belief, environmental sanitation and health facility, etc. (Bocabo and Eusebio, 1988).

Nutritional status is clearly compromised by diseases with an environmental component, such as those carried by insect or protozoan vectors, or those caused by an environment deficient in micronutrients. But the effects of adverse environmental conditions on nutritional status are even more pervasive. Environmental contamination (e.g. destruction of ecosystems, loss of biodiversity, climate change, and the effects of globalization) has contributed to an increasing number of health hazards (Johns and Eyzaguirre, 2000), and all affect nutritional status.

Good health depends on an adequate food supply and this in turn on a sound agricultural policy and a good system of food distribution. The social, economic and agricultural factors that determine the food supply also determine the state of health and incidence of disease among the population. These are the basic etiological factors causing nutritional diseases and they are closely linked with danger that arises from failure to control on excessive increase in the population. Even a good supply and preparation of food in the home, lack of education is responsible for much malnutrition, especially in poor rural areas and urban slums (Davidson, 1986).

Low birth, mother's education , knowledge about the micronutrient (Vitamin A, iron and iodine), management of diarrhea, feeding practice and complementary feeding practice, marriage, lack of maternal autonomy age are the factors affecting nutritional status (Dhungana, 2013).

2.1.2 Food availability and nutritional status

Food availability is a factor of production capacity, amount of imports and amount that is normally used at a given period of time and of the availability of storage. Food availability is also influenced by the availability of seeds, pest infestation, weather condition, availability of pasture, land acreage under cultivation, labor and insecurity issues. The amount of food used by households, traded or stored all influence availability at the household level (Gyawali, 2002).

Food plays a primary role in the nutritional status, information on the composition of 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 professionals and lay groups (Chany and Ross, 1979).

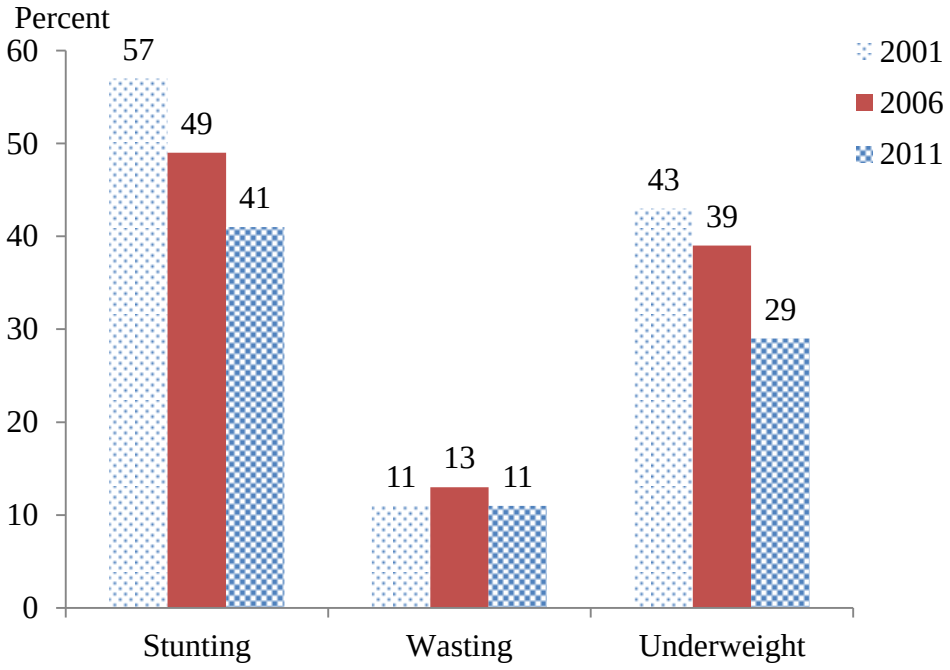
Increased production of food groups making the national balance is one of the most important measure of achieving nutritional adequacy. Where the national diet are deficit in nutrients, adverse consequences manifest themselves, e.g. there is high prevalence of anemia due to iron deficiency, blindness among children due to vitamin A deficiency, etc. Thus, the real solution is to overcome the deficiency diseases is to consume diets rich in these nutrients (Katawal, 1992).

2.1.3 Nutritional status of under five children in Nepal

There is wide variation in rates of malnutrition throughout Nepal both ecologically and regionally. Nepal Demographic and Health Survey indicates that more rural children are stunted (low height for age), 42% than urban children (27%). Regional variation of nutritional status of children is substantial. Stunting levels are way above the national average in mountains (53%). Whereas wasting (low weight for height) and underweight (low weight for age) are also high in mountains with 11% and 36% respectively in comparison with Terai and Hills. In Terai there is 37% stunting, 11% of wasting and 29% of underweight and in Hills it shows 42% of stunting, 11% of wasting and 27% of underweight (MOHP, 2011).

In general, the nutritional status of children in Nepal has improved over the past 15 years and is close to achieving the Millennium Development Goal (MGD) target of reducing the percentage of underweight children age 6-59 months to 29 percent by 2015. Figure 2.1 shows a downward trend in stunting and underweight over time. The percentage of underweight children declined by 14 percent between 2001 and 2006 and declined by additional 16

percent between 2006 and 2011. A similar pattern is observed for the percentage of underweight children, which dropped by 9 percent between 2001 and 2006 and by 26 percent between 2006 and 2011. Similarly, the percentage of wasting declined by 15 percent between 2006 and 2011 (MOHP Nepal, 2011).



Source: (MOHP (Nepal), 2011)

Fig 2.1 Trends in Nutritional Status of children under five years of age

Similarly when we look at the situation of anemia, forty six percent of children aged (6-59) months are anemic, 27 percent are mildly anemic, 18 percent are moderately anemic, and less than 1 percent are severely anemic. The proportion of anemia is higher among children age 6-17 months (72-78) percent than among children in other age groups. The prevalence of anemia among children age 6-23 months is 69 percent. Severe anemia which has a serious impact on the health of an individual, is highest among children age 12-17 months (2 percent). Male children and children residing in urban areas are less likely to be anemic. The prevalence of anemia in children varies across ecological regions. Children in Terai are more anemic (50 percent) than children in hill zone (41 percent). Children residing in Far-western terai (60 percent) and Mid-western terai (57 percent) sub regions are more likely to be anemic than children in the Central mountains (33 percent) and Mid-western hills (36 percent) sub regions (MOHP, 2011).

A study conducted in Rupandehi district concludes that 46% of children aged 36-59 months were underweight and 65% were found to be stunted . 50% children born to illiterate mother were underweight and 58% born by mothers less than18 years of age were underweight (Acharya *et al.*, 2013).

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

A study conducted in Padampur VDC, Chitwan showed that 23%, 37% and 26% of children were underweight, stunted and wasted respectively. It also revealed that children's age, occupation of mother and socioeconomic status were significantly related to stunting (Ruwali, 2011).

2.1.4 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 to be below 145 cm (5 percent and 7 percent respectively) (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).

Thirty five percent of the women aged 15-49 are anemic, 29 percent are mildly anemic, 6 percent are moderately anemic, and less than 1 percent are severely anemic. Anemia prevalence has declined only 1 percentage point since the 2006 NDHS. The prevalence of anemia is associated with maternity status. Pregnant women are more likely to be anemic (48 percent) than women who are breastfeeding (39 percent) and women who are neither pregnant nor breastfeeding (33 percent). This could be due to high demand for iron and folic acid during pregnancy. Anemia is more prevalent in rural areas (36 percent) than in urban areas (28 percent). Anemia prevalence is higher among women in terai (42 percent) than among women in the mountain or hill zone (27 percent) (MOHP, 2011).

2.2 Nutritional Requirements

Humans need a wide range of nutrients to lead a healthy and active life. The required nutrients for different physiological groups can be derived from a well-balanced diet. Components of the diet must be chosen judiciously to provide all the nutrients to meet the human requirements in proper proportions for the different physiological activities. The amount of each nutrient needed for an individual depends upon his/her age, body weight and physiological status. Adult needs nutrients for maintenance of constant body weight and for ensuring proper body function. Infants and young children grow rapidly and require nutrients not only for maintenance but also for growth. They require relatively more nutrients two to three times per kg body weight than adults. In physiological conditions like pregnancy and lactation, adult women needs additional nutrients to meet the demand for fetal growth and maternal tissue expansion in pregnancy and milk secretion during lactation. Nutritional requirement refers to the amount of food, energy and nutrient needed on an average per day by specific group and sex categories to meet the needs of healthy individuals or normal functioning of the body for work and growth (Burk, 1984).

The energy supplies are of utmost importance that seems to occur in those developing countries where the staple commodities are either are very low in protein content or the protein is very low in quality. Most of the people in developing countries depends on the starchy food and derived their 80% of the total calories from them. The people of those countries are able to obtain about 87% of their calories and 8.9% of their protein from the consumption of all meat, eggs, milk and milk fats combined (Schmitt, 1979).

2.3 Malnutrition

Malnutrition has been defined in different ways some believe that it is a result of an imbalance in the intake of nutrients; whereas other say that it is the result of too little or even too much intake of certain nutrient. There are still other who say it is a clinical syndrome with typical sign and symptoms depending on the types of nutrients responsible for the disease. Nevertheless, both over nutrition and under nutrition are considered malnutrition. Malnutrition has been defined as a pathological state resulting from a relative or absolute deficiency or excess of one or more of the essential nutrients in the diet (Jellife, 1966).

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

Malnutrition remains one of the most common causes of morbidity and mortality among children under five years of age throughout the world (UNICEF, 2005). Worldwide over 10 million children under the age of five years die every year from preventable and treatable illness despite effective health interventions. At least half of these deaths are caused by malnutrition. Malnourished children have lowered resistance to infection; therefore they are more likely to die from common childhood aliments such as diarrheal diseases and respiratory infections. In addition malnourished children that survive are likely to suffer from frequent illness, which adversely affects their nutritional status and locks them into the vicious cycle of recurring sickness, faltering growth and diminished learning ability. In developing countries, malnutrition is a major health problem (Caulfield, 2004).

Malnutrition and the state of deficiency or excess of energy, protein and other nutrients lead to measurable adverse effects on tissues, body functions, appearance and clinical outcomes (Nikolaos *et al.*, 2010). The causes of malnutrition are numerous and multifaceted. These causes are intertwine with each other and are hierarchically related. The most important determinant are poor diet and disease which are themselves caused by a set of underlying factors; household food security, maternal/child caring practices, access to health services and healthy environment. These underlying factors themselves are influenced by the basic socio economic and political conditions.

Study conducted on malnutrition among under five children in Bangladesh revealed that household economic status, mother's education, father's education, mother's antenatal visit, mother's age at birth and mother's BMI are the most significant factor of child's malnutrition (Siddiqi *et al.*, 2011).

Study conducted at Beta-Israel also showed that the main contributing factors for under five malnutrition were found to be sex of the child, child's age, diarrhea episode, deprivation of colostrum, duration of breastfeeding, pre lacteal foods, type of food, age of introduction of complementary feeding and method of feeding (Asres and Eidelman, 2011).

Study conducted in Gimbi district show that the main associated factors of wasting were childhood illness indicated by fever, low household income and maternal lack of education. Low birth size of children, parental lack of education, maternal lack of decision making on use of money and lack of animals were associated with chronic malnutrition (stunting). ARI of children and lack of windows in house are the most important factors of underweight (Zewdu, 2012).

