# PREVALENCE OF ANEMIA AND ASSOCIATED FACTORS AMONG NON-PREGNANT WOMEN OF REPRODUCTIVE AGE (15-49 YEARS) IN *DHIMAL* COMMUNITY OF DAMAK MUNICIPALITY

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# Prevalence of Anemia and Associated Factors among Non-Pregnant Women of Reproductive Age (15-49 Years) in *Dhimal* Community of Damak Municipality

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


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## Approval letter

**This *dissertation* entitled *Prevalence of Anemia and Associated Factors among Non-Pregnant Women of Reproductive Age (15-49 Years) in Dhimal Community of Damak Municipality* presented by *Kritee Niroula* has been accepted as the partial fulfillment of the requirement for the degree of B.Sc. in Nutrition and Dietetics.**

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## Abstract

This cross-sectional survey was carried out to determine the prevalence of anemia in non-pregnant women of reproductive age (15-49 years) in *Dhimal* community of Damak municipality and factors associated with it. A structured questionnaire was administered to the participants for socio-demographic and food frequency questionnaire for dietary data. Hemocue Hb kit was used to determine blood hemoglobin level. Anthropometric measurement was used to determine BMI as well as WHR. Chi-square test was used to analyze the association between hemoglobin level and various factors.

Out of the 134 participants, 87 (64.92%) were found to be anemic. Categorizing into various degrees, 50 (37.3%) were mildly anemic, 35 (26.10%) moderately anemic and 2 (1.50%) of them were severely anemic. The mean Hb level was 11.53±1.42 gm/dl and the median was 11.65 gm/dl. Similarly the maximum and minimum values were 15.7 gm/dl and 7.00 gm/dl. The only parameter where association was found was iron supplementation during pregnancy with p=0.006. Other characteristics such as age (p=0.118), marital status (p=0.413), number of births among the married population (p=0.613), education level (0.398), BMI (p=0.872), WHR (p=0.546), disease history of past 3 months (p=0.258) were not significantly associated with the p>0.05. The menstrual status and bleeding period were also not found to be associated with anemia with p=0.472 and 0.904 respectively. Factors such as yearly income (p=0.422) and occupation (p=0.862) were not significantly associated with anemia. Family characteristics: family size (p=0.221) and type of family (p=0.800) were also not associated with the dependent variable. Others factors such as knowledge about iron (p=0.168), treatment of drinking water (p=0.371) were not associated to the dependent variable. Anemia is found to be a major health problem in the target population. A multi sectorial long term approach is needed to overcome these issues.

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## List of abbreviations

| Abbreviation | Full form |
|---|---|
| Hb | Hemoglobin |
| BMI | Body Mass Index |
| WHR | Waist Hip Ratio |
| NGOs | Non-governmental organizations |
| INGOs | International non-governmental organizations |
| WHO | World Health Organization |
| IDA | Iron Deficiency Anemia |
| HIV | Human Immuno Deficiency Virus |
| RBCs | Red Blood Cells |
| NA | Nutritional Anemia |
| FDA | Folate Deficiency Anemia |
| SCA | Sickle Cell Anemia |
| PA | Pernicious Anemia |
| NDHS | Nepal Demographic Health Survey |
| PSAC | Pre-school age children |

| Abbreviation | Full form |
|---|---|
| PW | Pregnant women |
| NPW | Non-pregnant women |
| AIDS | Acquired Immune Deficiency Syndrome |
| WRA | Women of Reproductive Age |
| CVDs | Cardio vascular diseases |
| FFQ | Food Frequency Questionnaire |
| CBS | Central Bureau of Statistics |
| DCDC | *Dhimal* Caste Development Center |
| CI | Confidence Interval |
| SPSS | Statistical Package for Social Sciences |
| PoSHAN | Policy and Science of Health, Agriculture and Nutrition |
| gm/dl | Gram/deciliter |

# Part I

# Introduction

## 1.1 Background of the study

Nepal is one of the least developed nations in South East Asian Region, which was ranked 157 among 187 countries in the Human Development Index and 0.358 on education index in UN 2013. It has a total land area of 147, 181 Sq. Kms. It is surrounded by China on north and by India on east, south and west (UNDP, 2013). Nepal is one of the most under-nourished countries in the world and poor nutrition features as a major public health problem across the country's rural areas (WHO, 2017).

Good nutrition an adequate, well balanced diet combined with regular physical activity is a cornerstone of good health. Poor nutrition can lead to reduced immunity, increased susceptibility to disease, impaired physical and mental development, and reduced productivity (WHO, 2017). Anemia is a condition that develops when our blood lacks enough healthy red blood cells or hemoglobin. Hemoglobin is a main part of RBCs and binds oxygen. It is a widespread public health problem associated with an increased risk of morbidity and mortality, especially in women and young children. Among the numerous factors, both nutritional (such as vitamin and mineral deficiencies) and non-nutritional (such as infection and hemoglobinopathies), iron deficiency and malaria play an important role (Kraemer and B. Zimmermann, 2007).

