PREVALENCE OF ANEMIA AND ITS ASSOCIATED FACTORS IN CHILDREN AGED 6-59 MONTHS IN BHUTANESE REFUGEE CAMP OF DAMAK MUNICIPALITY

by

Neeta Shrestha

Exam roll no: 80082

TU Registration No: 5-2-0008-0060-2012

Department of Nutrition and Dietetics

Central Campus of Technology

Institute of Science and Technology

Tribhuvan University, Nepal

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PREVALENCE OF ANEMIA AND ITS ASSOCIATED FACTORS IN CHILDREN AGED 6-59 MONTHS IN BHUTANESE REFUGEE CAMP OF DAMAK MUNICIPALITY.

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

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Institute of Science and Technology

Tribhuvan University, Nepal

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Department of Nutrition and Dietetics

Central Campus of Technology, Dharan

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Approval letter

This *dissertation* entitled *Prevalence of Anemia and its associated factors in children aged 6-59 months in Bhutanese Refugee Camp of Damak Municipality presented* by Neeta Shrestha has been accepted as the partial fulfillment of the requirement for the B.Sc. degree in Nutrition and Dietetics.

Dissertation Committee

1. **Head of the Department ……..**

   (Mr. Dambar Bahadur Khadka)

2. **External Examiner ……**

   (Mr. Birendra Kumar Yadav)

3. **Supervisor ……..…**

   (Teaching Assistant, Mr. Arjun Ghimire)

4. **Internal Examiner …….**

   (Mr. Dambar Bahadur Khadka)

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Neeta Shrestha

Abstract

A cross sectional descriptive study was conducted to determine the prevalence of anemia of children aged 6- 59 months living in Bhutanese Refugee camp and to find out factors associated with it. A structured questionnaire was administered to the participants/care taker for socio-demographic and food frequency questionnaire for determining the prevalence of anemia. *Hemocue* Hb Photometer was used to determine hemoglobin level of the children and anthropometric measurement was done based on WHO reference. The anthropometric data were analyzed using WHO Anthro version 3.2.2. Similarly data on various characteristics were analyzed by SPSS version 20. Chi-square test was used to analyze the association between hemoglobin and factors associated with it.

Result showed that out of 131 samples the prevalence of anemia was 34.3% with varying degrees ranging from mild and moderate which were 26.7% and 7.6% respectively. None of the participants were severely anemic. The study prevails that religion, birth weight, disease history, stunting, time of initiation of breastfeeding and knowledge about anemia was significantly associated with anemia (p-value <0.05). The study indicated that in religion Hindus were more affected by anemia in comparison to other religion. Similarly, association was also found with the children who had initiated breastfeeding within eight hour or more, disease history in which children were mainly suffering from diarrhea and chronic diseases, and mothers who had less knowledge about anemia were directly related to anemia prevalence of children.

This study indicated that prevalence of anemia is still an important problem among children aged 6-59 months in Bhutanese refugee camp of Damak municipality, the intervention provided should be more advanced and implemented properly in camps to overcome the problem of anemia. Awareness, nutrition education and periodical evaluation are necessary to combat these issues.

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List of Abbreviation

Abbreviation	Full form
AMDA	Association of Medical Doctors of Asia
BMI	Body Mass Index
BRHP	Bhutanese Refugee health Profile
DNA	De-Oxy Ribonucleic Acid
EPO	Erythropoietin
FFQ	Food Frequency Questionnaire
HB	Hemoglobin
IFA	Iron and Folic Acid
ID	Iron Deficiency
MDG	Millennium Development Goal
MoHP	Ministry of Health and Population
MUAC	Mid Upper Arm Circumference
NDHS	Nepal Demographic Health Survey
NHRC	Nepal Health Research Council
NNS	National Nutrition survey
PEM	Protein Energy Malnutrition
PreSAC	Pre-School Aged children
RDA	Recommended Daily Allowances
SES	Socio Economic Status
SPSS	Statistical Package of social Sciences
UNHCR	United Nations High Commissioner for Refugees
WHO	World Health Organization

Part I

Introduction

1.1 Background of the study

Nepal is a landlocked country located in South Asia with an area of 147,181 sq kms and a population of approximately 27 million, Nepal is the world's 93rd largest country by area and the 42st most populous country. It is surrounded by China on north and by India on east, south and west (NDHS, 2011). Nepal is not only home for its people; it is home to 38,490 refugees officially recognized by the UNHCR. The refugees are now beginning to be relocated to other international destinations with the help of the UNHCR and the International Organization for Migration. Since the start of its Bhutanese refugee resettlement initiative in 2007 the UNHCR has relocated over 20,000 refugees (BRHP, 2014).

Nutrition is the intake of food, considered in relation to the body's dietary needs. Nutritional status is defined as the condition of the body resulting from the intake, absorption and utilization of food (WHO, 2014). It is determined by a complex interaction between internal/constitutional factors and external environmental factors: Internal or constitutional factors like: age, sex, nutrition, behavior, physical activity and diseases. External environmental factors like: food safety, cultural, social and economic circumstances (Joshi, 2012).

Anemia is a condition in which low levels of hemoglobin in the blood result in diminished oxygen transport (Pringle and Seal 2013). Anemia is one of the most common and widespread conditions in the world, and is a public health problem in both developed and developing countries. Iron deficiency is estimated to be the cause of about half of all anemia cases. Anemia can also be caused by a deficiency in vitamin B_{12}, folate, and other nutrients, parasitic infections, bleeding due to other causes, haemoglobinopathies resulting in abnormal hemoglobin formation(such as in sickle cell anemia), thalassemia, chronic disease, or rupture of red blood cells(hemolytic anemia). WHO definitions for Anemia differ by age, sex, and pregnancy status as follows: for children 6 months to 5 years of age Anemia is defined as a Hb level<11g/dl, children 5–11 years of age Hb < 11.5 g/dl, adults males Hb < 13 g/dl; non-pregnant females Hb < 12g/dl, and pregnant females Hb < 11g/dl. Severe Anemia is defined as Hb < 7.0 g/dl (WHO, 2001).

WHO estimates that some two billion people are anemic defined as hemoglobin concentrations that are below recommended thresholds. It is estimated that the number of anemic people worldwide to be a staggering two billion with approximately 50% of all anemia attributable to iron deficiency (Murray *et al.*, 2000). Anemia is a prevalent public health problem which affects about a quarter of the world population, notably pre-school aged (PreSAC) children with global prevalence in the 0–5 year-old age group rising to 47.4 %. According to WHO criteria, anemia ranks as a severe public health problem (defined as a prevalence of ≥ 40 %). Anemia can adversely affect cognitive advancement, performance in school, physical and behavioral growth, and immunization ability of children against disease. It remains a major cause of mortality and morbidity in developing countries where resources to determine the underlying etiology remain poor (Khan *et al.*, 2016). This study mainly focuses to find the prevalence of anemia and explore their associations with clinical, socioeconomic and anthropometric parameters of Bhutanese refugee children.

1.2 Problem statement and justification

Refugees are thought to be particularly vulnerable to anemia due to inadequate iron intake and other nutritional deficiencies, lack of appropriate complementary foods, and high rates of infection that are characteristic of crowded camp environments (Pringle and Seal, 2013). Children, particularly young ones, are more susceptible to anemia and ID because of high iron requirements during growth, low intake of iron from complementary foods, and frequent episodes of infection. Breast milk contains relatively low levels of iron but it is readily absorbable and sufficient for infants up to six months of age. Extra iron is required from six months of age onward, either from complementary foods or as a supplement. Nutritional iron deficiency is common in settings with monotonous plant based diets and low meat intake (Adhikari *et al.*, 2015).

There are adverse effects of anemia which are reduced cognitive development, reduced physical development and activity as well as impaired sexual and reproductive development. These effects are characterized by diminished concentration, disturbance in perception and poor learning ability, decreased work capacity and output, irregular menstruation, low pre pregnancy iron status, low birth weight babies and preterm delivery (NRHM, 2013).

According to the NDHS (2011), reported that 46 percent are anemic, 27 percent are mildly anemic, 18 percent are moderately anemic and less than 1 percent are severely anemic. The prevalence of anemia among children under age 5 has declined by only 2 percentage points in

the past five years. The proportion with anemia is higher among children age 6-17 months (72-78 percent) than among children in other age groups. Severe anemia is highest among children age 12-17 months (2 %).

Likewise in Bhutanese refugee camp, Jhapa, 2009, the prevalence of anemia was (50.8%). Severe anemia prevalence was 0.4%, moderate 21.1% and mild 29.3%. The 6-11 month age group had the highest prevalence (78.3%) and it was noted that anemia prevalence declined with increasing age. Prevalence of chronic malnutrition/stunting was found to be 28.5%. The prevalence of anemia in women of reproductive age is approximately 19% while pregnant women have an anemia prevalence of 28% (Pringle and Seal, 2013). Limited food diversity, frequent illness, and feeding practices have been identified as underlying causes of malnutrition in the Bhutanese refugee population and the most common cause of anemia is due to iron deficiency but a number of other conditions affecting Bhutanese refugees could play a contributory role, including malaria, intestinal parasites, deficiencies of vitamin B_{12} and other micronutrients, tuberculosis, hemoglobinopathies, and chronic disease (BRHP, 2014).

1.3 Objectives of the study

1.3.1 General Objectives

The main objective of this study is to find the prevalence of anemia and its associated factors in children aged 6-59 months in Bhutanese refugee camp of Damak municipality.

1.3.2 Specific Objectives

The specific objectives of this study were as follows:

a. To find out the prevalence of anemia in children aged 6- 59 months in Bhutanese refugee camp of Damak municipality.
b. To identify social, economic and demographic factors associated to anemia among children aged 6- 59 months in Bhutanese refugee camp of Damak municipality.
c. To find out the association between nutritional status of children with their blood hemoglobin concentrations.

1.4 Research questions

The purpose of this study is to determine the prevalence of anemia and its associated factors in children aged 6- 59 months in Bhutanese refugee camp of Damak municipality. This thesis addresses the following question.

a. What is the prevalence rate of anemia among children aged 6-59 months in Bhutanese refugee camp, Damak?

b. What are the factors associated with hemoglobin level of the participants?

1.5 Significance of the study

The significance of the study were as below:

a. Figure out distribution of hemoglobin level of children aged 6-59 months of the refugee camps.
b. Findings of study can provide relevant knowledge regarding the status of particular age group population.
c. Encourage concerned authorities for the proper micronutrients supplementation, planning and implementation of nutrition program effectively.
d. Encourage the target population to uplift their nutritional status.
e. To make the people aware of the real situation of the community.

1.6 Limitations of the study

Limitations of the study were:

a. This study may be affected by climatic and seasonal factor which was not taken into consideration.
b. The sample taken from the target populations and its results cannot be generalized for other populations or community.
c. Due to lack of equipment and economic factors, the study did not assess the types of anemia.

Part II

Literature review

2.1 Anemia

Anemia is a condition in which the number of red blood cells (and consequently their oxygen-carrying capacity) is insufficient to meet the body's physiologic needs (WHO, 2011). Specific physiologic needs vary with a person's age, gender, residential elevation above sea level (altitude), smoking behavior, and different stages of pregnancy. Iron deficiency is thought to be the most common cause of anemia globally. Approximately 50% of cases of anemia are considered to be due to iron deficiency, but the proportion probably varies among population groups and in different areas, according to the local conditions, but other nutritional deficiencies (including folate, vitamin B_{12} and vitamin A), acute and chronic inflammation, parasitic infections, and inherited or acquired disorders that affect hemoglobin synthesis, red blood cell production or red blood cell survival, can all cause anemia (WHO, 2001).

Anemia resulting from iron deficiency adversely affects cognitive and motor development, causes fatigue and low productivity and, when it occurs in pregnancy, may be associated with low birth weight and increased risk of maternal and perinatal mortality. In developing regions, maternal and neonatal mortality were responsible for 3.0 million deaths in 2013 and are important contributors to overall global mortality. It has been further estimated that 90 000 deaths in both sexes and all age groups are due to iron deficiency anemia alone (WHO, 2011).