The main important associated factors of under nutrition include education, income, and nutritional situation of parents, access to clean water and sanitation, access to primary health care, sex and age of child. Factors that are contributing to malnutrition may differ among regions, communities and over time. Identifying the underlying causes of malnutrition in a particular locality is important to solve the nutritional problems. Various studies have been made and conclusions were reached by different scholars in the past regarding predictors of health and nutritional status. Survey from available literature indicated that factors like knowledge of health practices, access to or interactions of age of child have strong effect on household and community variables in which the child grows up (Merrill, 1984).

2.3.1 Forms of malnutrition

2.3.1.1 Under nutrition

Under nutrition can be defined as a disturbance of form or function arising from the deficiency of one or more nutrients. Under nutrition can be mild or severe, helpful (if it results in appropriate weight loss in someone who is obese), or dangerous. Weight loss is the manifestations of energy depletion. Serious attention to the problem of under nutrition in hospitals was first given in 1992 with the publication of the King's Fund report, *A positive approach to Nutrition as Treatment* (King Fund., 1992).

A child's right to adequate and appropriate nutrition is stipulated under article 6 and 24 of the Convection on the Rights of Child (UN General Assembly, 1989). In 2010, an estimated 171 million children (167 of whom live in developing countries) were stunted (De Onis *et al.*, 2012). Children who are stunted are at greatest risk of having difficulty learning, playing, engaging in normal child hood activities and being productive members of the society later in life. Undernourished children are also more susceptible to frequent and repeated disease and illness due to a weakened immune response, as well as at a greater risk of becoming

underweight or obese later in life (SAVE, 2012). A child's nutritional future begins with the mother's nutritional status in adolescence and during pregnancy (WHO, 2012).

Young women and mothers are faced with many underlying challenges to fulfilling their nutritional needs, including poverty, lack of education, on healthy diets and infant care, poor access to a diverse variety of affordable, nutritious and safe foods, as well as inadequate health care and sanitation. Gender inequality and restrictive cultural practices exacerbate women's unequal access to appropriate nutrition (De Shutter, 2010).

Women and children are also affected by under nutrition from micronutrient deficiencies or 'hidden hunger', which affects over 2 billion people globally or can lead to reduced growth and cognitive development, birth defects, blindness, and overall poor health. Vitamin A deficiency, iron deficiency, anemia and iodine deficiency disorders are among the most common forms of micronutrient malnutrition (FAO, 1997)

2.3.1.2 Over-nutrition

Alongside under nutrition, a 'double burden' of malnutrition is emerging with rates of obesity and chronic diseases associated with urbanization, aging populations, technological development and globalization of food supply and industry (Galal and Harrison, 2010). Billions of dollars are spent annually by the food industry to promote the consumption of highly refined, high calorie foods with little or no nutritional value (Ebbeling *et al.*, 2002). A 'nutrition transition' is thus taking place, where disease pattern are shifting away from infectious illness towards a higher rate of non-communicable diseases such heart disease, diabetes, and some types of cancer (WHO, 2012).

A least 35 million overweight children are living in developing countries and 8 million in developed countries (WHO, 2011). Children are increasingly exposed to high-fat, high-sugar, high- salt, energy-dense, micronutrient poor foods which tend to be cheaper than healthy foods (WHO, 2011). There is general imbalance in energy intake compared to physical activity levels which is driving the obesity epidemic (Dietz and Gortmaker, 2001). In industrialized countries, child obesity risk is associated with lower household income, women with less education, and single parent household (Grow *et al.*, 2010).

2.3.1.3 Specific Deficiency

It is the pathological state resulting from a relative or absolute lack of an individual nutrient (Jellife, 1966).

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 nutrients (Jellife, 1966).

2.3.2 Nutrition deficiency disorders

2.3.2.1 Protein energy malnutrition

The World Health Organization (WHO, 1973) defined PEM as a range of pathological conditions arising from coincidental lack, in varying proportions, of infants and young children and commonly associated with infections. PEM in early childhood is the predisposing factor that leads to much of the mortality and morbidity in children under five (MOHP, 2006).

2.3.2.1.1 Marasmus

It usually occurs in children under 1 year of age when the quantity of mother's breast milk is insufficient to provide adequate amount of protein and calories for a growing child and when the supplementary feeding is inadequate (Cameron and Hofvander, 1993).

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

A child suffering from marasmus is less than 60% of normal weight for its age. There is little or no subcutaneous fat, so the skin is loose and seems to be too big for the body. The infant looks as an 'old man' or has a 'monkey face'. The muscles are markedly wasted. They are flabby; this can be easily felt on the thigh and buttocks where the muscles should be thick and strong. There is no edema and no change in hair color (Cameron and Hofvander, 1993).

2.3.2.1.2 Kwashiorkor

Kwashiorkor is a Ghanian word meaning “the sickness affecting children deprived of mother’s breast”. Kwashiorkor is far more common among poor communities and the depressed social classes than among privileged people.

It occurs at the time when the calories are adequate but the protein is inadequate. Growth is retarded and although the muscles are wasted and flabby, there is usually more subcutaneous fat than marasmic children. There is also edema; the child appeared ‘moon faced’ and the hair often turns red brown or gray (Cameron and Hofvander, 1993).

2.3.2.1.3 Marasmic Kwashiorkor

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

2.3.2.2 Vitamin A Deficiency Disorder

Vitamin A deficiency (VAD) is a nutritional deficiency of high magnitude that can be caused by insufficient intake of vitamin A food sources or by vitamin absorption, transport or metabolism process. The importance of adequate vitamin A is indisputable, as it has very diverse physiological roles in the visual process, in the integrity of epithelial tissue and immune system, as well as in other metabolic function (WHO, 2009) .

Usually VAD develops in an environment of ecological, social and economic deprivation, in which a chronically deficient dietary intake of Vitamin A coexists with severe infections, such as measles, and frequent infections causing diarrhea and respiratory disease that can lower intake through depressed appetite and absorption, and deplete body stores of vitamin A through excessive metabolism and excretion (Alvarez, 1995). Vitamin A deficiency impairs numerous functions and, as a result, can lead to many health consequences, to which infants, young children and pregnant women appear to be at greatest risk. Xeropthalmia is the most specific VADD, and is the leading preventable cause of blindness in children throughout the world (Sommer and West, 1996). Night blindness often appears during pregnancy, a likely consequence of preexisting, marginal maternal vitamin A status superimposed by nutritional demands of pregnancy and inter-current infections (Christian, 1988). Anemia can result from VAD in children and women, likely due to multiple apparent roles of vitamin A in supporting iron mobilization and transport, and hematopoiesis (West *et al.*, 2007). Preexisting VAD

appears to worsen infections (Scrimshaw *et al.*, 1968) and vitamin A supplementation has been shown to reduce the risk of deaths in 6-59 months children by about 20-30% (Beaton, 1993). Three trials from southern Asia have reported that neonatal vitamin A supplementation reduced mortality by 21% in the first six months of life (Bhutta, 2008) while two other studies conducted in Africa showed no impact of this intervention (Benn, 2008). One study has reported an approximate 40% reduction in maternal mortality following routine dietary supplementation with vitamin A during pregnancy (West *et al.*, 2007). According to World Bank estimates, vitamin A supplementation for preschool age children is one of the most cost effective child survival interventions (World Bank, 1993).

Nepal Micronutrient Status Survey 1988 has revealed that 32% children below 5 years of age and17% of women are being affected by vitamin A deficiency (New Era, 1998). NDHS 2011 shows that 47% of children age 6-23 months consumed foods rich in vitamin A. The proportion of children consuming vitamin A rich food increases with age. Urban children are more likely to consume vitamin A rich foods (58 percent) than children in rural areas (46 percent). Children in the hill zone consume more vitamin A rich foods (54 percent) than children in terai (41 percent). At the sub regional level, children in Eastern mountain region (63 percent) are most likely to consume vitamin A rich foods, and those in the central terai sub regions are least likely (35 percent) (MOHP, 2011).

2.3.2.3 Iron Deficiency Anemia

Iron deficiency anemia is a global health problem and common medical condition seen in everyday clinical practice. Iron deficiency has a substantial effect on the lives of young children and premenopausal women in both low-income and developed countries (McLean *et al.*, 2009).

Iron deficiency affects more than 2 billion people worldwide (McLean *et al.*, 2009), and iron deficiency anemia remains the top cause of anemia, as confirmed by the analysis of a large number of reports on the burden of disease in 187 counties between 1990 and 2010 (Kassebaum *et al.*, 2014) and by a survey on the burden of anemia in person at risk, such as preschool children and young women (Stevens *et al.*, 2013). Preventions programs have decreased the rate of iron deficiency anemia globally; the prevalence is highest in Central and West Africa and South Asia (Kassebaum *et al.*, 2014).

In developing countries, iron deficiency anemia typically result from insufficient dietary intake, loss of blood due to intestinal worm colonization, or both. In high income countries, certain eating habits (e.g., a vegetarian diet or no intake of red meat) and pathological conditions (e.g., chronic blood loss or mal absorption) are the most common causes. Paradoxically, it appears to be more difficult to reduce the prevalence of iron deficiency anemia in high income countries than in low income countries. One reason for this seeming paradox is the high rate of iron deficiency in ageing populations (Stevens *et al.*, 2013).

In Nepal, 46 percent of children are anemic; 27 percent are mildly anemic, 18 percent are moderately anemic, and less than 1 percent is severely anemic. The prevalence of anemia children under age 5 has declined by only 2 percentage points in the past 5 years (MOHP, 2011).

2.3.2.4 Iodine deficiency disorder

Iodine deficiency disorders (IDD) refers to all the adverse effects and consequences of iodine deficiency in a population that can be prevented by ensuring an adequate intake of iodine (United Nations Children's Fund). Effects of iodine deficiency-goiter and cretinism have been observed since ancient times. Dietary treatment has been known nearly as long, making iodine deficiency perhaps the earliest nutritional disease to be recognized (Gillie, 1978). Control programs through fortification of salt with iodine compounds have been implemented, usually following legislation, in more than 50 countries since the 1940's (De Maeyer *et al.*, 1979); Switzerland was the earliest, in the 1920's, to legislate salt iodization.

The principle factor related to the occurrence of IDD, is inadequacy of iodine intake due to the environmental deficiency of this essential element. This occurs where iodine is leached out and washed away from soil by glaciers and heavy rains in the hilly and mountainous areas like Ades, the Himalayans, the Alps and the Pyrenees. However, it is now clear that IDD are significantly prevalent also in plain, flooded riverine and even coastal areas - almost wherever they are looked for in developing countries (Stanbury, 1985). Inadequacy of iodine intake, although the major cause, is not the only factor responsible for all cases of IDD. For instance, the degree of iodine deficiency is not always related to severity of goiter in communities with low iodine intake (Delange *et al.*, 1968). Some degrees of goiter persist in regions where iodine intake is apparently inadequate (Gaitan *et al.*, 1978), and not all affected people benefit to the same extent from iodine supplementation (Ingenbleek and De Visschen, 1979).