Reproductive age of woman covers 15-49 years of age and is the transition period of life. Anemia is a common problem at this age group which may be due to low income as they are unable to take food, lack of awareness is also a main cause. It is defined as Hb less 12 gm/dl in women. Iron deficiency is the most common cause of anemia worldwide. It frequently occurs due to inadequate iron intake, chronic blood loss or disease, malabsorption, or a combination of all these factors. Women are more prone to anemia as there is iron loss through bleeding from very heavy and long periods, as well as from childbirth (A.K. Sinha *et al.*, 2013).

Globally, anemia affects 1.62 billion people, which corresponds to 24.8% of the population. The highest prevalence is in PSAC (47.4%), and the lowest prevalence is in men (12.7%). However, the population group with the greatest number of individuals affected is NPW (468.4 million) (WHO, 2008). The prevalence of anemia among the non-pregnant reproductive age women in Nepal is found to be 36.10%. The highest prevalence is observed for Far-Western terai (67.1%) followed by Mid-Western terai (59.4%), Central terai (55.5%) and Western terai (47.15%). Mean hemoglobin (Hb) level is found to be less than 12 g/dl at these regions (Bhandary and Shrestha, 2011).

This study aims to find the prevalence of anemia among NPW of reproductive age in *Dhimal* community of Eastern Nepal and to find out association of hemoglobin level with other parameters that may give progression to anemia.

### 1.2 Problem statement and justification

Adequate nutrition, a fundamental cornerstone of any individual's health, is especially critical for women because inadequate nutrition wreaks havoc not only on women's own health but also on the health of their children. Anemia is public health problem that affects populations in developing and developed countries. WHO estimates that around 1.75 billion people worldwide are affected by anemia, and the majority of them are from the developing countries. The prevalence of anemia among PW was lowest in the Americas (24.1%) and Europe (25.1%) and highest in the Africa (57.1%) and South-East Asia (48.2%). Among the non-pregnant women, 47.5% are anemic in the Africa followed by 45.7% in the South-East Asia while only 17.8% are anemic in the Americas and 19.0% in Europe (Bhandary and Shrestha, 2011). Prevalence of anemia among WRA (% of women ages 15-49) in Nepal is 36.10 as of 2011(Ransom and Elder, 2003).

Severe anemia places women at higher risk of death during delivery and the period following childbirth. Recent research suggests that even mild anemia puts women at greater risk of death (Ransom and Elder, 2003). For women, causal factors for iron deficiency in particular could include blood loss, such as that associated with menstruation, hookworm infestation and hemorrhage during childbirth (Knowles, 2007).

*Dhimal* is an indigenous ethnic group of Eastern Nepal. The people are very backward in every sector of development in Nepal. Most of them are involved in agriculture and do

the labor jobs for their livelihood. Only a very few of them are educated. Males are given more preference in the community than females. The overall average age at marriage of women of the community is 18.2 years and more number of children are given birth at younger age. This compromises the nutritional status of women of that particular community (Dhimal, 2010).

The results of this study will help to determine the prevalence of anemia and its associated factors. Findings of this study will help us to set prevention interventions and management programs, follow up and care of anemic women. It can also be used to formulate the policy and make public awareness regarding anemia within this population.

## 1.3 Objectives of the study

### 1.3.1 General objective

The main objective of this study is to find out the prevalence of anemia among NPW of reproductive age (15-49 years) in *Dhimal* community of Damak municipality, also to assess factors associated with anemia.

### 1.3.2 Specific objectives

a. To find out the prevalence of anemia among NPW of reproductive age (15-49 years) in *Dhimal* community of Damak municipality.

b. To assess social, economic, nutritional and demographic factors associated to anemia among NPW of reproductive age group (15-49 years) in *Dhimal* community of Damak municipality.

c. To find out the association between nutritional status of women with their blood hemoglobin concentrations.

## 1.4 Research questions

a. What is the prevalence of anemia among NPW of reproductive age (15-49 years) in *Dhimal* community of Damak municipality?

b. What are the factors that are associated with the prevalence of anemia among NPW of reproductive age (15-49 years) in *Dhimal* community of Damak municipality?

## 1.5 Significance of the study

The findings of this study will contribute to figure out the distribution of anemia among women of *Dhimal* community of the particular area. It can be used to aware the target community to bring dietary changes to improve their health status. The results can also serve as helpful guide to government and voluntary institution like NGOs and INGOs to plan suitable nutritional and health programs for the women of this community based on the facts and figures discovered from this study.

## 1.6 Limitations of the study

a. The sample taken from the target population and its findings cannot be generalized for other community.

b. As this is a cross sectional study, the prevalence of anemia might be affected by climatic and seasonal variation which was not taken into consideration.

c. The study did not assess the types of anemia due to lack of equipment, time and economic factors.

# Part II

## Literature review

### 2.1 Anemia

Nutritional anemia (NA) is defined as the condition that results from the inability of the erythropoietic tissue to maintain a normal hemoglobin concentration on account of inadequate supply of one or more nutrients leading to the reduction in total circulating hemoglobin (Srilakshmi, 2014). WHO defines anemia as a condition in which the hemoglobin content of blood is lower than normal as a result of deficiency of one or more essential nutrients, regardless of the cause of such deficiencies (WHO, 2001).