2.1.1 Types of anemia

a) Iron deficiency anemia: - The most common form of anemia is iron deficiency anemia which is usually due to chronic blood loss caused by excessive menstruation. Increased demands for iron, such as fetal growth in pregnancy, and children undergoing rapid growth spurts in infancy and adolescence, can also cause iron deficiency anemia. This condition is treated with iron supplementation as well as the treatment of the underlying cause of the iron deficiency (Anonymous, 2014).

b) Aplastic anemia: - It is a blood disorder in which the body's bone marrow doesn't make enough new blood cells. This may result in a number of health problems including

arrhythmias, an enlarged heart, heart failure, infections and bleeding. Exact cause is unknown but it is believed that any injury to bone marrow due to either of the cause chemotherapy, radiation, etc. cause aplastic anemia (Cavendish, 2008).

c) Hemolytic anemia: - It is a condition in which red blood cells are destroyed and removed from the bloodstream before their normal lifespan is up. A number of diseases, conditions and factors can cause the body to destroy its red blood cells. Hemolytic anemia can lead to various health problems such as fatigue, pain, arrhythmias, an enlarged heart and heart failure (Cavendish, 2008).

d) Thalassemia: - Thalassemia is inherited blood disorders which cause the body to make fewer healthy red blood cells and less hemoglobin (an iron-rich protein in red blood cells)(Cavendish, 2008).

e) Sickle cell anemia: - This inherited and sometimes serious condition is an inherited hemolytic anemia. It's caused by a defective form of hemoglobin that forces red blood cells to assume an abnormal crescent (sickle) shape. These irregular blood cells die prematurely, resulting in a chronic shortage of red blood cells(Cavendish, 2008).

f) Pernicious anemia: - It is a condition in which the body can't make enough healthy red blood cells because it doesn't have enough vitamin B_{12} (a nutrient found in certain foods). People who have pernicious anemia can't absorb enough vitamin B_{12} due to a lack of intrinsic factor (a protein made in the stomach). However, other conditions and factors can also cause vitamin B_{12} deficiency(Cavendish, 2008).

g) Megaloblastic anemia: If either or both folic acid or vitamin B_{12} is deficient than this type of anemia is manifested in body. Due to the lack of folate or vitamin B_{12}, the maturation of RBC in the bone marrow is impaired and the cells which enter the blood stream are irregular in size and shape, but usually larger than the normal and contain their full complement of hemoglobin(Cavendish, 2008). This is also called as orthrochromic macrocytic anemia (Srilakshmi, 2014).

2.1.2 Causes of anemia

Anemia is caused by either a low production of red blood cells or by destruction or shortened lifespan of red blood cells. The main causes of anemia according to the report are dietary iron deficiency; protein deficiency (Kumar, 2014) deficiencies of other key micronutrients

including folate, vitamin B_{12}, and vitamin A; infectious diseases such as malaria, hookworm infections, and schistosomiasis; and inherited conditions that affect red cell stability such as thalassemia, sickle cell anemia, etc (Thurnham and Northrop-Clewes,2007). In developing countries, low standards of living, low socio-economic conditions, restricted access to food and lack of knowledge for good dietary practices and personal hygiene contribute to a high occurrence of anemia (Odeh, 2006). This section will focus basically on common causes of anemia and will not focus on anemia caused due to pathological condition and blood disorder(Balarajan *et al.*, 2011).

2.2 Nutritional Anemia

Nutritional anemia's result from insufficient bioavailability of hemopoietic nutrients needed to meet the demands of hemoglobin and erythrocyte synthesis. As human diets have shifted over time from hunter-gatherer to more cultivated cereal-based diets with more heat exposure during food preparation, there has been a large drop in bioavailable hemopoietic nutrients (iron, vitamin B12, and folic acid) and absorption enhancers such as vitamin C. This situation is compounded by increased intake of other dietary factors that reduce the bioavailability of non-heme iron, such as polyphenols (e.g., tea, coffee, and spices such as cinnamon), phytates (whole grains, legumes), and calcium (dairy products). Restricted access to diverse micronutrient-rich diets, particularly for vulnerable groups, can exacerbate nutritional anemias (Balarajan *et al.*, 2011).

a) Iron deficiency

It occurs when the intake of total or bioavailable iron is inadequate to meet iron demands, or to compensate for increased losses. Periods of rapid growth, especially during infancy and pregnancy, result in substantial demands for iron, which accounts for the physiological vulnerability of children and women. The intergenerational transfer of poor iron status from mother to child has also been shown in several studies, with maternal iron deficiency increasing the vulnerability of infants to iron deficiency and anemia. Low birth weight and preterm infants are at increased risk because they are born with reduced iron stores. Iron deficiency and anemia in young children are associated with various functional consequences, especially in early childhood development. Inadequate access to fortified complementary foods and iron supplements, and exposure to infections during infant growth increases the risk of anemia and iron deficiency in young children. Strategies to lower risk of anemia in early infancy and break the intergenerational cycle of iron depletion include

optimization of maternal nutritional status, delayed cord clamping at delivery, improvement of infant feeding practices, and prevention and treatment of infectious disease (Balarajan *et al.*, 2011).

b) Folic acid deficiency

Folic acid is required for the synthesis and maturation of erythrocytes, and low serum and erythrocyte concentrations of folate can lead to changes in cell morphology and intramedullary death of erythrocytes and reduced erythrocyte lifespan. Folic acid deficiency contributes to megaloblastic anemia, a condition characterized by cells with large and malformed nuclei resulting from impaired DNA synthesis. Folic acid deficiency is common among poor vegetarians. This is due to poor intake of milk, vegetables and fresh fruits. As such the Indian diet also poor source of folic acid and cooking practices commonly encountered tend to destroy the folic acid to a considerable extent. Vitamin B12 deficiency and vitamin C can also result in folic acid deficiency (Srilakshmi, 2014). Indian diet is very similar to Nepali diet. A study shows that dietary intake of micronutrients including folic acid is inadequate in the diet of boys and girls as per RDA and that was positively correlated with the low hemoglobin level among them (Kaur and Kaur, 2011).

c) Vitamin B_{12} deficiency

Vitamin B_{12} is synthesized only by microorganisms, and its primary source is from ingestion of animal products. Absorption of vitamin B_{12} involves a complex process by which gastric enzymes and acid facilitate its release from food sources, before being bound by an intrinsic factor secreted by gastric parietal cells, followed by uptake in the distal ileum. Vitamin B_{12} deficiency can result in a megaloblastic macrocytic anemia, which is more common in severe vitamin B_{12} deficiency. The main causes of vitamin B_{12} deficiency are inadequate dietary intake, especially from vegetarian diets; pernicious anemia, an autoimmune disorder resulting from autoantibody against intrinsic factor, tropical sprue. Vitamin $B1_2$ deficiency is associated with lacto vegetarianism in India, and the scarcity of meat products in many south Asian diets (Balarajan *et al.*, 2011).

d) Vitamin A deficiency

Vitamin A deficiency is common in Africa and southeast Asia, affecting an estimated 21% of children of preschool age and 6% of pregnant women, and accounting for around 800 000 deaths of women and children worldwide. Vitamin A deficiency results from low dietary

intake of preformed vitamin A from animal products and carotenoids from fruits and vegetables. Vitamin A plays an important part in erythropoiesis and has been shown to improve hemoglobin concentration and increase the efficacy of iron supplementation. The mechanisms are not fully understood, but are suggested to operate through effects on transferrin receptors affecting the mobilization of iron stores, increasing iron absorption, stimulating erythroid precursors in the bone marrow, and reducing susceptibility to infections (Balarajan *et al.*, 2011).

e) Protein Deficiency

Decreased dietary intake of protein may lead to mild to moderate anemia. This protein deficiency anemia is seen in vegans, vegetarians, elderly, endurance athletes, anorexia nervosa and people of diminished intake of protein for any cause. Anemia caused due to protein is also called as hypo proliferative anemia. Inadequate intake of protein slows down the body metabolism. Decreased metabolic activity reduces oxygen demand and consumption by the kidneys and impairs production of erythropoietin (EPO) hormone, which results decreased production of RBC leading to anemia (Habibinia, 2015). But in a survey carried out in Spanish women of child-bearing age, no significant association between protein consumption was observed with women close to developing iron deficiency anemia, women with mild normal iron status (Rojo *et al*, 2014).

2.3 Underlying factors of anemia

In developing countries, insufficient dietary iron is considered the primary cause of anemia in children. However, other factors, such as early weaning, poor health of pregnant women, insufficient safe drinking-water, inadequate hygiene and sanitary conditions, and poverty which increases the likelihood of all the above mentioned factors, may contribute to the development of the disease. Additional risk factors of anemia include glucose-6-phosphate dehydrogenase deficiency, haemoglobinopathies, and infectious diseases, such as malaria, which is endemic in African countries (R. M. L. Semedo *et al.*, 2014).

2.4 Consequences of Anemia

An early symptom of anemia is fatigue and decreased ability to work (Haas & Brownlie, 2001). Yet, being anemia also is associated with an increased risk of mortality and cognitive loss in those who survive (Stoltzfus et al, 2005). Maternal anemia is associated with 20% of maternal deaths (Black et al, 2008), with greater evidence that anemia may cause increased

blood loss at delivery and put women at risk of postpartum hemorrhage (Kavle et al, 2008). Anemic mothers are at greater risk of delivering premature and low-birth-weight babies who have an increased risk of dying (USAID, 2017).

Giving iron during pregnancy reduces anemia and improves child outcomes. Indonesian children of mothers taking iron during pregnancy had a decreased risk of dying in their first five years of life, with a 40% decreased risk of dying in the first day of life (Dibley et al, 2012). Studies that administered iron and folic acid (IFA) supplements during pregnancy resulted in substantial impacts – halving neonatal mortality in China (Zeng et al, 2008) and markedly decreasing the risk of death in the first seven years of life (USAID, 2017).

Until six months of age, normal weight, full term infants, who are born to healthy mothers and are exclusively breastfed receive enough iron from their own stored iron and breast milk. Their stored iron is exhausted after six months. Additional iron is then required, because the iron content of unfortified conventional complementary foods is insufficient to meet the high iron requirements of growing six –twenty four months old infants and children. Infants and children who do not obtain adequate iron will suffer cognitive impairment that will affect their ability to learn and perform income earning tasks in later in life. Iron supplements provided after 24 months of age may not correct this cognitive impairment (USAID, 2003).

Children younger than two years of age with severe anemia, caused by malaria and iron deficiency, are at increased risk of mortality (Brabin et al, 2001), and less milder forms, even if corrected, cause permanent cognitive damage by decreasing attention span and shortening memory. Children with anemia have, on average, IQs that are two points lower per every 10 g/L decrease in hemoglobin than other children (Kotecha, 2011).

To achieve strides in preventing the consequences of anemia, an integrated package of interventions needs to be delivered at-scale to address all the causes of anemia.

2.5 Signs and symptoms of anemia

The symptoms of anemia vary according to the type of anemia and the underlying cause. The body also has a remarkable ability to compensate for early anemia(Anonymous, 2017)**.** Symptoms common to many types of anemia include the following:

a. Easy fatigue and loss of energy
b. Unusually rapid heartbeat

c. Shortness of breath and headache
d. Difficulty concentrating
e. Dizziness
f. Pale skin
g. Leg cramps
h. Insomnia
i. Pallor of the skin and mucus membrane(Anonymous, 2017)

2.6 Anemia and assessing dietary intake

Anemia is the most widespread nutritional problem in the world. The prevalence of anemia in a population is best determined by using a reliable method of measuring hemoglobin concentration. The only methods generally recommended for use in surveys to determine the population prevalence of anemia by hemoglobinometry are the cyanmethemoglobin method in the laboratory and the Hemocue system. The cyanmethemoglobin method for determining hemoglobin concentration is the best laboratory method for the quantitative determination of hemoglobin. It serves as a reference for comparison and standardization of other methods. A fixed quantity of blood is diluted with a reagent (Drabkins solution) and hemoglobin concentration is determined after a fixed time interval in an accurate, well calibrated photometer. The Hemocue system is a reliable quantitative method for determining hemoglobin concentrations in field surveys, based on the cyanmethemoglobin method. The *Hemocue* system consists of a portable, battery-operated photometer and a supply of treated disposable cuvettes in which blood is collected. The system is uniquely suited to rapid field surveys because the one-step blood collection and hemoglobin determination do not require the addition of liquid reagents. Survey field staff without specialized laboratory training can use this device with simple training (WHO, 2001b).