Iodine deficiency disorder (IDD) is a public health problem in Nepal and government programs have been geared towards promoting universal salt iodization (USI) since 1998 under a five year Plan of action for Control of IDD (1998-2003) in collaboration with UNICEF and JICA (MOHP., 2005). The fortification of salt with iodine is the most common method of preventing IDD. Fortified salt that contains 15 parts per million (ppm) or more iodine at the consumption level is considered s adequately iodized to prevent IDD. Previous national surveys in Nepal have indicated that nearly 95% of the households in Nepal use salt with some iodine (MOHP., 2005).

73% of children live in household that use adequately iodized salt, with more children in urban (91%) than rural (71%) areas living in such households. The percentage of children living in such households that use adequately iodized salt is lowest in the Far-western development region (51%), particularly the Far-western hill sub regions (41%). 80% of the household use salt that is adequately iodized (15+ ppm) (MOHP, 2011). The proportion of households that use adequately iodized salt has increased by 38% since 2005, when the figure was only 58% (MOHP, MI and New Era, 2005).

2.4 Infant and child mortality

Infant and child mortality rates are important indicators of country's socioeconomic and development and quality of life, as well as health status. Measures of childhood mortality also contribute to better understanding of progress of population, health programs and policies. Analyses of mortality measures are useful in identifying promising directions for health and nutrition programs and improving child survival efforts in Nepal. Disaggregation of these mortality measures by socioeconomic and demographic characteristics help to identify differentials in population subgroups and target high risk groups for effective programs. Measures of childhood mortality are also useful in childhood projections.

Childhood mortality in general and infant mortality in particular are often used as broad indicators of social development as specific indicators of health status. Childhood mortality rates are often used for monitoring a country's progress towards Millennium Development Goal 4, which aims for two third reduction in child mortality by the year 2015 (UNDP, 2011).

Neonatal mortality in the most recent period (2006-2010) is 33 deaths per 1,000 live births. This rate is two and half times the post-neonatal rate (13 deaths per 1,000 live births) during the same period. Therefore, the risk of dying any Nepalese child who survived the first month of life is reduced by two fifths (i.e., 39 percent) in the remaining 11 month of the first year of life. Infant and under five mortality rates in the past five years are 46 and 54 deaths per 1,000 live births, respectively. At these mortality levels, one in every 22 Nepalese children dies before reaching age 1, and one in every 19 does not survive to his/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 (MOHP, 2011).

Infant and child mortality is higher in rural areas than in urban areas. Infant mortality in rural areas is 55 deaths per 1,000 live births, compared with 38 deaths per 1,000 live births in urban areas. Moreover, there are wide differentials in infant and under-five mortality by ecological zone, with under-five mortality ranging 62 deaths per 1,000 live births in the terai zone to 87 deaths per 1,000 live births in the mountain zone. Under-five mortality is higher in the Far-western and Mid-western development regions than in other regions. Similarly, infant mortality is highest in the Far- western development region (65 deaths per 1,000 live births) and lowest in the Eastern development region (47 deaths per 1,000 live births) (MOHP, 2011).

2.5 Breastfeeding practices in Nepal

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

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

- Exclusive breastfeeding for the first six months of life.
- Continued breast feeding for two years or more.
- Safe, appropriate and complementary foods beginning at six months of age.

- Frequency of complementary feeding: two times per day for 6-8 months old; three times per day for 9-11months.
- It is also recommended that breastfeeding be initiated within 1 hour of birth.

Breastfeeding decreases the incidence or severity of diarrhea (Dewey *et al.*, 1995), lower respiratory infection (Wright *et al.*, 1989), bacterial meningitis (Cochi *et al.*, 1986) botulism (Arnon, 1984), urinary tract infections (Pisacane *et al.*, 1992), and necrotizing enterocolitis (Lucas *et al.*, 1990). Other studies suggest that breastfeeding may protect against sudden infant death syndrome (Ford *et al.*, 1993), insulin dependent diabetes mellitus (Gerestein, 1994), Crohn's disease (Koletzko *et al.*, 1989), ulcerative colitis (Rigas *et al.*, 1993), lymphoma (Davis *et al.*, 1988), allergic disease and other chronic digestive diseases (Sveger, 1985). According to AAP, breastfeeding also enhances cognitive development. A number of studies indicate possible health benefits for mothers as well, specifically, a reduction in hip fractures after menopause (Cumming, 1993), less postpartum bleeding (Chua *et al.*, 1994), reduced risk of ovarian cancer and premenopausal breast cancer (Newcomb *et al.*, 1994).

Breastfeeding in Nepal is almost universal, and exclusive breastfeeding for the first six months is widespread. 70 percent of children less than six months of age are exclusively breastfeed. This is an improvement from 2006 NDHS, where the figure was 53 percent. 88 percent of infants age 0-1 months and 74 percent of infant age 2-3 months receive breast milk only, compared to 53 percent of infant age 4-5 months. 10 percent of children under 6 months receive plain water in addition to breast milk, and 9 percent receive other milk other than breast milk. Ninety three percent of all children are still breastfeeding at age 1, and the same proportion are still breastfeeding at age 2. Four out of five Nepalese children age 0-23 months are breastfed appropriately for their age. This includes exclusive breastfeeding for children age 0- 5 months and continued breastfeeding along with complementary food for children age 6-23 months. Four-fifths of children under six months are predominantly breastfed. This percentage includes children who are exclusively breastfed and those who receive breast milk and only plain water or non-liquid source such as juice. 6 percent of children under age two are bottle fed (MOHP, 2011).

The median duration of exclusive breastfeeding for all children is 4.2 months and the mean duration is 5 months. These figures are higher than those reported in 2006, where the median duration of exclusive breastfeeding was 2.5 months and the mean duration was 4 months. Similarly, the median duration of predominant breastfeeding is 5.4 months.

Predominant breastfeeding is lower (4 months) among children of better educated mothers (SLC and above) than among children of mothers with no education (7 months) (MOHP, 2011).

2.6 Weaning practice

The word weaning comes from the word "wemin" which means to accustom. Weaning begins from the moment supplementary foods is started and continues till the child is taken off the breast milk completely (Srilakshmi, 2002).

Weaning pattern is the process of providing other nutritive food to the child besides mother's milk. Such foods help the child to grow in healthy way and to keep the children away from malnutrition. Growing children cannot only depend on mother's milk, so other foods should be given to the child in required quantity. If the baby is hungry and when the mother is absent, the baby may be fed with jaulo, milk, etc. This provides the temporary relief, although it is inappropriate for infants less than four months old (Vaidya, 1987).

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 psychological 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 is required and when foods should be easily digestible (Jellife, 1966).

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

In an under developed country like Nepal the average family food, "*Dal bhat*" in small quantities and in diluted form is given to the child, especially in the hills among low income group families, is "*Dhindo*". Roasted soybean or corn, flattened rice (*chiura*) and puffed rice are also given as snack food.

2.7 Assessment of Nutritional Status

Assessment of nutritional status of community is one of the first steps in the formulation of any public health strategy to combat malnutrition. The principal aim of such an assessment is to determine the type, magnitude and distribution of malnutrition in different geographic areas to identify at risk groups and to determine the contributory factors. In addition, fractural evidence of the exact magnitude of malnutrition is essential to sensitize administrators and politicians to obtain allocation of materials and human resources and to plan appropriately (Srilakshmi, 2002).

The assessment of nutritional status can be done by using following information (WHO, 1966).

a) Direct method: Deals with the individual and measures objective criteria. e.g. anthropometric, clinical examination, biochemical and bio-physical parameters.
b) Indirect method: Use community indices that reflect the community nutritional status or need. e.g. dietary intake, morbidity and mortality rates, as specific mortality and vital statistics.
c) Ecological factors: e.g. Socioeconomic status, housing and environmental hygiene, health and education services, conditioning infection.

2.8 Anthropometric measurement

Anthropometry is the study of the measurement of the human body in terms of the dimensions of bone, muscle, and adipose (fat) tissue. The word “anthropometry” is derived from the Greek word “anthropo” meaning “human” and the Greek word “metron” meaning “measure” (Ulijaszek, 1994). The field of anthropometry encompasses a variety of human body measurements. Weight, stature (standing height), recumbent length, skinfold thickness, circumferences (head, waist, limb, etc.), limb lengths, and breadths (shoulder, wrist, etc.) are the examples of anthropometric measures.

Growth assessment is the single measurement that best defines the health and nutritional status of children because the disturbance in health and nutrition, regardless of their etiology, invariability affect child growth. The most commonly used anthropometric indices for assessing child growth are weight for age, weight for height, height for age and mid upper arm circumference (Onis and Habitch, 1997).

2.8.1 Height for age

The height of an individual is made up of the sum of four components; leg, pelvis, spine and skull. While for detailed study of body proportions, all of these measurements are required, in the field nutritional anthropometry usually only the total height is measured (WHO, 1966).

The height for age index provides an indicator of linear growth retardation and cumulative growth deficits in children. Children whose height for age z-score is below minus two standard deviation (-2 SD) from the median of WHO reference population are considered short for age (stunted) or chronically malnourished. Children below minus three standard (-3 SD) deviation are considered severely stunted. Stunting reflects failure to receive adequate nutrition over a long period of time and is affected by recurrent and chronic illness. Height for age, therefore, represents the long term effects of malnutrition in a population and is not sensitive to recent, short term changes in dietary intake.

2.8.2 Weight for height

The weight for height index measures body mass in relation to body height or length and describes current nutritional status. Children with z-score below minus two standard deviation (-2SD) are considered thin (wasted) or acutely malnourished. Wasting represents the failure to receive adequate nutrition in the period immediately preceding the survey and may be the result of inadequate food intake or recent episode of illness causing loss of weight and the onset of malnutrition. Children with a weight for height index below minus three standard deviation (-3 SD) are considered severely wasted. The weight for height index also provides data on overweight and obesity. Children more than two standard deviations (+2 SD) above the median weight for height are considered overweight or obese.

2.8.3 Weight for age

Weight is the anthropometric measurement most in use. Its potential value, especially for children, is appreciated not only by health personnel, but often by less educated parents, for whom it is useful as a source of health education (WHO, 1966).

Weight for age is a composite index of height for age and weight for height. It takes into account both chronic and acute malnutrition. Children whose weight for age is below minus two standard deviations (-2 SD) are classified as underweight. Children whose weight for age is below minus three standard deviations (-3 SD) are considered severely underweight.

2.8.4 MUAC (Mid Upper Arm Circumference)

The use of mid upper arm circumference (MUAC) has improved the ability of front line health workers to screen and assess for acute malnutrition among children by increasing the reach and enhancing the quality of Community Based Management of Acute Malnutrition (CMAM) services (Collins, 2006). In 2009, the World Health Organization (WHO) and UNICEF published updated guidelines recommending a MUAC cutoff of <11.5 cm as one of three screening criteria for identifying and managing severe acute malnutrition in infants and children 6-60 months (WHO and UNICEF, 2009). Largely due to guidance from WHO and UNICEF on a standardized cut off, MUAC has become a widely used and successful diagnostic tool for screening children and determining eligibility for services to manage acute malnutrition (Brown *et al.*, 2009). Measurement if MUAC requires minimal equipment and calculations as compared to height and weight measurements for calculation of body mass index (BMI) (weight [in kg] / height [in meters]^2) or other anthropometric measurements, such as skin fold thickness.

Numerous studies have shown that MUAC correlates well with BMI in adult populations (Mazicioglu, 2010). However, globally recognized MUAC cut offs have not been established to classify malnutrition among adolescents and adults. Many countries and programs have established their own MUAC cut offs to determine eligibility for program services (Republic of Zambia Ministry of Health and FANTA 2011, Federal Democratic Republic of Ethiopia Ministry of Health and Social Services and FANTA 2008), but there is limited evidence supporting these cutoffs and it is not known whether these cut offs are optimal.

Part III

Materials and Methods

3.1 Research instruments

Instruments and equipment used during the survey were:

a) Weighing machine (Seca scale): The weight of the child measured using Seca Scale. Child weighing capacity of 100 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: Shakir's 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. (see Appendix**)**

3.2 Research Method

The study was quantitative and based on primary data. A community based cross sectional survey was conducted in Inaruwa-7, Sunsari 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 area was Inaruwa-7 of Sunsari district, Nepal located in the eastern development region. Generally people of low socioeconomic status reside here.

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: caste, head of households, family types, family size, income, occupation, education and food availability.
b) Child characteristics: Age, sex, birth weight.
c) Child caring practices: Feeding, hygiene, health care seeking.
d) Maternal characteristics: Age, ANC visits, extra food during pregnancy/lactation, care during pregnancy/lactation, intake of iron tablets.
e) Environmental health condition: Water supply, sanitation, fuel for cooking.

3.5 Target population

Children under five years of age were included as target population of the study.

Inclusion and exclusion criteria:

Inclusion criteria: Children aged 6-59 months who live in Inaruwa-7 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. In household with more than 1 children of age between 6-59 months, one child was chosen by lottery method.

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 age of (6-59) months living in Inaruwa-7. Altogether 89

children were selected as sample during the survey. In households with more than one child between the age of 6-59 months, one child was selected by lottery method.

3.8 Pre testing

The study was conducted among under five 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 Inaruwa Municipality, 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 anthropometric measurements. Foam 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. The questionnaire comprised mainly of details on household profiles like age,

sex, educational level, occupation of household members, etc. Anthropometric measurements taken for children aged (6-59) months included:

Date of birth: Date of birth was inquired from caretakers and recorded in months.

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 and were on minimal cloths.

MUAC: Shakir's 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 interferential 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

Permission to conduct survey in Inaruwa-7 was obtained from the office of Inaruwa municipality.

Prior consent to conduct the research was obtained from the parents of the respective children. General discussion with the respondents was held to take their consent as well as inform the importance of the study to get their actual prevailing nutritional status. They were assured that the data collected only be used for study purpose with the uttermost confident.

Part IV

Results and Discussion

An anthropometric and household schedule questionnaire survey was conducted in Inaruwa-7 of Sunsari district covering 89 households to gauze the nutritional status of (6-59) months children and factors that are associated with it. The study result had 100% response rate. Some of the important findings of the study are listed below.

4.1 Demographic and socioeconomic characteristic

Table 4.1 Demographic characteristics of the study population (n=89)

Variable	Frequency	Percent
Caste		
Brahmin	11	12.4
Chhetri	2	2.2
Janjati	72	80.9
Dalits	4	4.5
Family type		
Nuclear	55	61.7
Joint	34	38.3
Family size		
1 to 4	32	36
5 to 8	43	48.3
9 to 12	12	13.5
More than 12	2	2.2
Father's educational status		
Illiterate	7	7.9
Primary	10	11.2
Lower secondary	12	13.5
Secondary	32	36
Higher secondary	22	24.7
Bachelor	6	6.7

Table 4.1 shows that out of the 89 households, 12.4% were *Brahmin*, 2.2% were *Chhetri*, 80.9% were *Janjati* and 4.5% were *Dalits*. 61.7% of families were nuclear and 38.3% were joint. The breakdown for family size of household is as follows; household with 1 to 4 members (36%), 5 to 8 members (48.3%), 9 to 12 members (13.5%) and with more than 12 members (2.2%) respectively. The educational status of the father of children was superseded by secondary level (36%) followed by higher secondary level (24.7%), lower secondary level (13.5%), primary level (11.2%), illiterate (7.9%) and bachelor level (6.7%).

Most of the families in the survey area were nuclear. Nuclear families relatively have better advantages than joint ones which include financial stability, consistency in raising children, strong support system and emotional bonding. Only few percentage of fathers were uneducated in the study area. A study conducted by Pramod in rural terai of eastern Terai showed that educated father had significantly lower number of malnourished children than uneducated ones (Pramod, 2005). This could be due to the fact they could be earning more, are aware of health and nutrition. Educated fathers are exposed to mass media and other opportunities which make expectations of their children much higher than those who are uneducated.

Table 4.2 shows that maximum households (30.3%) were engaged in some type of business and 23.6% were labor work while 18%, 14.6% and 13.5% were engaged in service, foreign employment and agriculture respectively. Considering the estimated annual income depicted in Table 4.2, of all respondents, those with annual income between NRs one hundred thousand to three hundred thousand had the highest percentage (70.8%) and the household that earn below one hundred thousand and above three hundred thousand annually were 22.5% and 6.7%. It was found that 93.3% of the household had enough food for more than 12 months. The house were mostly owned by the respondents themselves (87.6%) and 12.4% were living in rented house. In 59.6% of the household, husband made decision regarding the use of money in the family.

The major occupation of the people in this area was agriculture. But nowadays due to urbanization, people are more attracted towards business. Some are also dependent on foreign employment to sustain their livelihood. Enhancement of the social and economic progress of the people is needed. For example, by increasing household income and employment opportunities for better jobs. Because of the male dominated society, in most of the family

husband made decision regarding the use of money in the family. However, this concept is slowly changing.

Table 4.2 Socioeconomic characteristics of the study population (n=89)

Variable	Frequency	Percent
Occupation		
Agriculture	12	13.5
Service	16	18
Labor	21	23.6
Business	27	30.3
Foreign employment	13	14.6
Annual income		
Less than 100,000	20	22.5
Between 100,000 and 300,000	63	70.8
More than 300,000	6	6.7
Food availability		
More than 12 months	83	93.3
6-12 months	6	6.7
3-6 months	0	0
Household type		
Own	78	87.6
Rented	11	12.4
Decision on making use of money		
Husband	53	59.6
Wife	36	40.4

4.2 Child Characteristics

Table 4.3 depicts that from the total of 89 children included in this study 53.9% were girls and 46.1% were boys. The children of age 6-59 months were categorized according to WHO standard in five groups which showed that majority of them were in age group of 12-23 months (30.3%), followed by age groups of 36-47 months (20.2%), 48-59 months (20.2%), 24-35 months (18.1%) and 6-11 months (11.2%). 87.6% percent of children had more than 2.5 kg of birth weight while 9% had birth weight lesser than 2.5 kg and remaining 3.4% were

unknown about the birth of their children. 76.4% families under the survey had only child below five years of age while 22.5% and 1.1% families had two and three children respectively.

Table 4.3 Child characteristics of study population (n=89)

Variables	Frequency	Percent
Gender		
Male	41	46.1
Female	48	53.9
Age Groups (months)		
6-11	10	11.2
12-23	27	30.3
24-35	16	18.1
36-47	18	20.2
48-59	18	20.2
Weight of child during birth		
Less than 2.5 kg	8	9
More than 2.5 kg	78	87.6
Not in memory	3	3.4
Number of under five children		
One	68	76.4
Two	20	22.5
Three	1	1.1

Most of the child had birth weight more than 2.5 kg. Child with birth weight more than 2.5 kg are considered to be healthy. But child with birth weight less than 2.5 kg are vulnerable and relatively more prone to various diseases. Few families had more than two under five children. It may be due to increasing awareness among people about family planning and advantages of having less number of children.

4.3 Child caring practices

Table 4.4 Distribution of different child caring practices (n=89)

Variables	Frequency	Percent
Time of initiation of breastfeeding		
Within 1 hour	30	33.7
Between 1 and 8 hours	26	29.2
Between 8 and 24 hours	3	3.4
After 24 hours	26	29.2
Not in memory	4	4.5
Colostrum feeding		
Yes	64	71.9
No	22	24.7
Not revealed	3	3.4
Intake of other food prior to breastfeeding		
Nothing	71	79.8
Water	1	1.1
Honey and ghee	5	5.6
Cow milk	1	1.1
Not revealed	11	12.4
Time of initiation of weaning food		
Before 6 months	12	13.5
After 6 months	77	86.5
Type of complementary food		
Lito	21	23.6
Jaulo	14	15.7
Similar to family members	54	60.7
Iodized salt consumption		
Yes	89	100
No	0	0
Treatment center		
Pharmacy	6	6.7
Nearby health center	83	93.3

Table 4.4 depicts that breastfeeding was initiated within the first hour of birth by 33.7% of mothers. Among others, 29.2% of them started breastfeeding between 1 to 8 hours of birth, 2.4% between 8 to 24 hours of birth, 29.2 % after 24 hours of birth while 4.5% of mothers did not remember the exact first time of initiation of breast milk. 71.9% of mothers had fed colostrum to their baby and 24.7% did not feed colostrum to their baby while 3.4% could not remember whether they fed colostrum to their baby or not. All children were exclusively breastfed for the first six months.

79.8% of children were fed nothing before initiation of breast milk while 1.1%, 5.6% and 1.1% fed water, honey or ghee and cow milk respectively and 12.4% of them did not revealed answer to the question.

Regarding weaning practices, about 13.5% of children were introduced to solid or semi-solid foods before six months of age. 86.5% of children were weaned after six months. The type of complementary food given to children was same as other family members in 60.7% children followed by lito (60.7%) and jaulo (15.7%).

Almost 100% of the families used adequately iodized salt in the study area. Regarding Vitamin A supplementation, all children were given Vitamin A capsule during the last vitamin A campaign. The preference of health services for treatment of children during acute illness was highest to nearby health post 82 (92.1%) followed by pharmacy 6 (6.8%) and traditional healer 1 (1.1%). 85.4% of children had suffered from diarrhea at some stages of their life while 14.6% were still unaffected by the disease.

Positive attitude and practices towards the early initiation of breastfeeding and colostrum feeding was seen. Their knowledge regarding breastfeeding and colostrum feeding may have improved because of the community based intervention of maternal and neonatal child programs by government through health system. These health and nutrition education from various government and health institutions improved their knowledge resulting in better child caring practices.

Initiation of weaning food at 6 months is comparatively higher (86.5%) than NDHS finding (66%) (MOHP, 2011). About 100% of the families used adequately iodized salt in the surveyed area. This finding is similar to Nepal Demographic and Health Survey 2011 which revealed that more than 95% of the household were using iodized salt (NDHS, 2011). Similarly the effectiveness of National Vitamin A supplementation program was similar to

that of the country as the national data on Vitamin A supplementation which showed nine in ten children aged 6-59 months received vitamin supplementation (NDHS, 2011). This may be due to increasing awareness of people regarding child vaccination and availability of health facilities.

4.4 Maternal Characteristics

Table 4.5 shows that 34.8% of mothers had secondary level education while 21.4% with lower secondary, 18% with higher secondary and 11.2% with primary level of education. 11.2% were illiterate and 44.5% had bachelor degree.