Hemoglobin concentration varies along with different gender and age groups. The severity of anemia is based on the cut off value of hemoglobin present in blood and is classified as below

Table 2.1 Classification of anemia on the basis of hemoglobin level.

Population (years)	Non-anemia (gm./l)	Mild-anemia (gm./l)	Moderate-anemia (gm./l)	Sever-anemia (gm./l)
Children 6-59	110 or high	100-109	70-99	70 or below
Children 5-11	115 or high	110-114	80-109	80 or below
Children 12-14	120 or high	110-119	80-109	80 or below
Non-pregnant woman above 15	120 or high	110-119	80-109	80 or below
Pregnant woman	110 or high	100-109	70-99	70 or below

Source: WHO (2001)

FFQs ask a participant to recall their usual diet over a longer period of time and are advantageous because they can be completed rapidly relative to food records while still providing an estimate of usual intake. FFQs are limited in that they only contain a list of foods and foods not listed are likely missed. As such, FFQs need to be developed carefully and often validated to ensure the appropriate foods are included. In addition, in order to estimate usual nutrient intake from an FFQ, one needs quantitative information about each food listed, that is, the typical portion size and frequency of consumption. This requires participants to recall this information and is likely less accurate than quantitative information from a food record. In addition, when they are long, FFQs can impose burden on the participant, while FFQs are thought to provide better estimates of usual intake of an individual.

2.7 Prevalence of anemia worldwide

Globally, anemia affects 1.62 billion people, which corresponds to 24.8% of the population with iron deficiency being the primary cause. Iron deficiency and anemia caused by iron deficiency are problematic both in developed and developing countries. The prevalence of anemia worldwide is highest in preschool children (47.7%), pregnant women (41.8%) and non-pregnant women (30.2%) (McLean et al, 2008). In Southeast Asia, 48% of pregnant women (18 million), 46% of non-pregnant women (182 million), and 66% of preschool children (115 million) suffer from anemia (Balarajan *et al.*, 2011).

According to WHO, in Africa and Asia it accounts for more than 85% of the absolute anemia burden in high risk groups. Anemia is estimated to contribute to more than 115000 maternal deaths and 591000 perinatal deaths globally per year. It has been further estimated that 90 000 deaths in both sexes and all age groups are due to iron deficiency anemia alone. Africa and Asia are the most heavily affected regions, with Africa having the highest prevalence of anemia, and Asia bearing the greater absolute burden (WHO, 2011). The 6–23 month period (and more specifically, the 6–12 month period) constitutes a high-risk period for the development of anemia, particularly due to iron deficiency, which underlies a large percentage of anemia cases in this age group. Anemia affects between 45 and 78% of children under 2 in the five countries with data available for this age group. Less maternal education, rural households, and lower wealth status are frequently (although not always) associated with greater anemia risk among children, and there are country-by-country regional variations as well. In terms of progress in reducing anemia in children, in Cambodia, anemia among children under 5 has declined from 62% of children in 2005 to 55% in 2010.

However, in Timor Leste, 32% of children under 5 were anemic in 2003, compared to 38% in 2010, indicating that there has been deterioration in the nutritional status (or other causes of anemia) during this time period. In Burma 3 out of 4 children under age 5 are anemic. In Cambodia, iron deficiency, vitamin A deficiency, general infection (as measured through markers of inflammation), and genetic hemoglobin disorders (which affected 60% of rural Cambodian children) were all associated with anemia in children under 5 months of age (Chaparro *et al.*, 2014), indicating the range of factors potentially contributing to anemia apart from iron deficiency, which in this population was associated with slightly less than half of anemia cases. Thus, while iron deficiency is a primary cause of anemia, it is important to be aware of and address other causes of anemia (both nutritional and non-nutritional).

Similarly, National Survey data of Pakistan shows that overall 62.1% (severe deficient 5.4 and Moderate deficiency 56.7%) of children were found to be anemic. The prevalence of severe anemia was observed comparatively high in rural areas (6.1%) compare to urban areas (3.9%)(NNS, 2011). The consequences of morbidity associated with chronic anemia extend to loss of productivity from impaired work capacity, cognitive impairment, and increased susceptibility to infection, which also exerts a substantial economic burden. Determinants of the prevalence and distribution of anemia in a population involve a complex interplay of political, ecological, social, and biological factors. At the country level, anemia prevalence is inversely correlated with economic development. It was found that patterning of anemia by

socioeconomic status was also noted for children. A child living in a household in the lowest wealth quintile was 21% more likely to be anemic than were those in the highest wealth quintile. Risk of anemia was also raised in children whose mothers had no education. Conditional on demographic and socioeconomic factors, mother's anemia status was among the strongest predictors of anemia in children (NNS, 2011).

2.7.1 National Scenario of anemia prevalence

The prevalence of severe anemia was observed comparatively high in rural areas (6.1%) compare to urban areas (3.9%).Overall, 46 percent of Nepalese children ages 6-59 months are anemic. The majority of children who suffer from anemia are classified as having mild or moderate anemia (27 and 19 percent, respectively) while less than 1 percent are severely anemic. Anemia among both children and women is especially prevalent in rural areas, where nearly half of the children (47 percent) and more than one-third of women (36 percent) have some degree of anemia. Across zones, children and women who live in the Terai are most likely to be anemic than those in other zones. Overall, there has been hardly any improvement in the anemia status of children and women in Nepal 2006 (NDHS, 2011).

According MoHP, the prevalence of anemia is higher among younger children (57–78% among children 6–23 months) and the distribution of anemia varies geographically by ecological zones and rural/urban residence. Among children 6–59 months, 50% had anemia in the terai (plains); 41% in the hills; 48% in the mountains; 41% in the urban areas; and 47% in the rural areas (MoHP, 2011). All socioeconomic groups are affected by anemia in Nepal and the prevalence is high even among children in the highest socioeconomic quintile: 38% of children 6–59 months. Among children 12–59 months who received deworming tablets in the last six months, anemia prevalence was 41% compared to 51% among eligible children who had not received treatment in the last six months (MoHP, 2011).

A study done in Bhaktapur shows the prevalence of anemia was 49% among infants 2–6-month-old (hemoglobin (Hb) <10.8 g/dl) and 72% among infants 7–12-month-old (Hb <11.3 g/dl). Iron deficiency anemia, defined as anemia and serum ferritin <20 or <12 μg/l, affected 9 and 26% of infants of these same age groups. The population according to census report of 2011 is 81 748 people, and the majority have agriculture as their main occupation (Chandyo *et al.*, 2015).

A study carried out in Kathmandu Medical College, Kathmandu, among the children aged 6- 60 months; it was found that out of 100 children forty six percent of the study group showed various degree of anemia (Bajracharya *et al.*, 2006). According to the WHO classification 32.7% were in the state of mild anemia, 12.4% were in the state of moderate anemia and 2 % in the state of severe anemia. Among the total anemic patient 72% male and 28% female .Among those with severe anemia all were male and among those with moderate anemia 10.34% were male and only 0.94 % was female and among the mild anemia 15 % were male and 10.3% were female.

This showed that among the anemic children of under-five age group males were more anemic than females. Anemia was more common in infants under one year of age. Younger children were more anemic among whom 70% were below two years. Among anemic children, less than one-year age, 28 % of them had mild, 9.3% moderate and 2% had severe anemia. Thirty percent of the anemic children were in between one to two years age group among them 20.9% were mild, 9.3% were moderate anemic. None of them were suffering from severe anemia. Among anemic children aged between 25 to 36 months 9.3% had mild, 4.6% moderate and 2% had severe anemia. Similarly, among anemic children 37 to 48 months 9.3% had mild, 2% moderate while none were severely anemic and between 49 to 60 months age group 4.6% had mild and 2% had moderate anemia. In comparing the average weight of anemic children with the normal children, it was found that the weight of female children of both group are almost similar in 6 months to 24 months. While 25 to 36 months anemic female children were more malnourished than normal female children. Similarly, in male 12 to 24 months anemic male children were malnourished than the normal children, while those from 37 to 60 months anemic children were also malnourished.

Most of the anemic children had iron deficiency anemia and they were in various state of the malnutrition because none them had any signs of other types of anemia like hemolytic anemia, chronic renal failure, signs of malignancies etc. It has shown in various studies that lack of education of the parents has direct impact on the nutritional status of their children. This study has shown that it is true in case of anemia as well. In their study, 18% of mothers and 8% of fathers were illiterate which those who had studied less than 10 grades were 5% mothers and 38% of fathers. Parents who have had education above grade 10 to 27% for mothers and 55% for fathers (Bajracharya *et al.*, 2006).

Anemia is a common condition among Bhutanese refugees, reflecting global rates among people of a similar age and gender. The prevalence of anemia among children aged 6-59 months has significantly improved between 2012 and 2013. However, anemia still remains high for the children aged 6-23 months, despite the reduction from 68.3% in 2012 to 50.8% in 2013.the anemic rates of other age group was found as 20% of refugees aged 65 and older were anemic. The prevalence of anemia in women of reproductive age is approximately 19% while pregnant women have an anemia prevalence of 28% (Pringle and Seal, 2013). The most common cause of anemia is due to iron deficiency but a number of other conditions affecting Bhutanese refugees could play a contributory role, including malaria, intestinal parasites, deficiencies of vitamin B12 and other micronutrients, tuberculosis, hemoglobinopathies, and chronic disease. According to another survey administered to refugee children aged 6-59 months and their mothers in Nepali refugee camps in 2007, anemia was detected in 13.6% of mothers and 43.3% of children and decreased with age in children (BRHP, 2014).

2.8 Nutritional Status

Nutritional status is the state of our body as a result of the foods consumed and their use by the body. Nutritional status can be good, fair or poor (Mudambi et al, 2012). Nutrition has been defined as the food at work in the body. Nutrition includes everything that happens to food from the time it is eaten until it is used for various functions in the body (Srilakshmi, 2014).

Childhood is a time of active growth in terms of physical size, mental, emotional and psychological development. Normal growth is dependent on adequate nutrition and encompasses major transformations from birth to adulthood. Socio-economic status and behaviors of family members, environmental factors are other determinants of nutritional status under five year children (Acharya *et al.*, 2013).

2.8.1 Nutritional status of under-five children in Nepal

The nutritional status of children under age five is an important measure of child's health. Nepal Demographic Health Survey (2011) reveals that 41% of under five children are stunted and 16% are severely stunted, 11% are wasted and 3% are severely wasted and 29% are underweight and 8% are severely underweight.

Similarly, stunting is highest (53%) in children age 36 – 47 months and lowest (14%) in 9-11 months, wasting is found to be highest (25%) in children age 9-11 months and lowest

(7%) in children age 36-47 months and proportion of underweight children is highest (37%) among age 18-23 months and lowest (18%) among under 6 months children. Male children are more likely to be stunted, wasted and underweight as compared to female children (MoHP, 2011). The nutritional status of children in Nepal has improved over the past 15 years and is close to achieving the MDG target of reducing the percentage of underweight children age 6-59 months to 29% by 2015(NPC, 2010). The percentage of stunted children declined by 14% between 2001 and 2006 and declined by an additional 16% between 2006 and 2011. A similar pattern is observed for the percentage of underweight children, which dropped by 9% between 2001 and 2006 and by 26% between 2006 and 2011. Similarly, the percentage of wasting has declined by 15% between 2006 and 2011 (MoHP, 2011). Currently, the infant mortality rate in Nepal is 46 deaths per 1,000 live births for the five year period before the survey, just two deaths below the infant mortality reported in 2006. Under-five mortality is 54 deaths per 1,000 live births, down from 61 deaths per 1,000 in 2006. Mortality rates are much higher in rural than urban areas. For example, infant mortality is 55 deaths per 1,000 live births in rural areas compared to only 38 in urban areas. According to the 2011 NDHS, 87% of Nepalese children aged 12–23 months have received all recommended vaccines one dose each of BCG and measles and three doses each of DPT and polio. Only 3% of children did not receive any of the recommended vaccines (NDHS, 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 mother less than 18 years of age were underweight (Acharya *et al.*, 2013).