It was found that in most of the families, mother occupation was found to be housewife with the highest percentage of 86.5% followed by business (5.6%), service (4.5%), labor (2.2%) and agriculture (1.1%). Survey shows that maximum mothers were between the age group of 20 to 30 years, 10.1% were had more than 30 years of age and 5.6% were below 20 years of age.

88.7% of mothers had taken iron and folate tablets during pregnancy. 5.6% of them did not consume the tablets and 5.6% of them were unfamiliar about the term. 60.7% of the mothers were supplemented with Vitamin A capsule within 45 days of lactation while 32.6% had not received the supplements and 6.7% were unfamiliar about it. About 42.5% of mothers had the knowledge about malnutrition while 57.3% of mothers were still unfamiliar about the term.

Mother educational level plays a significant role on the nutritional status of children as well as on the health of family members. The research showed that large number of mothers in the survey area were literate. Educated mother have more opportunities to be informed and be aware about health are, better nutrition, child development, etc. as compared to uneducated mother. However most of them were not engaged in any profession .i.e. they were housewife. It might be because of their dependency on male members to run their family. Only few mothers were of age below 20 years were present which shows they had become aware that marriage should be done only after 20 years of age.

Table 4.5 Distribution of maternal characteristics in study population (n=89)

Variables	Frequency	Percent
Mothers educational status		
Illiterate	9	10.1
Primary	10	11.2
Lower secondary	19	21.4
Secondary	31	34.8
Higher secondary	16	18
Bachelor	4	4.5
Mother occupation		
Housewife	77	86.5
Agriculture	1	1.1
Service	4	4.5
Labor	2	2.2
Business	5	5.6
Age of mother		
Less than 20 years	5	5.6
Between 20 to 30 years	75	84.3
More than 30 years	9	10.1
Iron and folate tablets		
Yes	79	88.7
No	5	5.6
Not revealed	5	5.6
Intake of Vitamin A capsule within 45 days		
Yes	54	60.7
No	29	32.6
Not familiar	6	6.7
Knowledge on malnutrition		
Yes	38	42.7
No	51	57.3

4.5 Environmental and Hygiene Characteristics of the Households

Table 4.6 Environmental and Hygiene Characteristics of the Households (n=89)

Variables	Frequency	Percent
Source of drinking water		
Tube well	70	78.7
Tap water	19	21.3
Purification of water		
Yes	37	41.6
No	52	58.4
Method of purification (n=37)		
Filtration	8	21.6
Boiling	29	78.4
Source of fuel		
Firewood	36	40.5
LP gas	53	59.5
Toilet facilities in the house		
Yes	89	100
No	0	0

Table 4.6 shows that most of the people used tube well as the main source of drinking water. Out of the total respondents, 78.7% of respondents used tube well and 21.3% of them used tap water for drinking purposes. Only 37 (41.6%) of the households purified water for drinking purposes while the rest 52 (58.4%) did not. Among 37 households who purified water, 78.4% of them boiled it while 21.6% of them filtered before drinking. The largest percentage of households used LP gas (59.5%) as a source of fuel for cooking purposes followed by firewood (40.5%). 100% of households had toilet facility in the survey area.

The people in the surveyed area had good source of drinking water. But most of the utensils used for collecting water from the tube well were found to be yellowish in color. It may be due to high concentration of iron or arsenic in the water. Although the use of LP Gas for cooking food had increased over the recent days, people were still dependent on firewood. Greater coverage on toilet facilities was seen as the government had focused on toilet facilities, knowledge regarding health and disease in the recent period.

4.6 Prevalence of Malnutrition

4.6.1 Weight for Height

Table 4.7 shows that among 89 children, 89.9% of children were found to be normal (≥-2 and < 2 z-score). 6.7% were found to be wasted (≥-3 and<-2 z-score) and 2.2% were severely wasted (<-3 – score) while 2.2% were found to be overweight (z-score ≥2). The prevalence of wasting was found high among the age group of 6-11 months but all children between the age group of 24-35 months and 36-47 months were found to be normal. About 89% of the children were found to be normal.

Table 4.7 Prevalence of wasting among 6-59 month age based on z-score values of WHO

	Weight for Height Z-score (WHZ) class			
Age Group (months)	**Normal**	**Wasted**	**Severely wasted**	**Overweight**
6-11	7 (70%)	2 (20%)	1 (10%)	0
12-23	23 (85.2%)	2 (7.4%)	1 (3.7%)	1 (3.7%)
24-35	16 (100%)	0	0	0
36-47	17 (94.4%)	0	0	1 (5.6%)
48-59	16 (88.9 %)	2 (11.1%)	0	0
Total	**79 (88.9%)**	**6 (6.7 %)**	**2 (2.2%)**	**2 (2.2%)**

Nepal Demographic and Health Survey NDHS (2011) showed that 11% of children were wasted in Nepal which was slightly more than the finding in the survey area. The result of the study revealed that the prevalence of wasting was also lower than NDHS (2011), result of eastern terai where wasting was found to be 10.3%. However the result was found somewhat similar to NDHS (2011) result of western hill where wasting was found to be 7.9%. Acute malnutrition is affected by the present state of living condition and environment. Wasting in an individual children and population groups can change rapidly and shows marked seasonal patterns associated with change in food availability or disease prevalence.

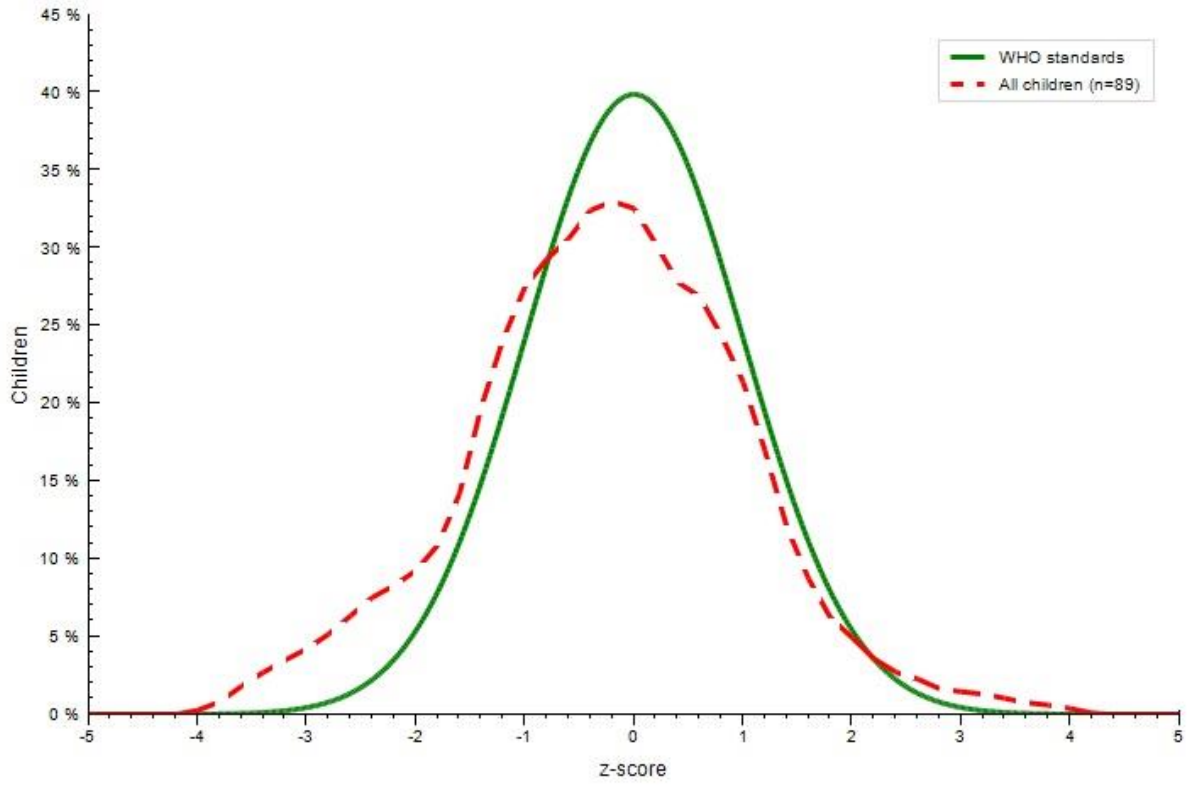


Fig 4.1: Distribution of wasting among (6-59) months children of Inaruwa-7 based on WHO standard (n=89)

The WHZ curve compared with WHO standards for combined sex is shown in figure 4.1. Regarding Weight for Height, 6.7% children were below -2 S.D. and 2.2% children were below -3 S.D. while 2.2% children were above +2 S.D.

4.6.2 Height for Age

According to Height for Age (Table no 4.8), 71.9% of children were found to be normal (≥-2 and <2 z-score). 21.3% of children were stunted (≥-3 and <-2 z-score) and 6.8% were severely stunted (<-3 z- score).

Stunting in early stages of one's life is associated with adverse functional effects, including cognition deficiencies, educational performance, low adult incomes, loss of productivity and, when accompanied by too much weight increase later in childhood, increased risk of nutrition-related chronic diseases (Cousens *et al.*, 2010).The prevalence of stunting was found highest among the age group of 48-59 months in the survey area. As a child's age increases, the process of weaning, the introduction to new types of feeding, make him or her to be more exposed to the risks of stunting.

Table 4.8 Prevalence of stunting among 6-59 month age based on z-score value of WHO

		Height for Age Z-score (HAZ) class	
Age Group (months)	**Normal**	**Stunted**	**Severely stunted**
6-11	10 (100%)	0	0
12-23	19 (70.4%)	5 (18.5%)	3 (11.1%)
24-35	11 (68.8%)	4 (25%)	1 (6.2%)
36-47	13 (72.2%)	4 (22.2%)	1 (5.6%)
48-59	11 (61.1%)	6 (33.3%)	1 (5.6%)
Total	**64 (71.9%)**	**19 (21.3%)**	**6 (6.8%)**

According to Nepal Demographic and Health Survey (NDHS) 2011, 41% of children under five years of age were stunted. The result obtained is slightly lower than the national survey. The result of the study also revealed that the prevalence of stunting was similar with NDHS (2011), result of eastern terai. Stunting indicates chronic malnutrition. A case of stunting is probably not just a question of food availability in that household. Improper feeding practices have a major role with acute infection of diarrhea. This condition is especially detrimental to child growth and nutrition. Stunting, usually results from extended periods of inadequate food intake, disease or a combination of both, especially during the period of greatest growth for children when the slowing of skeleton growth results in reduced stature or length (Johns and Eyzaguirre, 2000).

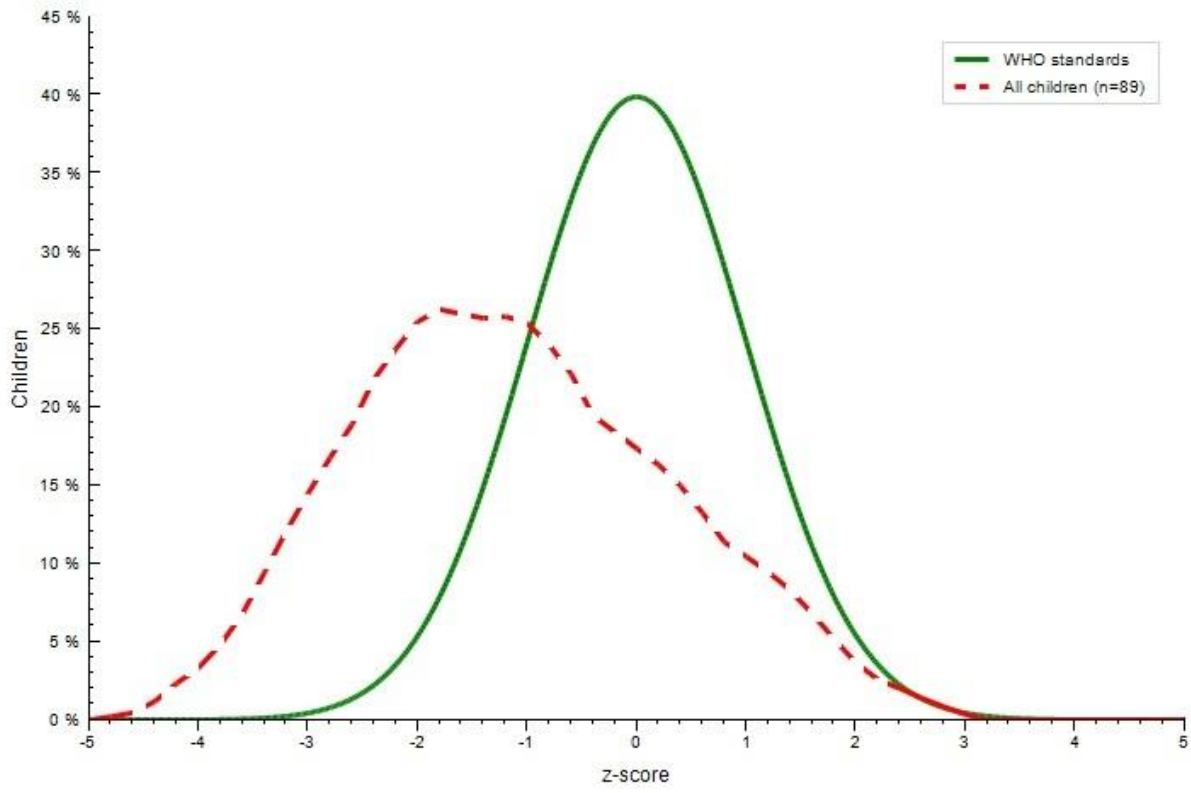


Fig 4.2 Distribution of stunting among 6-59 months children in Inaruwa-7 based on WHO standard (n=89)

The HAZ curve compared with WHO standards for combined sex is shown in figure 4.2. Regarding Height/ Length for Age, 21.3% of children were below -2 S.D. and 6.8% of children were below -3 S.D.

4.6.3 Weight for Age

Results of the survey show that 89.9% of children were found to be normal (≥-2 and<2 z-score), 7.9% were underweight (≥-3 and <-2 z-score) and 2.2% were severely underweight (<-3 z-score). Underweight was found highest among the age group of 24-35 months and least among the age group of 6-11 months children.

According to NDHS 2011, 29% of children under five years of age are underweight. The result of this study is somewhat lower than the national average. This may be different because of the study period, socioeconomic characteristics, health service delivery and geographical characteristics of the study area. The result of the study showed that the prevalence of underweight was lower compared to NDHS (2011) result of Eastern Terai 24%.

Table 4.9 Prevalence of underweight among 6-59 months age based on z-score value of WHO

		Weight for Age Z-score (WHZ) class	
Age Group	**Normal**	**Underweight**	**Severely underweight**
6-11	9 (90%)	1 (10%)	0
12-23	24 (88.9%)	1 (3.7%)	2 (7.4%)
24-35	13 (81.3%)	3 (18.7%)	0
36-47	16 (88.9%)	2 (11.1%)	0
48-59	15 (83.3%)	3 (16.7%)	0
Total	**77 (86.5%)**	**10 (11.2%)**	**2 (2.3%)**

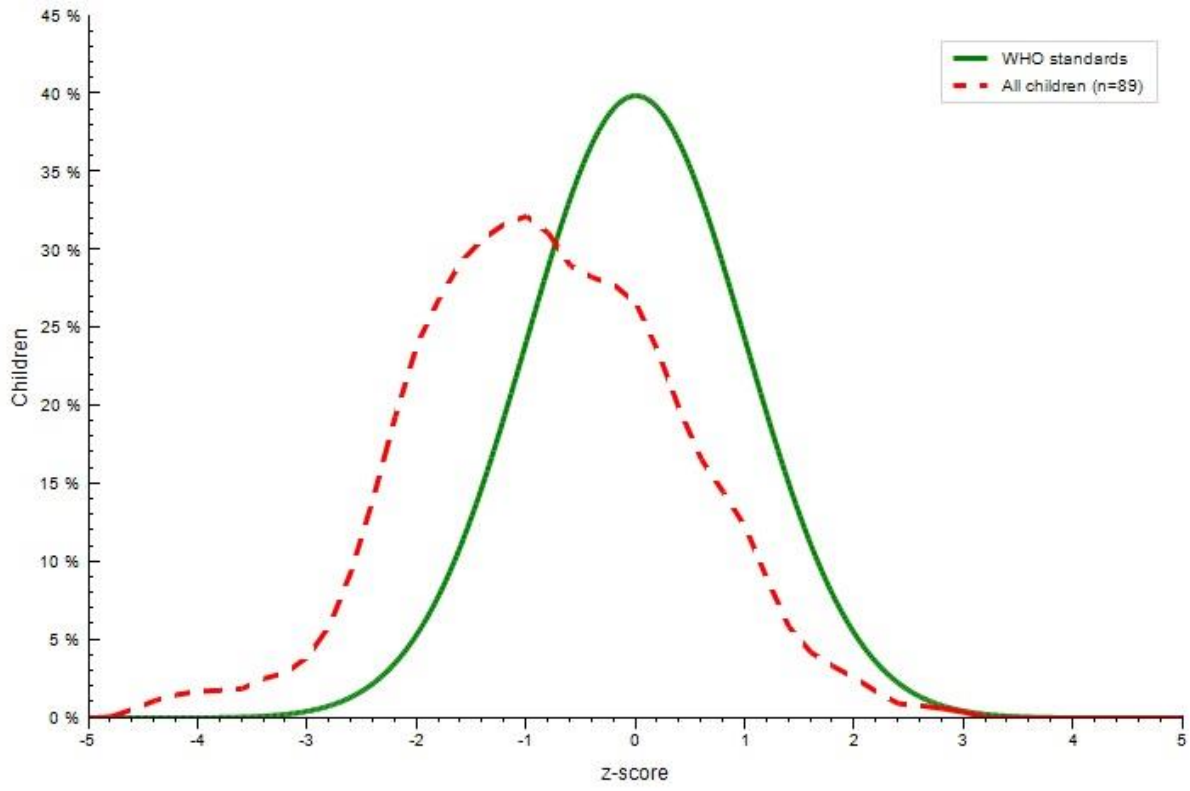


Fig 4.3 Distribution of underweight among 6-59 months children in Inaruwa-7 based on WHO standard (n=89)

The WAZ curve compared with WHO standards for combined sex is shown in fig 4.3. Regarding Weight for Age 11.2% of children were below -2 S.D and 2.3% children were below -3 S.D.

4.6.4 Mid Upper Arm Circumference

Table 4.10 shows that 88.8% of children were found to be normal based on MUAC value as obtained from Shakir's tape. 4.5% were severely malnourished (MUAC <115 mm) and 6.7% were moderately malnourished (MUAC 115mm-125 mm).

Table 4.10 Classification of malnutrition based on MUAC (n=89)

Class	MUAC reading	Frequency	Percent
Severe Acute Malnutrition	<115 mm	4	4.5%
Moderate Acute Malnutrition	115 mm-125 mm	6	6.7%
Normal	>125 mm	79	88.8%
Total		**89**	**100%**

4.6.5 Distribution of malnutrition based on sex

Table 4.11 Sex wise distribution of malnutrition

	Characteristics	Boys	Girls	Total
	Severely wasted	1 (2.4%)	1 (2.1%)	2 (2.2%)
WHZ	**Moderately wasted**	4 (9.8%)	2 (4.1%)	6 (6.7%)
	Overweight	1 (2.4%)	1 (2.1)	2 (2.2%)
	Normal	35 (85.4%)	44 (91.7%)	79 (88.9%)
	Severely stunted	4 (9.8%)	2 (4.2%)	6 (6.8%)
HAZ	**Moderately stunted**	8 (19.5%)	11 (22.9%)	19 (21.3%)
	Normal	29 (70.7%)	35 (72.9%)	64 (71.9%)
	Severely underweight	1 (2.4%)	1 (2.1%)	2 (2.3%)
WAZ	**Moderately underweight**	3 (7.3%)	7 (14.6%)	10 (11.2%)
	Normal	37 (90.2%)	40 (83.3%)	77 (86.5%)

Based on WHO growth standard of under nutrition indicators, about 9.8% and 4.1% were wasted, 19.5% and 22.9% were stunted, 7.3% and 14.6% were underweight for boys and girls respectively, (<-2 z-score) (Table 4.11). The study shows that wasting and stunting was higher in boys than girls while in case of underweight, the prevalence was found higher in girls than boys. A study in Sri Lanka revealed that male children were at higher risk as well

as more vulnerable to malnutrition (Jayatissa *et al.*, 2006). The reason behind this could be that male children are more likely to fall ill in the first few years of their lives compare to female children (Agnihotri, 1999).

Figure 4.4 shows that 6.7% children were moderately wasted, 21.3% children were moderately stunted and 11.2% children were moderately underweight. Similarly, 2.2%, 6.8% and 2.3% of children were severely wasted, stunted and underweight respectively. The prevalence of malnutrition in Eastern Terai is 10.3% wasted, 31% stunted and 24% underweight (MOHP, 2011). The survey result concluded that Inaruwa-7 had better nutritional status than National data. This may be difference due to socioeconomic characteristics, health service delivery, availability of facilities and geographical characteristics of study area.