According to a survey conducted by Shrestha (2014) in Western Nepal, 20% of under-five children were underweight, 34% were stunted and 15% were wasted. Out of them 4.7% were severely underweight, 14% severely stunted and 7.2% severely wasted. Significant association of underweight and stunting was found among different ethnic group while the association of wasting with sex, ethnicity and age groups were not found to be statically significant.

Likewise, In Bhutanese refugee camps of Nepal, Ethnic persecution in 1991 led to approximately 100,000 Bhutanese of Nepali ethnicity settling in 7 refugee camps of South-Eastern Nepal. The refugees in the camps remain highly dependent on food aid, receiving rations from WFP, and primary healthcare services from UNHCR through its implementing

partner AMDA. A major resettlement program has been in action since 2007/2008, with some 65,325 refugees having been resettled in third countries, resulting in a population of approximately 47,000 by mid- 2012. The resettlement program is continuing, with departures of 12,000 to 18,000 per year; in five years' time it is expected that only 10,000 refugees from Bhutan will remain in Nepal. A survey conducted shows the prevalence of stunting decreased significantly every year from 2007-2010. In 2007 the prevalence was recorded as 39.2% which reduced significantly to 28.4% in 2010 ($p<0.001$); a relative decrease of 40%. Important to note here is the fact that measurements of stunting in Nepal have good reliability, as the vast majority of infants' birthdates are verified through reliable documentation such as birth certificates.

2.8.2 Factors affecting nutritional status and anemia

The factors affecting nutritional status of children are mother's food security, breast feeding practices , types of food given to young children , feeding frequency , status of women and child nutrition and last but not the least who feeds the child and how the child eats and his/her preference (NMIS, 1996)

Among the underlying determinants of chronic malnutrition, we considered as a proxy measure of current or recent SES, the asset index, household size, the nutritional status of the mother (measured by her BMI), health knowledge and care practices measured by mother's education, mother's marital status, birth interval and place of delivery of children. (Kandal et al, 2011). Also factors influencing the nutritional status are food availability and its distribution system , consumption , income , and purchasing power , price of commodities , illiteracy , family size , sociocultural and religious beliefs, environmental sanitation and health facilities play very integral roles in the nutritional status of the people in developing countries (Eusebio, 1988).

2.9 Assessment of nutritional status

Nutritional Assessment may be required to encompass nations, communities, vulnerable segments of communities or individuals, It may be done as a part of an exercise to document current status as compared with past status or as a specific attempt to evaluate the impact of an intervention program (Ramcharan *et al*., 1987).

A well-built body, a bounce in the step, sparkling eyes, clear skin and ready smile are generally associated with good health. Methods for assessing nutritional status are as follows:

1. Direct methods: It includes Anthropometric measurement, Biochemical tests, Clinical examinations and Dietary Survey.
2. Indirect methods: It includes Vital statistics and using information of ecological factors.

2.9.1 Direct method

a) Anthropometric measurement: Nutritional anthropometry is concerned with the measurement of the variations of the physical dimensions and the gross composition of human body at different age levels and degrees of nutrition (Jelliffe, 1966). Nutritional Anthropometry has most commonly been conducted on preschool children, the age group in which PEM is usually most prevalent and most severe. The commonly used anthropometric measurements or indicators of nutritional status for pre scholar children are briefly discussed below:

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

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

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

iv) Mid upper arm circumference: It is significant during the diagnosis of protein energy malnutrition. MUAC is taken on the left hand midway between the elbow and shoulder joint so that the hand was simply relaxed and hanging by the side.

v) Edema: Accumulation of fluid in interstitial cells is called as edema it also reflects PEM.

vi) Head and chest circumference: Measurement of head circumference is important because it is closely related to brain size. It is often used with other measurements to detect pathological conditions too (Rosalind, 1993).

Table no 2.2 Classification of Nutritional Status according to MUAC

Nutritional status	MUAC	Indicator
Adequate nutrition	≥13.5 cm	Green
Risk of malnutrition	12.5 - 13.4 cm	Green
Moderate acute malnutrition	≥11 - <12.5cm	Yellow
Severe acute malnutrition	<11 cm	Red

Source: Park (2007)

Some of the consequences and implications of nutritional imbalance are as follows:

i) Underweight: As weight is easy to measure, this is the indicator for which most data have been collected in the past. Evidence has shown that the mortality risk of children who are even mildly underweight is increased, and severely underweight children are at even greater risk.

ii) Stunting: Children who suffer from growth retardation as a result of poor diets or recurrent infections tend to be at greater risk for illness and death. Stunting is the result of long-term nutritional deprivation and often results in delayed mental development, poor school performance and reduced intellectual capacity. This in turn affects economic productivity at national level. Women of short stature are at greater risk for obstetric complications because of a smaller pelvis. Small women are at greater risk of delivering an infant with low birth weight, contributing to the intergenerational cycle of malnutrition, as infants of low birth weight or retarded intrauterine growth tend be smaller as adults.

iii) Wasting: Wasting in children is a symptom of acute under nutrition, usually a consequence of insufficient food intake or high incidence of infectious diseases, especially

diarrhea. Wasting in turn impairs the functioning of the immune system and can lead to increased severity and duration of and susceptibility to infectious diseases and an increased risk for death.

iv) Overweight: Childhood obesity is associated with a higher probability of obesity in adulthood, which can lead to a variety of disabilities and diseases, such as diabetes and cardiovascular diseases. The risks for most non communicable diseases resulting from obesity depend partly on the age at onset and the duration of obesity. Obese children and adolescents are likely to suffer from both short-term and long-term health consequences, the most significant being:

- cardiovascular diseases, mainly heart disease and stroke
- diabetes
- musculoskeletal disorders, especially osteoarthritis and
- Cancers of the endometrium, breast and colon.

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

c) Clinical examinations: we can also assess one's nutritional status by observing certain signs and symptoms which are associated with various nutrient deficiencies in various organs of body like skin, hair, mouth, tongue etc.

d) Bio physical tests: While routine radiographic studies of Population groups are rarely possible, or indeed required, it is sometimes valuable to carry out these investigations on a sample of a population if the physical signs and circumstances suggest the rickets, osteomalacia, fluorosis or beriberi may be present (Jelliffe, 1966).

2.9.2 Indirect methods

a) Vital statistics: A variety of vital statistics such as maternal, infant and childhood mortality rates, prevalence rates have been considered as indirect indicators of nutritional status of community.

b) Ecological information: The nutritional status of an individual or community is affected by socioeconomic and ecological factors. Therefore these parameters are likely to serve useful indirect indicators (Rajalakhsmi, 1987).

Part III

Materials and methods

3.1 Research design

Descriptive cross sectional study was carried out. The area of prevalence of anemia in children of 6-59 months old was Bhutanese refugee camp which consisted of three approaches which are:

a) Hemocue Hb Photometer for determining hemoglobin concentrations.
b) Anthropometric measurements of 6- 59 months children.
c) Household survey belonging to the children with the help of semi structured questionnaire.

3.2 Study area

Household situated around various area of Bhutanese refugee camp situated at Jhapa district.

3.3 Study Variables

Study Variables were classified as follows:

Dependent Variables: Hemoglobin levels of the children.

Independent Variables:

a) Demographic and Socio-economic characteristics: Ethnicity, religion, family size, education, occupation, income, Head of Households etc. Also economic characteristics have been categorized into 2 groups less than 1 lakh and more than 1 Lakh.

b) Child characteristics: Age, Sex, birth order, type of birth, breastfeeding status

c) Infant and young child feeding practices: Feeding , hygiene

d) Maternal characteristics: age, number of children ever born, extra food during pregnancy/lactation, care during pregnancy or lactation.

e) Household characteristics: Water supply, source of fuel.

3.4 Sampling Technique

Bhutanese Refugee camp was selected by using the simple random sampling.

3.5 Target population

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

Inclusion Criteria: Children aged 6-59 months who lived in Bhutanese Refugee camp were included in the study.

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

3.6 Sample size

The calculation of sample size will be done by using the statistical formula: $N= t^2 \times p\ (1-p)/m^2$

Where, n=required sample size

t=confidence interval at 95 % (standard value of1.96)

p=estimated prevalence of malnutrition in project area

m=margin of error at 9 % (standard value of 0.05)

Here, as the prevalence rate of anemia in Bhutanese refugee camp was found to be 50.8%

I.e. p=0.508, 1-p=0.492

Now, $N= (1.96)^2 \times 0.508 \times 0.492/ (0.09)^2 = 118.53$

Thus, the new sample size was further calculated below assuming non response rate as 10%

Now the required sample size was = $(118.53+10)/100 \times 118.53 = 130.38$

Hence desired sample size for the conduction of this survey was 131.

3.7 Research instruments

a. Hemocue Hb Photometer: A well standardized hemocue Hb 201^+ along with lancet and cuvette for determining hemoglobin concentrations.
b. Stadiometer (height measuring scale): A well calibrated stadiometer to measure height with minimum and maximum measuring capacity of 1cm and 196 cm respectively.
c. Weighing Balance: A digital weighing balance manufactured by Micro life, USA to measure weight with minimum and maximum capacity of 0.1 kg and 150 kg respectively.

d. Questionnaire A well designed and pretested set of questionnaire to collect household information.

3.8 Pre – testing

The study was pre- tested among the 6-59 months children from a selected area under sampling procedure. The pre- testing was conducted to establish accuracy of questionnaire and to check for consistency in the interpretation of questions and to identify ambiguous items. After review of instruments all suggested change were made before being administered in the actual study.

3.9 Validity and reliability

To ascertain the degree to which the data collection instruments will measure what they purposed to measure, the instruments was validated by comparing with standard known weights (for weighing balance). Reliability refers to quality control measure of data collected. Questionnaire was checked for completeness, consistency and clarity. Validity and reliability of the study was ensured by pre-testing of the tools, using standardized instruments. For validation of Hemocue hemoglobin photometer 5 samples were taken as trial samples and their specimen were taken to a clinical lab for hemoglobin diagnosis using cyanomethaemoglobin and Drakbin's solution. The observations made are presented with t-value (0.37) it was seen that use of either instrument had no significant difference. Close supervision was done in the field.

Table 3.1 Validity of Hemocue Hemoglobin Photometer

Method	Readings					Mean SD	t-test
Hemocue hemoglobin photometer	12.6	13.3	11.6	11.7	11.3	12.1±0.82	0.37
Standard Method	12.7	13.4	11.7	11.6	11.2	12.1±0.87	

3.10 Data Collection Techniques

Data from the respondents were collected with the help of structured questionnaire form in which answers of every question was coded with unique identity number for each child household. The data was collected by face to face interview with mother of the child or the caretaker with the help of structured questionnaire developed by reviewing different related

studies. The questionnaire was pre tested before taking interview and essential changes were made in the questionnaire according to findings. The data indicators used for hemoglobin estimation was spot test for hemoglobin concentration was done using Hemocue Hb photometer during the study. Finger prick method was used for collection of blood samples into the cuvettes and the cuvettes were inserted into the hemocue machine and the results were obtained accordingly. The data indicators used for anthropometry were age, height, weight and mid upper arm circumference. Age, height and weight were only used for assessment as per developed chart scale for boys and girls using WHO standard deviation score (Z score).

Three summary indices of nutritional status: Weight for age (underweight), Weight for height (wasting), and Height for age (stunting) were used as per recommended by WHO which was also used for nutritional assessment in NDHS. To measure height and weight, measuring tape and weighing machine were used. For child below 24 months, recumbent length was taken with assistance by keeping knee extended, foot plantar flexed and forehead touching wall. Similarly for child greater than 24 months to 59 months, standing height with footwear removed and support with wall was taken. The zero error of the weighing machine was corrected and weight of child was taken with minimum clothing. Child not able to stand, weight of child with mother was taken then mother weight was only taken and later was subtracted to previous weight to get the weight of the child.