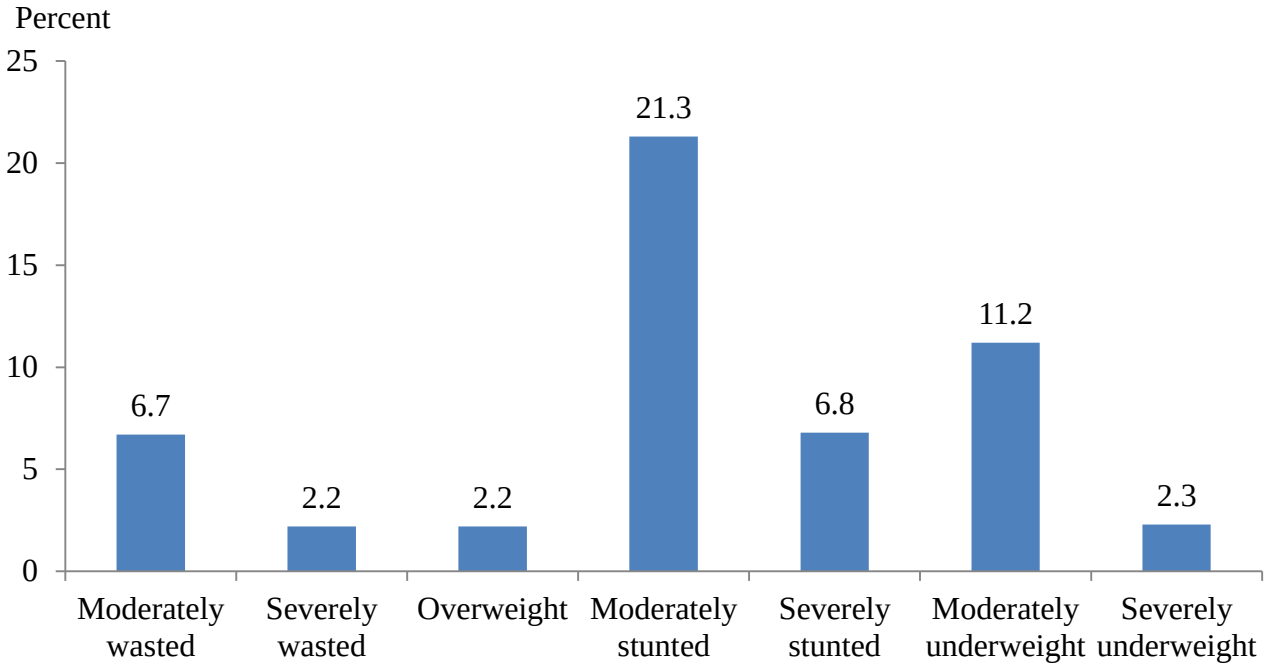


Fig 4.4 Prevalence of malnutrition in Inaruwa-7, Sunsari

Result also revealed that prevalence of malnutrition was lower than a cross-sectional comparative study conducted in Belahara VDC of Dhankuta district in Nepal where the prevalence of underweight, stunting and wasting was 27%, 37% and 11% respectively (Sapkota and Gurung, 2012).

A community based cross-sectional survey conducted West Gojam zone revealed that 49.2 % children were found to be under-weight ,43.2 % of the children under age five were

suffering from chronic malnutrition and 14.8 % acutely malnourished (Teshome *et al.*, 2006). The cross sectional survey conducted rural communities of Tigray region also revealed that, the levels of stunting, underweight and wasting were 42.7%, 38.3% and 13.4%, respectively (Mulugeta *et al.*, 2005).

Study done on malnutrition among under-five children in Bangladesh revealed that, the high prevalence of stunting and underweight, for instance 42% and 40% of under-five children were stunted and underweighted, respectively (Siddiqi *et al.*, 2011). Also study conducted on nutritional status of under- five children in Mongolia showed the prevalence of stunting, wasting and underweight were 15.6%, 1.7% and 4.7% respectively (Otgonjargal *et al.*, 2012).

Similarly, study done at Beta-Israel community revealed that, the prevalence of stunting, underweight and wasting were 37.2%, 14.6%, and 4.5%, respectively. Moreover, severe stunting, severe underweight and severe wasting were seen in 14.8%, 2.9%, and 0.5% of the children respectively (Asres and Eidelman, 2011).

According to research conducted in pre-school children in a rural area of western Kenya, the prevalence of stunting, underweight and wasting were 30%, 20%, and 4%, respectively (Kwena *et al.*, 2003).

4.7 Factors associated with under nutrition

In order to successfully tackle the malnutrition problem in Inaruwa-7, 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.

4.7.1 Factors associated with wasting

Different possible factors were analyzed using Chi- square to find the association with wasting (Table 4.12). Child age group (P = 0.102), gender (P = 0.545), family type (P = 0.735), annual income (P = 0.374), maternal education (P = 0.068), number of under five children (P = 0.922) and weight at birth (P = 0.286) did not showed association with wasting in the study area.

Mother occupation had shown significant association with wasting (P = 0.02). Survey showed wasting was not prevalent in children whose mothers were involved in occupation

like agriculture, service and business. But was prevalent in the families whose mothers were housewife and laborers. It shows that if mothers are involved in income generating occupation, then the risk of wasting could be minimized as they could provide nutritious food to their children, support the family economically and improve the nutritional status of their children.

Table 4.12 Factors associated with wasting among 6 -59 months children in Inaruwa-7

Factors		Wasted	Normal	$א^2$ value	P-value
Child age	< 24 months	6(16%)	31(83.8%)		
Group	≥ 24 months	2(3.8%)	50(96.2%)	2.673	0.102
Gender	Male	5(12.2%)	36(87.8%)		
	Female	3(6.2%)	45(93.5%)	0.367	0.545
Family type	Nuclear	5(9.1%)	50(90.9%)		
	Joint	3(8.8%)	31(91.2%)	0.115	0.735
Annual income	Less than 1 lakh	3(15)	17(85%)		
	1 to 3 lakh	5(7.9%)	58(92.1%)		
	More than 3 lakh	0(0%)	6(100%)	1.968	0.374
Mother	Illiterate	2(22.2%)	7(77.8%)		
education	Up to SLC	6(10%)	54(90%)		
	Above SLC	0(0%)	6(100%)	5.384	0.068
Under 5	<2	6(9%)	61(91%)		
Children	≥2	2(9.1%)	20(90.9%)	0.01	0.922
Birth weight	Less than 2.5 kg	2(25%)	6(75%)		
	More than 2.5 kg	6(7.7%)	72(92.3%)		
	Unknown	0(0%)	3(100%)	2.503	0.286
Mother	Housewife	6(7.8%)	71(92.2%)		
occupation	Agriculture	0(0%)	1(100%)		
	Service	0(0%)	4(100%)	11.66	0.02*
	Labor	2(100%)	0(0%)		
	Business	0(0%)	5(100%)		

The significant association between child age and wasting (P<0.05) was found in the study conducted by Badake *et al.* in Mbeere district, Kenya (Badake *et al.*, 2014). A similar result

was found in this present study where 16% of children below 24 months were found to be wasted however there was no significant association.

Comparatively more male children were found to be wasted than females in the study area. Similarly wasting prevalence was higher in families with low income than in higher income families.

4.7.2 Factors associated with stunting

Table 4.13 Factors associated with stunting among 6-59 months children in Inaruwa-7

Factors		Stunted	Normal	χ^2 value	P-value
Child age	< 24 months	8(21.6%)	29(78.4%)		
Group	≥ 24 months	17(32.7%)	35(67.3%)	1.312	0.252
Gender	Male	12(23.9%)	29(70.7%)		
	Female	13(27.1%)	35(72.9%)	0.052	0.819
Family type	Nuclear	13(23.6%)	42(74.6)		
	Joint	12(35.3%)	22(64.7%)	1.414	0.234
Annual income	Less than 1 lakh	6(30%)	14(70%)		
	1 to 3 lakh	18(28.6%)	45(71.4%)		
	More than 3 lakh	5(83.3%)	1(16.7%)	0.473	0.789
Mother	Illiterate	2(22.2%)	7(77.8%)		
Education	Up to SLC	18(30%)	42(70%)		
	Above SLC	5(25%)	15(70%)	0.085	0.954
Under 5	<2	18(26.9%)	49(73.1%)		
Children	≥2	7(31.8%)	15(68.2%)	0.374	0.541
Birth weight	Less than 2.5 kg	3(37.5%)	5(62.5%)		
	More than 2.5 kg	20(25.6%)	58(74.4%)		
	Unknown	2(66.7%)	1(33.3%)	2.486	0.288
Mother	Housewife	21(27.3%)	56(72.7%)		
Occupation	Agriculture	1(100%)	0(0%)		
	Service	1(25%)	3(75%)	4.231	0.376
	Labor	0(0%)	3(100%)		
	Business	2(40%)	3(60%)		

Table 4.13 shows chi- square test analysis results of factors associated with stunting. The chi-square test revealed that there was no significant association of stunting with child age group (P = 0.252), gender (P = 0.819), family type (P = 0.234), annual income (P = 0.789), maternal education (P = 0.954), number of under five children (P = 0.541), weight at birth (P = 0.288) and mother occupation (P = 0.376).

From the results of the present study, as the age of child increases, it has been shown that the rate of stunting also increased though there was no significant association. These findings are supported by similar studies indicating that the males are more likely to be stunted than females (Ramli *et al.*, 2009). This could be due to many factors including poor care, poor weaning process, ignorance, poverty, childhood diseases which all can contribute to the stunting of a child.

A comparative study conducted in Mexico indicated that extreme poverty of families is positively associated with stunting among the under-five years old children (Reyes *et al.*, 2004). A study conducted in Bangladesh revealed that malnutrition rate was twice developed among the poorest families than richest ones and children of lower income families were more likely to be undernourished than children of higher income families (Giashuddin *et al.*, 2005). However in this study, stunting was more prevalent in higher income families than lower ones. This might be due to lack of proper care practices or inadequate nutrition knowledge in parents.

4.7.3 Factors associated with underweight

Table 4.14 shows chi square test analysis result of factors associated with underweight. The survey shows that there was no significant association of underweight with age group of children, gender, family type, annual income, maternal education, number of under five children.

In this study, child's gender (P = 0.341) and annual family income (P = 0.211) were not significant with underweight. Similar result was observed in study performed by Mishra in Mohattari, Nepal (Mishra and Sharma, 2010).

A study conducted by Bhandari and Chhetri in Kapilvastu district showed that children with more than two numbers of under five children in the family were found to be highly underweight (Bhandari and Chhetri, 2013). A similar result was obtained in this survey however they were not statistically significant.

Table 4.14 Factors associated with underweight among 6-59 months children in Inaruwa-7

Factors		Underweight	Normal	χ^2 value	P-value
Child age	< 24 months	4(10.8%)	33(89.2%)		
Group	≥ 24 months	8(15.4%)	44(84.6%)	0.095	0.758
Gender	Male	4(9.8%)	37(90.2%)		
	Female	8(16.7%)	40(83.3%)	0.905	0.341
Family type	Nuclear	9(16.4%)	46(83.6%)		
	Joint	3(8.8%)	31(91.2%)	0.48	0.89
Annual income	Less than 1 lakh	4(20%)	16(80%)		
	1 to 3 lakh	6(9.5%)	57(90.5%)	3.113	0.211
	More than 3 lakh	2(33.3%)	4(66.7%)		
Mother	Illiterate	2(22.2%)	7(77.8%)		
Education	Up to SLC	7(11.7%)	53(83.3%)	1.107	0.575
	Above SLC	3(15%)	17(85%)		
Under 5	<2	8(11.9%)	59(88.1%)		
Children	≥2	4(18.2%)	18(81.8%)	0.239	0.635
Birth weight	Less than 2.5 kg	3(37.5%)	5(62.5%)		
	More than 2.5 kg	9(15.5%)	49(84.5%)	4.019	0.134
	Unknown	0(0%)	3(100%)		
Mother	Housewife	9(11.7%)	68(88.3%)		
Occupation	Agriculture	0(0%)	1(100%)	2.575	0.631
	Service	1(25%)	3(75%)		
	Labor	1(50%)	1(50%)		
	Business	1(20%)	4(80%)		

Education is one of the most important resources that enable women to provide appropriate care for their children. Education of women is believed to exert an impact on health and nutritional status of children since it provides the mother with the necessary skills for child care, increase awareness of nutritional needs and preference of modern health facilities as well as change of traditional beliefs about diseases causation, and use of contraceptives for birth spacing (Tesfaye, 2009). In this study significant association was not found between prevalence of under-nutrition and the educational level of mothers.

Part V

Conclusion and Recommendation

5.1 Conclusion

Conclusively, this study has generally assessed the nutritional status of children in Inaruwa-7, Sunari which was not explored before and findings are important to understand prevalence and determinants of under–nutrition among 6-59 months children in Inaruwa-7. The results of this study indicate that under nutrition is still an important problem among under five children in Inaruwa-7, Sunsari. The overall magnitude of malnutrition among children in Inaruwa-7 was found to be 28.1%, 8.9% and 13.5% for stunting, wasting and underweight respectively. 6.8% of them were severely stunted, 2.2% were found to be severely wasted and 2.3% were severely underweight. The study shows that wasting and stunting was higher in boys than girls while in case of underweight, the prevalence was found higher in girls than boys. The findings of this study confirmed that mother occupation was the risk factor associated with wasting in children. The determinants of malnutrition like mother's educational status, annual family income, birth order and gender though considered as important factors affecting nutritional status of under five children were not significantly associated with any forms of malnutrition in this study. These findings are of great importance as they identify potential actions that can be used to improve the nutritional status of children. This study point out the need of making a comprehensive, integrated and multi-sectorial plan for addressing the problem of malnutrition in long term.

5.2 Recommendation

a) Community based nutrition program should be established to tackle the problem of malnutrition at community level depending on the severity of malnutrition identified in this study.
b) The study did not describe the cause and effect relationship between dependent and independent variables as the study is cross sectional in design. So, longitudinal study might give better information on cause and effect relationship between different variables.
c) There is more need for more attention on feeing and hygiene practices in order to reduce the problem of malnutrition.
d) Furthermore, further studies can be done to see unexplored variables such as dietary diversity, seasonal factors and household food security which were not included in this study.
e) Nutrition surveillance should be done continuously and special attention should be given to vulnerable groups such as poorest and the most severely malnourished children.

Part VI

Summary

Nutritional survey was conducted among 6-59 months children of Inaruwa 7. Anthropometric measurements were carried out to fond the level of malnutrition of preschooler. Household survey was conducted with the help of questionnaire in order 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 for the purpose of uplifting nutritional situation of the population.

89 households of Inaruwa-7 were selected for the study. Anthropometric measurement of 89 children was taken to assess their nutritional status. The data collected were analyzed using SPSS version 20 and WHO anthro 3.2.2 version.

61.7% of the households under the study were nuclear and 38.3% were joint. Maximum households .i.e. 30.3% were involved in business. In 59.3% of the households, husband made decision regarding the use of money in the household.

Breastfeeding was initiated within first hour of birth by 33.7% of mothers in the study area. 71.9% of mothers fed colostrum to their baby. 86.5% of the children were introduced to solid or semi-solid foods after six months of age while the rest 13.5% were weaned before six month of age. Most of the people (78.7%) used tube well as a source of drinking water while the rest (21.3%) used tap water. 41.6% of the households used to purify water before drinking.

The prevalence of wasting, stunting and underweight in Inaruwa-7 was found to be 8.9%, 28.1% and 13.5% respectively. The study shows that wasting and stunting was higher in boys than girls while in case of underweight, the prevalence was found higher in girls than boys. Study indicated that mother occupation was statistically significant with wasting.

The result of the work can be utilized by government as well as voluntary organization and the local government to initiate steps to tackle the existing malnutrition problems and encourage the people of that population to try to improve their existing poor nutritional status by improving dietary pattern of under five children as well as pregnant and lactating women.

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Appendices

Questionnaires

Form No. | | | | |

Date of interview ……..... Interviewer …….....

1. Introduction

Household head name …….....

Respondent details ……..... a) Mother b) Father c) Others

Mother's name …… Age …….. Education …….....

Children name …….... Age ….....

2. Family background

Q. No. 1. Type of family

a) Single b) Joint c) Extended

Q. No. 2. Total family members ……

a) Male …… b) Female ……. . c) Children under 5 years ……

Q. No. 3. Mother's educational level

a) illiterate b) primary c) lower secondary

d) secondary d) higher secondary e) bachelor and above

Q. No. 4. Father's educational level

a) illiterate b) primary c) lower secondary

d) secondary d) HSEB d) bachelor and above

Q. No. 5. Occupation of mother

a) housewife b) agriculture c) service

d) labor e) business f) others

Q. No. 6. Occupation of father

a) agriculture b) service c) labor

d) business e) works abroad f) others

Q. No. 7. Annual family income

a) less than 1 lakh b) 1 to 3 lakh c) more than 3 lakhs

Q. No. 8. How long the income source of your family will sustain for food?

a) less than 3 months b) 3 to 6 months c) 6 to 12 months

d) more than 12 months e) others

Q. No. 9. Religion of your family

a) Hindu b) Buddhism c) Islam

d) Christianity d) Others

Q. No. 10. Main food for consumption

a) rice b) chapatti c) others

Q. No. 11. Have television in home?

a) Yes b) No

Q. No. 12. How often do you read newspapers or listen the news?

a) sometimes b) always c) once or twice in a week

d) never e) others

Q. No. 13. House in which you are living

a) own b) rent c) others

3. View regarding gender equality

Q. No. 14. Decision on using money

a) mother b) father c) son

d) daughter e) others

Q. No. 15. In your opinion whose role is important in the family?

a) son b) daughter c) both are equal

Q. No. 16. Who makes decision in your family regarding the use of health services?

a) mother b) father c) son

d) daughter e) others

Q. No. 17. Who must get the opportunity of reading more?

a) son b) daughter c) both

4. Personal and environmental hygiene

Q. No. 18. Fuel used for cooking food in house

a) firewood b) kerosene c) dried animal dung

d) gobargas e) LPG

Q. No. 19. What do you use to wash dishes in your house?

a) soap and water b) mud c) water

e) ash and water f) others

Q. No. 20. Source of drinking water

a) river b) tube well c) tap water

d) well e) others

Q. No. 21. Do you purify water?

a) Yes b) No

Q. No. 22. Which method do you use to purify water?

a). filtration b) boiling c) chlorination

d) others

Q. No. 23. Do you have toilet in house?

a) Yes b) No

Q. No. 24. When do you wash your hands?

a) before eating foods b) before feeding children c) before cooking food

d) after going to toilet e) others

Q. No. 25. When do you brush your teeth?

a) never b) in the morning c) after eating

d) morning and evening e) others

Q. No. 26. What do you use to brush teeth?

a) ash and water b) toothpaste c) fingers

d) others

5. Knowledge regarding disease

Q. No. 27. Cause of disease

a) microorganisms b) wart of gods c) superstition

d) ghosts e) others

Q. No. 28. Where do you first go for treatment when your family members get sick?

a) medicine shop b) health post c) FCHVs

d) dhami e) others

Q. No. 29. What is necessary to keep your family members healthy?

a) hygiene and sanitation b) balanced diet c) vaccinate children

d) make gods happy e) others

Q. No. 30. Is any one of your family members affected by the disease during the last 1 year?

a) Yes b) No

6. Question for under five children mothers

Q. No. 31. Number of under five year children in your house …….

Q. No. 32. Who take care of your child in absence of you?

a) mother/father in law b) husband c) brothers/ sisters

d) neighbors e) others

7. Nutrition and breastfeeding related questions

Q. No. 33. Did you breast feed your child?

a) Yes b) No

Q. No.34. When did you first breastfeed your child?

a) within 1 hour b) between 1 to 8 hours c) between 8 to 24 hour

d) after 24 hours e) don't remember f) others

Q. No. 35. Did you feed colostrum to your baby?

a) Yes b) No

Q. No. 36. Did you fed anything to your baby before feeding colostrums to them?

a) nothing b) honey and ghee c) cow milk

d) do not remember e) others

Q. No. 37. What kind milk do you feed to your child except mother's milk?

a) cow milk b) buffalo milk c) goat milk

d) packets e) nothing f) others

Q. No 38. In your opinion, up to how many months should a child be fed the mother's milk?

…… months

Q. No. 39. When did you start giving complementary food to your child? …… months

Q. No. 40. What type of food do you feed your child?

a) lito b) jaulo c) sarbottam pitho

d) others

Q. No. 41. Weight of child during birth

a) less than 2.5 kg b) more than 2.5 kg c) do not remember

Q. No. 42. Have you heard about malnutrition (marasmus and kwashiorkor)?

a) yes b) no

Q. No.43. If yes, what do you think is the main cause of malnutrition?

a) lack of balanced diet b) superstition c) touch of pregnant women

d) warts of gods e) others

Q. No. 44. What is the best source of Vitamin A?

a) green leafy vegetables b) meat and fish c) yellow fruits

d) milk and milk products e) do not know f) others

Q. No. 45. What type of salt do you use for cooking?

a) crystal salt b) iodized salt c) others

Q. No. 46. Do you give vitamin supplementation to your child in 6th and 7th of Baisakh?

a) Yes b) No

8. Maternal and infant care information

Q. No. 47. Where do you visit for ante natal care during pregnancy?

a) doctors b) ANM c) sudeni

d) FCHVs e) dhami f) others

Q. No. 48. For how many days did you consume iron tablets?

a) …… days b) didn't consume c) don't know

Q. No. 49. What types of food is necessary for pregnant women?

a) milk, meat and fish b) green leafy vegetables c) fruits

d) eggs e) others

Q. No. 50. What type of complementary foods did you feed your child? ……

Q. No. 51.What types of symptoms does a child show when he/she becomes sick?

a) don't know b) stop sucking milk c) loss of appetite

d) eyes become red e) child shivers f) child becomes bluish

g) baby cries a lot h) child becomes yellow i) high fever

k) difficulty in breathing l) others

Q. No. 52. Did you consume vitamin A capsule within 45 days after birth of your child?

a) Yes b) No

Q. No. 53. Have you vaccinated your child?

a) Yes b) No

9. Knowledge regarding diarrhea

Q. No. 54. How did you feed your milk to the child when he/she was suffering from diarrhea?

a) more than often b) like always c) less than often

d) stopped feeding e) others

Q. No. 55. How often did you feed solid foods to your child when suffering from diarrhea?

a) more than often b) like always c) less than often

d) stopped feeding e) others

Q. No. 56. Did you feed ORS solution to your children when suffering from diarrhea?

a) Yes d) No

Q. No. 57. Do you know to prepare ORS solution?

a) Yes b) No

Q. No. 58. What is the cause of diarrhea?

a) dirty water b) heavy food consumption c) superstition

d) others

Anthropometric measurements

Name	**Age (months)**	**Sex (M/F)**	**Wight (kg)**	**Height (cm)**	**MUAC (mm)**

Consent letter

Namaste!

I Mr. Biplove Shrestha, graduate student in Department of Nutrition and Dietetics conducting a dissertation work for the award of bachelor's degree in Nutrition and Dietetics.

The topic of my study is "STUDY OF NUTRITIONAL STATUS OF 6-59 MONTHS CHILDREN IN INARUWA-7, SUNSARI AND FACTORS THAT ARE ASSOCIATED WITH IT".

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

Signature of parent/guardian:	Signature of witness:
Date:	Date:
Place:	Place:

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

Investigator's sign:

Date:

Survey Photos