3.11 Data Analysis

Quantitative data were firstly coded and were entered in SPSS Version 20. Similarly qualitative data was transcribed and coded by assigning labels to various categories.

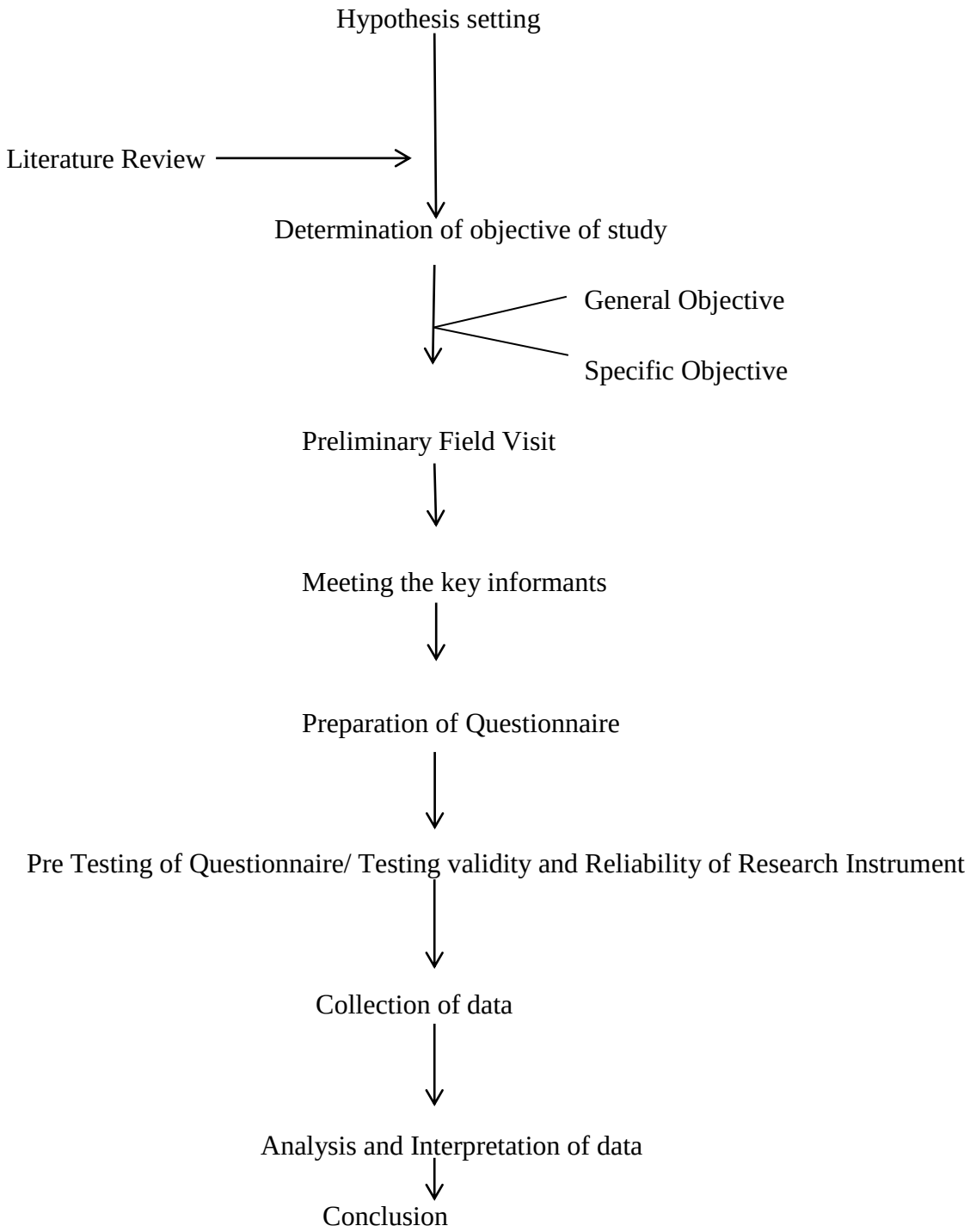
Statistical analysis: Data were entered and analyzed using SPSS version 20 to estimate the frequencies of descriptive variables (Gender, level of education, income and age etc.), Cross tabulation was done to find the relationship between variables. P value less than 0.05 were accepted as statistically significant. WHO Anthro software version 1.04 was used to estimate the prevalence of malnutrition among the 131 children of age 6 to 59 months.

3.12 Logistic and Ethical Consideration

Ethical approval for the study was provided by the Nepal Health Research Council (NHRC) and permission to conduct survey in Bhutanese Refugee Camp in Damak municipality was obtained from office of the Refugee Coordination Unit, Beldangi, Damak municipality.

Verbal and written consent from parents/care taker of study subjects was obtained. Respondents were assured that the data collected will be for the purpose of the study and will be treated with the uttermost confidentiality.

3.13 Conceptual Framework of Study



Part IV

Results and Discussion

The cross sectional descriptive study with 131 sample size was conducted in Bhutanese Refugee Camp, Jhapa district in order to determine the prevalence of anemia and its associated factors of 6-59 months children. Based on concentration of hemoglobin in the blood, anemia is classified into three groups: mild, moderate and severe (Sinha *et al.*, 2013).

4.1 Prevalence of anemia

The total numbers of sample for measuring prevalence of anemia were 131.Out of 131 samples 34.3% of the children were anemic with varying degrees ranging from mild and moderate which were 26.7% and 7.6% respectively. None of the participants were severely anemic (with Hb<7gm/dl).

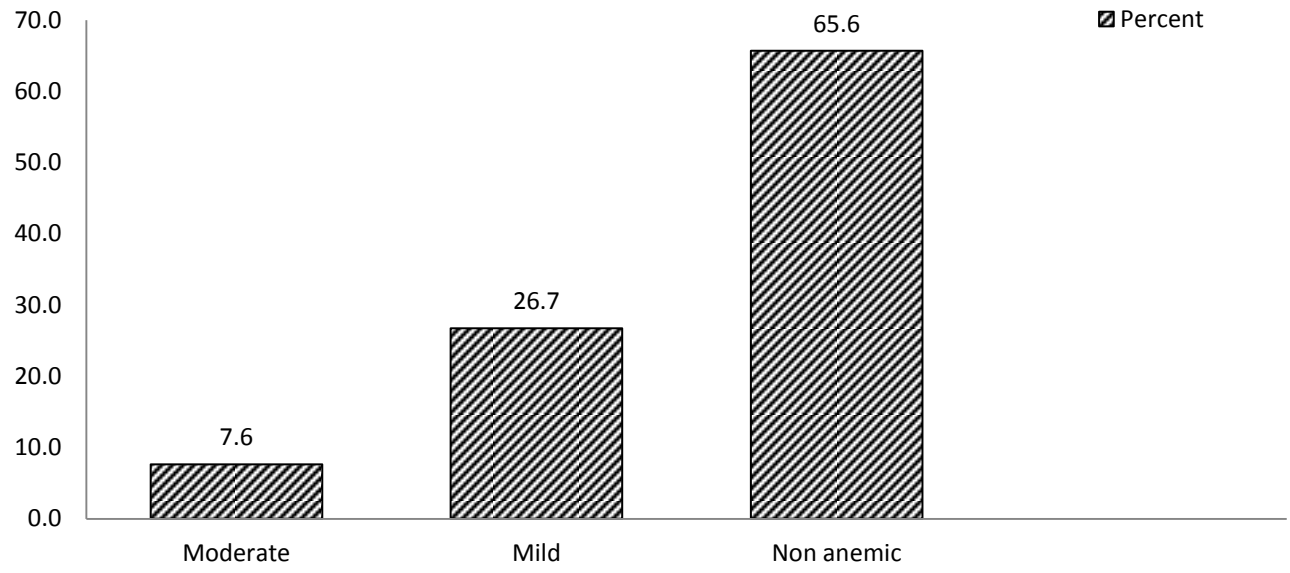


Figure 4.1: Classification of anemia of children of 6- 59 months children (n=131)

According to a survey done by UNHCR in Bhutanese Refugee Camp of Jhapa and Morang district in 2007, the prevalence of anemia was 50.8%, Severe anemia prevalence was 0.4%, moderate 21.1% and mild 29.3% which is similar to the result of this study(BRHP, 2014).

According to NDHS, (2011) Overall, 46 percent of Nepalese children ages 6-59 months are anemic. The majority of children who suffer from anemia are classified as having mild or

moderate anemia was 27 and 19 percent, respectively while less than 1 percent are severely anemic. These differences on prevalence of anemia may be due to difference in study area and other associated factors.

4.2 Demographic and socio economic characteristics and anemia

4.2.1 Religion distribution and Anemia

The main religion of the refugees were Kirat (33.6%) followed by Buddhist (29.8%), Hindu (28.2%) and Christian (8.4%). Distribution of anemia was found high among the participants who were Hindus and this result was statistically significance ($p<0.05$) which shows there was association between religion and hemoglobin level of the participants.

A study among the children aged 6-59 months in India shows that Hindu children are highly affected by anemia as compared with Christian and Buddhist children and the result is also statistically significant at the 1% level. The result in compliance with the present study as anemia is seen high among the children from Hindus than others. It may be due to number of vegetarians were high among the Hindus in comparison to others. It was also found that food fads and taboos were high among Hindus as compared to other religion which is a major factor for high prevalence of anemia (Bharati *et al.*, 2013).

Table 4.1 Religion Distribution and Anemia among Children among 6-59 months (n=131)

Religion	Percent	Non-anemic	Anemic	p-Value
Hindu	28.2	18 (48.6%)	19 (51.4%)	0.032*
Buddhist	29.8	25 (64.1%)	14 (35.9%)	
Christian	8.4	8 (72.7%)	3 (27.3%)	
Kirat	33.6	35 (79.5%)	9 (20.5%)	

*Statistically significant (p value<0.05)

4.2.2 Economic Characteristics and Anemia

The economic characteristics of households revealed that most of the households have labor as a main occupation and maximum households had annual income less than 60,000. Most of the participants whose family income source was from labor were anemic as compared to

other categories. Similarly, participants whose family's yearly income was less than 60,000 were found more likely to be anemic as compared to others. However income source and yearly income was not significantly associated with blood hemoglobin level (p-value > 0.05) of the participants in this study.

The mentioned table shows that 38% of the participants were anemic whose parents were laborers. Similarly, participants whose family's yearly income was less than 60,000 were found anemic (37.9%) while 28.9% were anemic whose annual income was between 60,000 - 100,000. It is due lack of proper nutrition which is directly related to insufficient income sources of the parents. It was found that monotonous eating habit of the laborers also affects the blood hemoglobin level of the child.

Table 4.2 Economic characteristics and anemia among children of 6- 59 months (n=131)

Variables	Percent	Non-Anemic	Anemic	p-Value
Income Sources				
Agriculture	0.8	Nil	1 (100%)	0.285
Service	38.2	36 (72%)	14 (28%)	
Labor	60.3	49 (62%)	30 (38%)	
Business	0.8	1 (100%)	Nil	
Annual Income				
less than 60,000	60.3	49 (62%)	30 (37.9%)	0.282
60,000-100,000	39.7	37 (71.1%)	15 (28.9%)	

4.2.3 Socio Demographic characteristics and Anemia

Table 4.3 shows that most of the participants belonged to nuclear families (70.2%) where as 29.8% of the participants were from joint family. The educational status among the mother of participants was superseded by primary to secondary level followed by illiterate and higher secondary. Table 4.3 shows that higher anemic percentage among the participants who belonged to nuclear families (36.9%) as compared to joint family (28.1%). The reasons for high anemic prevalence in nuclear family were due to lack of proper food as the income source is only through head of the family. It was found that anemia is positively associated

with poor access to antenatal care and maternal nutrition during pregnancy as there may be lack of other members helping during pregnancy.

Looking through the anemic percentage as per the educational level of family, prevalence of anemia was high in the participants whose mothers were illiterate. The study shows that 71.5% children were anemic whose mothers were illiterate followed by 35.9% anemic children whose mothers have primary education and 28.6% anemic children whose mothers have secondary level education. The p-value was >0.05, therefore the test was not statistically significance. Mother's education is directly related to iron status of the child. As the mother is illiterate there may le lack of proper hygiene and sanitation, she may be unaware about the foods rich in iron sources. So the prevalence of anemia would be higher in children whose mothers have low education.

Present study result is similar to the study by (Woldie *et al.*, 2015) that more anemic children were from the family whose mother's education is low followed by primary education and secondary education which is in compliance with this study.

A study done in Cameroon shows those children whose mothers have a secondary level or higher education have a 22% lower risk of developing anemia than do the children of less educated mothers(Pinlap, 2015).

A study done in Kathmandu Medical College Teaching hospital has also shown that 50% of parents who were either illiterate or have had only primary level of the education had the highest percentage of anemic children(46%) (Bajracharya *et al.*, 2006).

Table 4.3 Socio-demographic characteristics and anemia among children of 6- 59 months (n=131)

Variables	Percent	Non-anemic	Anemic	p-Value
Family Type				
Nuclear	70.2	58 (63%)	34 (37%)	0.335
Small	29.8	28 (71.7%)	11 (28.3%)	
Family Size				
Less than 5	58	50 (65.7%)	26 (34.2%)	0.968
5 or more than 5	42	36 (65.4%)	19 (34.6%)	
Mother's Education				

Primary Level	51.1	43 (64.1%)	24 (35.9%)	0.128
Secondary Level	42.7	40 (71.4%)	16 (28.6%)	
Higher Secondary	0.8	1 (100%)	Nil	
Illiterate	5.3	2 (28.5%)	5 (71.5%)	

4.3 Sample Characteristics and Anemia

In total 131 children included in this study, 66 were females and remaining 65 were males. Majority of children fall between 48 – 59 (32.1%) months age group followed by 12 – 23 (24.4%), 24 – 35 (16.8%), 36 – 47 (15.3%) and 6 – 11 (11.5%).Most of the anemic children fall under the group 36-47 months (50%) followed by 24-35(41%),6-11(33.4%),48-59(28.6%) and the least anemic participants fall under the12-23(28.2%) . A study done in West Africa shows that the male children were more anemic in comparison to females (Semedo *et al.*, 2014).

Most of children's weight at birth was above reference range (more than 2.5 Kg) i.e. (89.3%) and 28.5 % were below 2.5 kg. It was found that 31.5% children whose weight was more than 2.5 kg while birth were anemic and 57% children whose weight was below 2.5 kg while birth were found to be anemic. The p-value from chi square statistics was <0.05 for birth weight; therefore the result was statistically significance. A study in Brazil by Leal *et al.* (2011) presented that low birth weight was significantly associated with anemia which is similar to the present study. Thus this reveals that higher is the low birth weight there is high chances of anemia prevalence. It may be due to under nutrition in women before and during their pregnancy (Srilakshmi, 2014).

It was found that 50.4% of families under the survey had only one child below five year while 49.6% had two or more children. It was found that families having only one child below 5 years were less anemic (27.3%) in comparison to families having two or more children (41.6%).It was found that large family size and number of children per family, when more than 3, were found to have higher rate of anemia, as the birth order of the child increases there is higher changes of anemia prevalence in children.

Similarly, 24.4% of the children were anemic who had consumed deworming tablets for 6 or less than 6 months duration while 38.2% children were anemic who had consumed deworming tablets for more than 6 months duration. Similarly the effectiveness of National Vitamin A supplementation program was similar to that of the country as the national data on

vitamin A supplementation showed nine in ten children aged 6-59 months received vitamin supplementation (MoHP, 2011). Over the past decades, refugee children has had success in reducing under five mortality, largely due to the implementation of MNP program and the immunization program (Pringle and Seal, 2013). This may be due to increasing awareness of refugee people regarding child vaccination and availability of health facilities and increment of implementation of program (IP *et al.*, 2009).

While observing the disease history, it was found that children who were sick prior to study period were more anemic in which the children were mainly suffering from diarrhea and chronic disease and 29.5% children were found to be anemic who had no health problems. A study in Bhaktapur by Adhikari *et al.* (2015) showed that the children who had acute diarrhea were more anemic which is very similar to present study. In this study the proportion of anemia in children presenting with acute diarrhea was high but mostly mild or moderate.

Out of 131 children, the study shows that, 0.8%and 4.6% were severely and moderately wasted and 94.7 % were in normal range. Out of the wasted children 66.7% were found to be anemic while 32.3% children were anemic who were in normal range.

Similarly, 1.5% of the participants were severely and 32.1 %of the participants were moderately stunted. Out of the stunted children 54.8% were anemic while 22.9% were anemic who fall under the normal range. A significant association between stunting and anemia was found in study in Kenya by Kisiangani *et al.* (2015) revealed that stunting was related to anemia which is consistent with the present study. These result supported that stunted children were at high risk of becoming anemic.

Likewise, 8.4% children were found to be moderately underweight. There were no any cases of severely underweight. 91.6% of the children were normal. The results show that 54.6% of the underweight children were anemic while 32.5% of normal range children were found to be anemic.

Thus the present study found that birth weight, disease history and stunting had association with anemia (p value <0.05).

Table- 4.4 Sample characteristics and anemia among children of 6-59 months (n=131)

Variables	Percent	Non anemic	Anemic	p- Value
Gender				
Female	50.4	47 (71.2%)	19 (28.8%)	0.177
Male	49.6	39 (60%)	26 (40%)	
Age groups (months)				
6-11	11.5	10 (66.6%)	5 (33.4%)	0.438
12-23	24.4	23 (71.8%)	9 (28.2%)	
24-35	16.8	13 (59%)	9 (41%)	
36-47	15.3	10 (50%)	10 (50%)	
48-59	32.1	30 (71.4%)	12 (28.6%)	
Birth order				
First	58	52 (68.4%)	24 (31.6%)	0.686
Second	29	22 (57.8%)	16 (42.2%)	
Third	8.4	7 (63.6%)	4 (36.4%)	
Fourth	3.8	4 (80%)	1 (20%)	
Fifth	6.8	1 (100%)	Nil	
Birth weight				
Less than 2.5 kg	10.7	6 (42.8%)	8 (57.2%)	0.057
More and equal to 2.5 kg	89.3	80 (68.3%)	37 (31.7%)	
Total number of children under 5				
One	50.4	48 (72.7%)	18 (27.3%)	0.086
More than one	49.6	38 (58.4%)	27 (41.6%)	
Deworming Tablets				
6 and less than 6 months	28.2	28 (75.6%)	9 (24.4%)	0.129
More than 6 months	71.8	58 (61.7%)	36 (38.2%)	
Disease History				
Diarrhea	2.3	Nil	3 (100%)	0.001*
Chronic Disease	4.6	Nil	6 (100%)	
Malaria	0.8	Nil	1 (100%)	
Others	1.5	2 (100%)	Nil	

No health Problems	90.8	84 (70.5%)	35 (29.5%)	
Wasting				
Severe	0.8	Nil	1 (100%)	0.085
Moderate	4.6	2 (33.3%)	4 (66.7%)	
Normal	94.7	84 (67.7%)	40 (32.3%)	
Stunting				
Severe	1.5	Nil	2 (100%)	0.001*
Moderate	32.1	19 (45.2%)	23 (54.8%)	
Normal	66.4	67 (77%)	20 (23%)	
Underweight				
Moderate	8.4	5 (45.4%)	6 (54.6%)	0.141
Normal	91.6	81 (67.5%)	39 (32.5%)	

*Statistically Significant (p value <0.05)

4.4 Infant and child feeding practices

Among 131 children, 97.7% were breast fed on the very first day of birth which is slightly higher than (NDHS, 2011) which revealed 85 percent of children breastfed within the day of birth. The results show that 33.5% children were anemic who breastfed were on the first day of their birth while 66.7% children were anemic who were not breastfed on the first day of their birth.

Colostrum feeding was done in 85.5 % of children in which 31.2% of the colostrum fed children was anemic while 66.6% of the children who were not fed colostrum were found to be anemic. Initiation of breast feeding scenario showed 64.9% children were breast feed with in first hour after delivery while 17.7% of children who were breastfed with in first hour of delivery were anemic followed by 58.4% anemic within eight hour of delivery.

Similarly, 91.6% were exclusively breastfed for six months which is greater than finding of NDHS, 2011 i.e. 70%. The result showed that 30.9% who were exclusively breastfed were found to be anemic while 72.6% were anemic children where the exclusive breastfeeding was not done. The p-value from chi square statistics was <0.05 for exclusive breastfeeding; therefore the result was statistically significance. According to the study done in Sri Lanka by Malkanthi and Silva (2014) found that there was relationship between hemoglobin concentration and duration of exclusive breastfeeding. Hemoglobin concentration was

modestly negatively correlated with duration of exclusive breastfeeding, which is in compliance with the present study finding. This may be due to lack of appropriate knowledge regarding sigificance of exclusive breastfeeding in the very study area.

No any food was given prior to breastfeeding to 99.2% of children, while 0.8% fed cow's milk respectively. Complementary food was introduced to the children at 6 months. It was found that 14.3% children was anemic consuming jaulo as a complementary food while 35.3% and 35.6% were anemic who consumed sarbottam pitho and similar food items to other family members respectively.

Table number 4.5 Infant and Child feeding practices and anemia among children of 6-59 months (n=131)

Variables	Percent	Non-anemic	Anemic	p-Value
Breastfeeding on first day of birth				
Yes	97.7	85 (66.5%)	43 (33.5%)	0.233
No	2.3	1 (33.3%)	2 (66.7%)	
Colostrum Feeding				
Yes, I fed	85.5	77 (68.7%)	35 (31.2%)	0.07
No, I didn't	14.5	9 (47.3%)	10 (52.7%)	
Still Breastfeeding your child				
Yes	61.8	59 (72.8%)	22 (27.2%)	0.027*
No	38.2	27 (54%)	23 (46%)	
Exclusive Breastfeeding				
Yes	91.6	83 (69.1%)	37 (30.9%)	0.005*
No	8.4	3 (27.2%)	8 (72.8%)	
Time of initiation of breastfeeding				
Within 1 hour	64.9	70 (82.3%)	15 (17.7%)	0.001*
Within 8 hour	9.2	5 (41.6%)	7 (58.4%)	
After 24 hour	26	11 (32.3%)	23 (67.7%)	
Feeding Prelacteals				
Nothing	99.2	86 (66.1%)	44 (33.9%)	0.165

Cow's Milk	0.8	Nil	1 (100%)	
Feeding commercial milk				
Yes	25.2	19 (57.5%)	14 (42.5%)	0.259
No	74.8	67 (68.3%)	31 (31.7%)	
Type of complementary food				
Jaulo	5.3	6 (85.7%)	1 (14.3%)	0.517
Sarbottam Pitho	13	11 (64.7%)	6 (35.3%)	
Similar to other family members	81.7	69 (64.4%)	38 (35.6%)	

*Statistically Significant (p value <0.05)

4.5 Maternal Characteristics

The highest number of mother were from age group 20-29.9 (71%) followed by 30 and above years (19.8%) and less than 20 years (9.2%). Among them 46.2% mothers from 30 and above age group were found to be anemic followed by 31.2% in 20 -29.9 age groups and 33.3% anemic in mothers who were less than 20.

Most of the mothers (90.1%) had consumed iron tablets during pregnancy. In this study 33.1% children were found to be anemic to their mothers with iron supplementation while 46.1% children were anemic to their mothers with no iron supplementation during pregnancy. It may be due to lack of proper iron supplementation during pregnancy in which there were higher chances of anemic prevalence in children. In absence of mother, the highest percentage of care done to the children was by husband (66.4%) followed by father/ mother in law and neighbor respectively.

The evaluation of the mother's knowledge about anemia was done using a self-developed multiple choices questionnaire. Questions like what you understand about anemia, what are its causes, its affects were asked to the mothers. Data indicate that out of 131 mothers, 59.5% mothers have knowledge about anemia while 40.5% mothers don't have any knowledge regarding anemia. The result also indicates that 14.2 % children were anemic to the mothers having knowledge about anemia while 64.2% children were anemic to the mothers having no knowledge about anemia. As the mothers knowledge is highly linked with the health of the child, low knowledge about anemia to the mother's shows direct relationship with the anemia prevalence of children as mothers are less aware about the value of nutritious food rich in iron.

Table number 4.6 Maternal characteristics and anemia among children of 6- 59 months (n=131)

Variables	Percent	Non Anemia	Anemia	p-Value
Age group of mothers				
Less than 20	9.2	8 (66.6%)	4 (33.4%)	0.363
20-29.9	71	64 (68.8%)	29 (31.2%)	
30 and above	19.8	14 (53.8%)	12 (46.2%)	
Iron Supplementation				
Yes	90.1	79 (66.9%)	39 (33%)	0.345
No	9.9	7 (53.8%)	6 (46.2%)	
Care of children in parent's absence				
Father/mother in law	29.8	28 (71.7%)	11 (28.3%)	0.607
Husband	66.4	55 (63.2%)	32 (36.8%)	
Elder brother/sister	0.8	1 (100%)	Nil	
Neighbor	3.1	2 (50%)	2 (50%)	
Knowledge about Anemia				
Yes	59.5	67 (85.8%)	11 (14.2%)	0.001*
No	40.5	19 (35.8%)	34 (64.2%)	

*Statistically significant (p value <0.05)

4.6 Household characteristics

It was found that every two house shared one toilet and no individual toilets were provided to them. It was found that every toilet were simple. Main source of drinking water was tap water. Common tap was used by the refugees and the water was chlorinated under the supervision of WFP and none of the households use hand pumps.

4.7 Intake of iron rich food and Anemia

Eating habits of the children were evaluated through qualitative, pretested food frequency questionnaire (FFQ) in which foods were divided into plant and animal products and the frequency of food were characterized as at least once a day, once a week, , 2-4 times a week

once in 15 days and never. For data analysis purposes, the foods were distributed into three groups of consumption: “frequent”, “regular” and “rare”. The consumption of plant and animal products was considered “frequent” if ingested at least once a day, “regular” when ingested 2-4 times a week ,“rare” if ingested once a week or less and never.

The results showed that 19.8% children frequently consumed plant products while 76.3% regularly consumed plant products and 3.8% children rarely consumed plant products. Similarly, 39.7% children regularly consumed animal products while 60.3% rarely consumed animal products. The results also showed that none of the children frequently consumed animal products. This may be one of the major reasons for increased prevalence of anemia among children.

The result showed that 27%, 37% and 20% children were anemic who frequently, regularly and rarely consumed plant products. Likewise in animal products none of the children consumed meat and meat products daily while 21.2 % were anemic who regularly consumed animal products and 43.1% were anemic who rarely consumed animal products. The p-value was >0.05 for plant and animal products; therefore the result was not statistically significance. However results indicate that the children who do not consume animal products on regular basis are more prone to anemia as compared to others.

It is important to highlight that there are two types of iron in food and they have different bioavailability. The heme iron, found in food of animal origin in the form of hemoglobin and myoglobin is more easily absorbed by the intestinal mucosa. The non-heme iron, found in food of vegetal origin has lower bioavailability and is affected by chemical or food factors(Fujimori *et al.*, 2010). Low consumption of animal products in refugee camps may be due to lack of income sources, no land for agriculture and rearing domestic cattle’s, lack of proper education regarding the rich sources of iron and consumption of monotonous food products as their daily meal.

A study done by Mallikarjuna and Geetha (2013) is similar to this study which showed that children consuming vegetarian diet were more anemic in comparison to children who consumed animal products.

Table 4.6 Intake of iron rich food and anemia among children of 6-59 months (n=131)

Variables	percent	Non anemic	Anemic	p-Value
Plant Products				
Frequent	19.8	19 (73%)	7 (27%)	0.496
Regular	76.3	63 (63%)	37 (37%)	
Rare	3.8	4 (80%)	1 (20%)	
Animal Products				
Regular	39.7	41 (78.8%)	11 (21.2%)	0.07
Rare	60.3	45 (56.9%)	34 (43.1%)	

Part V

Conclusions and Recommendations

5.1 Conclusions

Conclusively, this study has generally assessed the prevalence of anemia of children in Bhutanese refugee camp and findings are important to understand prevalence and determinants of anemia among 6-59 months children in Bhutanese refugee camp of Damak municipality. The results of this study indicate that anemia is still an important problem among children of 6-59 months in Bhutanese refugee camp of Damak municipality. Following points can be concluded from the study.

a) Anemia is major problem among children with the prevalence of 34.3% with varying degrees ranging from mild and moderate which were 26.7% and 7.6% respectively.

b) The findings of this study confirmed religion, birth weight, disease history, stunting, exclusive breastfeeding, time of initiation of breastfeeding and knowledge about anemia were significantly associated with anemia among children (p-value <0.05).

c) The study indicated that in religion Hindus were more affected by anemia in comparison to other religion (p=0.03). Children whose birth weight were lower than 2.5 kg were more susceptible to anemia (p=0.006).Likewise, children who were sick prior to study period mainly suffering from anemia and chronic disease were found to be anemic (p =0.001). Similarly, children who had not initiated breastfeeding within eight hour or more are prone to anemia (p= 0.000) and mothers who had less knowledge about anemia were directly related to anemia prevalence of children (p=0.001).

d) The determinants of anemia like family income, education level of parents, family type, gender, maternal characteristics, initiation of breastfeeding, deworming tablets and intake of iron rich foods though considered as an important factors were not associated with anemia (p value >0.05) among children.

e) These findings are of great importance as they identify potential actions that can be used to improve the hemoglobin level of children.

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

5.2 Recommendations

The results of this study suggest that following recommendations:

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

b) Similar cross-sectional descriptive or longitudinal survey can be conducted to determine the distribution and type of anemia and other probable causes of anemia.

c) These results may be used in policy formulation regarding children in this refugee camp and other similar areas in the country.

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

Part VI

Summary

Anemia is considered the most prevalent nutritional deficiency globally. Anemia is the decreased ability of the red blood cells to provide adequate oxygen to body tissues. Childhood period is the most challenging period in human development. In children aged 6-59 months, anemia has adverse negative health consequences that include altered cognitive development, poor school performance, impaired physical growth, and poor immunity. Present work is mainly focused to assess the prevalence of anemia and factors associated among children aged (6-59months) of Bhutanese refugee camp of Damak municipality.

A community based cross-sectional survey was conducted in Bhutanese refugee camp of Damak municipality to assess prevalence of anemia and factors associated with anemia. Study was conducted in areas of the refugee camp which was obtained by simple random sampling. Hemoglobin estimation was performed using automated Hemocue Hb photometer and categorization of severity of anemia was done and anthropometric measurements and semi structured questionnaire were used to collect information on anthropometric parameters and socioeconomic characteristics respectively. Questionnaire was administered to the mother or caretaker of child who was available in the household at the time of survey and the child's anthropometric measurements was recorded at the same time. Thus collected anthropometric data were entered and analyzed using WHO Anthro version 3.2.2. Similarly, all other data of various characteristics were entered to SPSS version 20 and frequencies, percentages were calculated and associations of various variables were tested with it. Chi-square test of significance was performed to find out the factors associated with anemia at 95% confidence interval.

Out of 131 children, 66 were females and 65 were males. The study showed that prevalence of anemia among children of 6-59 months in Bhutanese refugee camp was 34.3% with varying degrees ranging from mild and moderate which were 26.7% and 7.6% respectively. None of the participants were severely anemic (Hb<7gm/dl).Most of the anemic children fall under the group 36-47 months (50%) followed by 24-35(41%), 6-11(33.4%), 48-59(28.6%) and the least anemic children fall under the12-23(28.2%). The study found that 50.4% of families under the survey had only one child below five year similarly 38.2% children was anemic who had consumed deworming tablets for more than 6 months duration. While observing the disease history, it was found that prevalence of anemia was high in

children who were mainly suffering from diarrhea and chronic disease. Similarly, 1.5% of the participants were severely and 32.1 %of the participants were moderately stunted whereas 0.8%and 4.6% were severely and moderately wasted and 8.4% children were found to be moderately underweight. The study also revealed that 89.3% children's birth weight was more than equal to 2.5 kg. More, 28.2% children followed Hinduism. The result showed there was significant association between religion of the participants and anemia. Participants belonging to nuclear family were higher (70.2%) and (58%) of the participants was living in the family with less than 5 members. Out of 131 samples 5.3% of the mothers were illiterate.

The study showed that 97.7% children were breastfed on their first day of birth while 85.5% children were fed colostrum. 64.9% children were found to be breastfed within one hour of their birth and 99.2% children were not fed any prelacteals. Children who were exclusively breastfed for 6 months were 91.6% and 61.8%children are still breastfeeding, while 25.2%children were started to feed the commercial milk. Results showed significant association of time of initiation of breastfeeding and still breastfeeding with the p-value of 0.000 and 0.033 respectively. In the maternal characteristics, 71% mothers were from the age group 20-29.9 years, 90.1% mothers had iron supplementation during their pregnancy. It was found that in mother's absence 66.4% care was done by fathers and 59.5% mothers have knowledge about anemia.

This study shows that anemia prevalence is still an important problem among children aged 6-59 months in Bhutanese refugee camp of Damak municipality, there is a need of intervention to overcome the problem of anemia which in turn can lead to profound and long-term benefits for individuals and for society as a whole.

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Appendices

Appendix - A

INFORMED CONSENT

Namaste!

I Ms. Neeta Shrestha, graduate student in Department of Nutrition and Dietetics conducting a dissertation work for award of bachelor‘s degree in Nutrition and Dietetics.

The topic for the study is —”Prevalence of Anemia and its associated factors among children aged 6-59 months in Bhutanese refugee camp at Damak municipality

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

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

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

Signature of parent/guardian: _____ Sign of 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.

Appendix – B

Questionnaire

Code number

Date of the survey 2073/ /

General information:

1. Name of the Head Of the Family:
2. Ward No:
3. Name Of the Respondent:
4. Name of the mother:
5. Age of the mother
6. Name of the participant: Date of Birth:

Personal Information

1. Total members of the family: Males…… Females……..
2. How many children do you have?
3. Children less than 5 years old?
4. Type of family: Single……. Joint……
5. Which religion do you follow?
   a. Hindu b. Buddhist c. Christian d. Kirat e. Others
6. Main occupation:
   a. Farming b. Service c. Labor d. Business e. Foreign Country
7. Yearly income of the family:
   a. Less than 60,000 b. 60,000-100,000 c.100,000- 140,000 d. More than 140,000
8. Education of mother:
   a. Primary level b. Secondary level c. Higher secondary and more d. illiterate
9. Education of father:
   a. Primary level b. Secondary level c. Higher secondary and more d. illiterate

Hygiene and Sanitation

1. What is the main source of drinking water for your household?
   a. Tube well b. river c. well d. Tap e. others
2. Do you treat your water before using it?
   a. Yes b. No
3. Do you have toilet in your house?
   a. Yes b. No
4. When do you wash your hands?
   a. Before cooking b. Before eating c. After using toilet d. Before breastfeeding child e. all of the above

Questions asked to the mother or the caretaker of the children:

1. How many of the children are below 5 years? .....
2. In the absence of mother, who takes care of the children?
   a. Father in law/Mother in law b. Husband c. Elder brother or sister d. other members of the family e. Neighbor g. No one
3. What is the birth order of this participant? .....
4. How old was the first child when this child was born? .....
5. Does the child have any kind of health problem?
   a. Yes b. No
6. If yes then what kind of health problem she/he has
   a. Diarrhea b. Malnutrition c. Malaria d. Chronic diseases (heart problem, cancer) e. Others
7. When your child gets sick, where do you take him/her at first?
   a. Health post b. Medicine shop c. Female health worker d. witch doctor
   e. Nowhere f. others

Nutrition and Breastfeeding Information:

1. Did you breastfed your child since birth?
   a. Yes b. No
2. Did you breastfed your child on your own?
   a. Yes b. No

If no then why didn't you breastfed your child? .....

3. If you have breastfed your child then, at what time did you first feed your milk to child?
   a. Within 1 hour b. after 8 hour c. after 24 hour d. you don't remember
4. Before giving colostrum to the baby did you fed any other thing? If yes then what?
   a. Honey, water and ghee b. cow's milk c. alcohol d. others
5. Are you still breastfeeding your child?
   a. Yes b. No
6. If yes, then how many times do you breast feed your child? …….. times/day
7. How long a child should be breast fed or how long did you breast feed your child? …… months/years
8. Did you exclusively breast fed your baby for six months?
   a. Yes b. No
9. Did you feed commercial or formula milk to your baby?
   a. Yes b. No
10. Are you feeding food other than breast milk to your baby?
    a. Yes b. No
11. When did you start giving foods other than breast milk to your child?
    a. 4 month b. 5 month c. 6 month d. 7 month
12. How many times do you feed food other than breast milk to your child?
    ……times a day
13. What do you feed to your child?
    a. Lito b. Jaulo c. Sarbottam Pitho d. Same as other family members
14. . Do you feed sarbottam pitho to your baby?
    a. Yes b. No
15. If yes then from where did you obtain it?
    a. Prepare at home b. Market c. sometimes from market and sometimes at home
16. What type of food does your child like to have?
    a. Homemade b. Junk food
17. Did you give "Vit.A" capsule and "De-worming" tablet to your baby?
    a. Yes b. No
18. Do you feed green leafy vegetables to your child?

a. Always b. Sometimes c. When available d. Never

Child and Maternal Health Related Information

1. Mother's age when she got married? …….. year
2. Mother's age when she was pregnant for first time? …….year
3. Weight of child during birth?
   a. Less than 2.5 kg b. more than 2.5 kg c. do not remember
4. Did you take iron and folate tablet during pregnancy?
   a. Yes b. No c. Do not remember
5. If yes, how long did you take it? ……

Foods consumed by children

Food groups	Foods	Daily	Once a week	Twice a week	Thrice a week	Four times a week	Once in a two week	Never
Cereals	Wheat							
	Millet							
	Barley							
	Flaked rice/Puff rice							
Legumes and pulses	Lentil							
	Soyabean							

	Black gram							
	Horse gram							
Fruits	Promogranate							
	Grapes							
	Apple							
Vegetables	Amaranth							
	Rape leaves							
	Broccoli							
	Pumpkin							
	Beans							
Meat and its products	Fish							
	Chicken							
	Meat							
	Egg							

Anthropometric Measurements:

Age (months)	Gender (M/F)	Weight (Kg)	Height (Cm)	MUAC (mm)	Hemoglobin Level (mg/dl)

Signature of Guardian

…….

Signature of Interviewer

……

Appendix –C

Table 8.1 Distribution of different forms of anemia based on different study variables

Variables		Types of Anemia		
		Non anemic	**Mild**	**Moderate**
Religion	Hindu	48.6%	37.8%	13.5%
	Buddhist	64.1%	33.4%	64.1%
	Christian	72.7%	27.2%	Nil
	Kirat	79.5%	11.4%	9%
Income Sources	Agriculture	Nil	100%	Nil
	Service	72%	22%	6%
	Labor	62%	29.1%	8.9%
	Business	100%	Nil	Nil
Annual Income	Less than 60,000	62%	29.2%	8.8%
	60,000-100,000	71.1%	23.2%	5.7%
Family Type	Nuclear	63%	29.4%	7.6%
	Joint	71.7%	27.6%	6.7%
Family Size	Less than 5	65.7%	27.6%	6.7%
	5 or more than 5	65.4%	25.4%	9.2%
Mother's Education	Primary level	64.1%	26.9%	8.9%
	Secondary level	71.4%	25.1%	3.5%
	Higher secondary	100%	Nil	Nil
	Illiterate	28.5%	42.8%	28.5%
Gender	Male	71.2%	24.2%	4.5%
	Female	60%	29.2%	10.7%
Age Group	6-11	66.6%	26.6%	6.8%
	12-23	71.8%	21.8%	6.4%
	24-35	59%	31.8%	9.3%
	36-47	50%	45%	5%
	48-59	71.4%	19.1%	9.5%
Birth order	First	68.4%	22.3%	9.3%
	Second	57.8%	36.8%	5.4%
	Third	63.6%	27.4%	9%

	Fourth	80%	20%	Nil
	Fifth	100%	Nil	Nil
Birth weight	Less than 2.5 kg	42.8%	28.7%	28.5%
	More and equal to 2.5 kg	68.3%	26.6%	5.1%
Total no of children under 5	One	72.7%	19.6%	7.5%
	More than one	58.4%	33.8%	7.6%
Deworming Tablets	6 and less than 6 months	75.6%	18.9%	5.4%
	More than 6 months	61.7%	28.1%	10.1%
Disease history	Diarrhea	Nil	33.4%	66.6%
	Chronic disease	Nil	50%	50%
	Malaria	Nil	Nil	100%
	Others	100%	Nil	Nil
	No health problems	70.5%	26.2%	3.3%
Wasting	Severe	Nil	100%	Nil
	Moderate	33.3%	50%	16.4%
	Normal	67.7%	25.1%	7.2%
Stunting	Severe	Nil	100%	Nil
	Moderate	45.2%	42.9%	11.9%
	Normal	77%	17.3%	5.7%
Underweight	Moderate	45.4%	36.5%	18.1%
	Normal	67.5%	25.9%	6.6%
Breastfeeding on first day of birth	Yes	66.5%	27.3%	7.2%
	No	33.3%	33.4%	33.3%
Colostrum Feeding	Yes, I fed	68.7%	25.1%	6.2%
	No, I didn’t fed	47.3%	36.1%	16.6%
Still breastfeeding your child	Yes	72.8%	23.4%	3.7%
	No	54%	32%	14%
Exclusive breastfeeding	Yes	69.1%	26.6%	4.1%
	No	27.2%	27.2%	45.6%
Time of Initiation of breastfeeding	Within one hour	82.3%	17.6%	Nil
	Within eight hour	41.6%	50.1%	8.3%

	After 24 hour	32.3%	39.3%	28.4%
Feeding prelacteals	Nothing	66.1%	26.2%	7.7%
	Cow's milk	Nil	100%	Nil
Feeding commercial milk	Yes	57.5%	30.3%	12.1%
	No	68.3%	25.5%	6.1%
Type of complementary food	Jaulo	85.7%	14.3%	Nil
	Sarbottam Pitho	64.7%	29.5%	5.8%
	Similar to other family members	64.4%	27.1%	8.4%
Age group of mothers	Less than 20	66.6%	25%	8.4%
	20-29.9	68.8%	24.7%	6.4%
	30 and above	53.8%	34.6%	11.5%
Iron supplementation	Yes	66.9%	24.5%	12.6%
	No	53.8%	46.1%	Nil
Care of children in parent's absence	Father/mother in law	71.7%	23%	5.3%
	Husband	63.2%	28.7%	8.1%
	Elder brother/ sister	100%	Nil	Nil
	Neighbor	50%	25%	25%
Knowledge about anemia	Yes	85.8%	12.8%	1.2%
	No	35.8%	47.1%	16.9%
Plant products	Frequent	73%	23.07%	3.84%
	Regular	63%	29%	8%
	Rare	80%	Nil	20%
Animal products	Regular	78.8%	19.2%	1.92%
	Rare	56.9%	31.6%	11.4%

Appendix - D

Government of Nepal

Nepal Health Research Council (NHRC)

Estd. 1991

Ref. No.: 1237.

15 January 2017

Ms. Neeta Shrestha
Principal Investigator
Central Campus of Technology
Dharan, Sunsari

Ref: **Approval of Research Proposal** entitled **Prevalence of anemia and its associated factors among children aged 6-59 months in Bhutanese refugee camp of Damak Municipality**

Dear Ms. Shrestha

It is my pleasure to inform you that the above-mentioned proposal submitted on 19 December 2016 **(Reg. no. 453/2016** please use this Reg. No. during further correspondence) has been approved by Nepal Health Research Council (NHRC) National Ethical Guidelines for Health Research in Nepal, Standard Operating Procedures Section 'C' point no. 6.3 through Expedited Review Procedures.

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

If the researcher requires transfer of the bio samples to other countries, the investigator should apply to the NHRC for the permission.

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

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

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

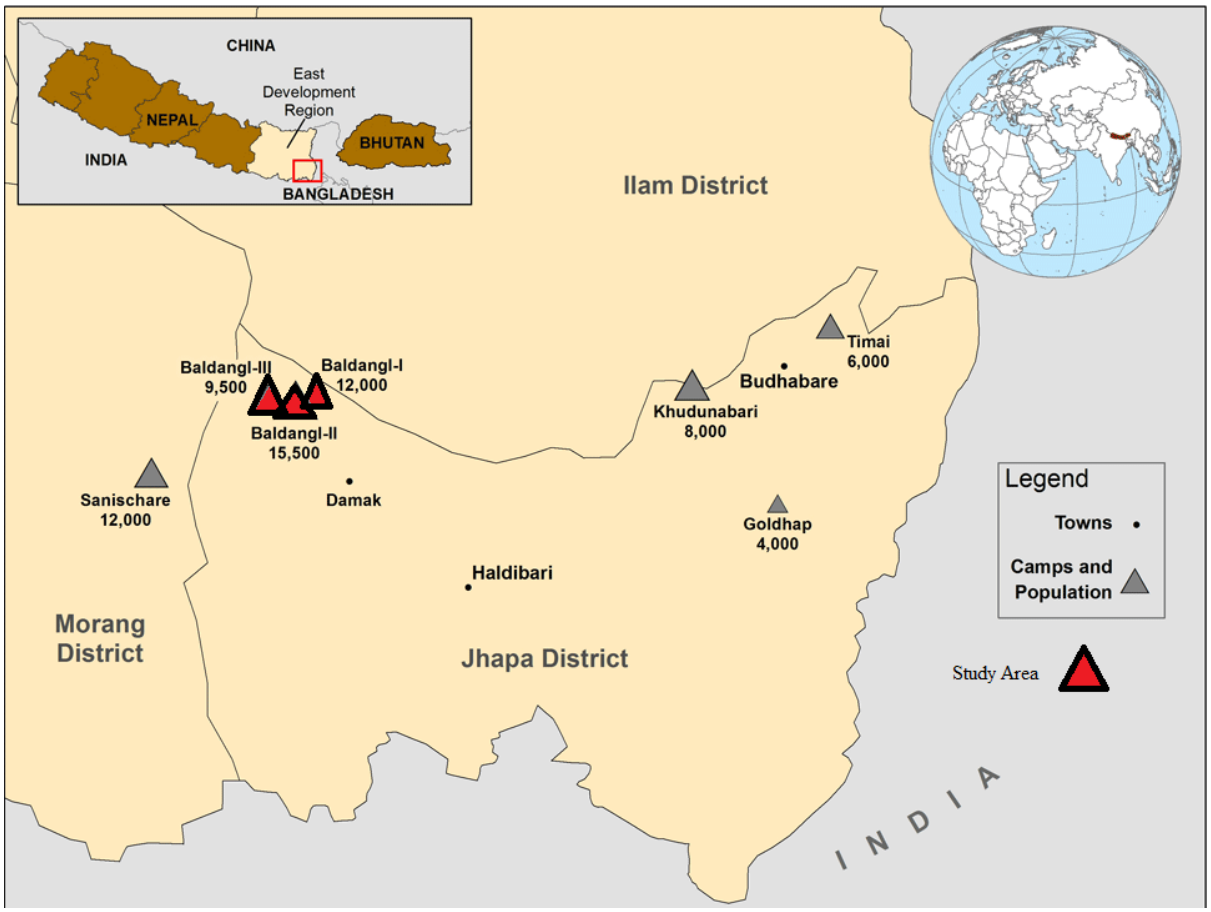
Thanking you,

Dr. Khem Bahadur Karki
Member- Secretary

Tel: +977 1 4254220, Fax: +977 1 4262469, Ramshah Path, PO Box: 7626, Kathmandu, Nepal
Website: http://www.nhrc.org.np, E-mail: nhrc@nhrc.org.np

Appendix – E

Map of survey site



Appendix –F

Photo glimpse of data collection