**Table 2.1** Hemoglobin thresholds used to define anemia

| Age or gender group | Hemoglobin threshold (g/dl) |
|---|---|
| Children (0.50–4.99 years) | 11 |
| Children (5.00–11.99 years) | 11.5 |
| Children (12.00–14.99 years) | 12 |
| NPW (≥15.00 years) | 12 |
| PW | 11 |
| Men (≥15.00 years) | 13 |

Source: WHO (2001)

Anemia is a public health problem that affects populations in both rich and poor countries. An estimated 50% of anemia in women worldwide is due to iron deficiency. Although the primary cause is iron deficiency, it is seldom present in isolation. More frequently it coexists with a number of other causes, such as malaria, parasitic infection, nutritional deficiencies and hemoglobinopathies (WHO, 2008). More than 350 million women and up to twice as many infants, children and adolescents, around the world suffer from NA. Ninety percent of these individuals live in developing countries, and among these, the highest prevalence of anemia is found in South Asia. Recent anemia studies in

several states of India, Bangladesh and Nepal indicate that up to 90 percent of infants and young children and 75 percent of women may be suffering from NA (UNICEF, 2002).

## 2.2 Types of anemia

a. Iron deficiency anemia (IDA): This is the most common type of anemia. It accounts for approximately 50-percent of the diagnosed cases of anemia. IDA can result from inadequate iron intake, decreased iron absorption, increased iron demand, or increased iron loss. Symptoms may include fatigue, shortness of breath, chest pain, dizziness, headache, and pica (unusual cravings for substances with no nutritional value such as ice, dirt, or starch). IDA is treated with iron supplementation (Morris, 2015).

b. Thalassemia: It is a group of inherited blood disorders characterized by the body making an abnormal form of hemoglobin. It results in hemolysis, or the destruction of red blood cells. Often there is mild to severe anemia (low RBCs). Anemia can result in feeling tired and pale skin. There may also be bone problems, an enlarged spleen, yellowish skin, dark urine, and among children slow growth. There are two main types of thalassemia, alpha and beta. Thalassemia is diagnosed using a test called hemoglobin electrophoresis. Alpha thalassemia major, also called hydrops fetalis, is the most severe form and causes stillbirth (death of the unborn baby during the late stages of pregnancy). Beta thalassemia major, also known as Cooley's anemia, is the most severe form and can result in severe anemia during the first year of life. Treatment of severe disease is with regular blood transfusions and in some cases bone marrow transplantation (Morris, 2015).

c. Aplastic anemia: Aplastic anemia refers to a deficiency of all types of blood cells (red cells, white cells, and platelets) caused by bone marrow failure. It is a rare and serious condition that can develop at any age and can be fatal. It develops when a person's bone marrow is injured. Factors that can temporarily or permanently injure bone marrow include radiation and/or chemotherapy treatments, exposure to toxic chemicals, certain medications (antibiotics), autoimmune disorders (lupus and rheumatoid arthritis), and certain viral infections (hepatitis, cytomegalovirus, parvovirus B19, and HIV).The diagnosis of aplastic anemia is confirmed with a bone marrow biopsy. Treatment of aplastic anemia may involve blood transfusions, drugs that alter

or suppress the immune system (immunosuppressants), bone marrow stimulants, and bone marrow transplantation (Morris, 2015).

d. Hemolytic anemia: This is a disease in which RBCs are destroyed and removed from the bloodstream before their lifespan is over. The average lifespan of a RBC is 120 days. Hemolytic anemia can be inherited or acquired. Inherited means the disease is passed on due to genetic contributions from a person's parents. Acquired means the disease develops at some point in life after birth (Morris, 2015).

e. Sickle cell anemia: This type of anemia is an inherited disorder of RBCs where they assume a crescent, or sickle shape. Under normal circumstances red blood cells are disc shaped. The sickle shaped red blood cells can slow or block the flow of blood to body tissues and organs leading to attacks of sudden, severe pain. The only cure for SCA is bone marrow transplantation. There are several effective treatments that can reduce the symptoms (Morris, 2015).

f. Pernicious anemia: PA is a decrease in red blood cells that occurs when the intestines cannot properly absorb vitamin $B_{12}$. The body needs vitamin $B_{12}$ to make red blood cells. The intestines cannot properly absorb vitamin $B_{12}$ due to a deficiency of a special protein called intrinsic factor in the stomach. The disease can lead to irreversible nerve damage if treatment is not initiated within 6-months of developing symptoms. Treatment of pernicious anemia may involve monthly injections, oral supplements, or nasal administration of vitamin $B_{12}$. Blood transfusions are rarely required to treat the disease. There is no way to prevent PA, but early diagnosis and treatment can help reduce complications (Morris, 2015).

g. Folate-deficiency anemia: FDA is a decrease in RBCs due to a lack of folate. The cells are abnormally large and are called megaloblasts. They are seen in the bone marrow. That is why this anemia is also called megaloblastic anemia (MedlinePlus, 2016).

### 2.3 Symptoms of anemia

Because a low RBC count decreases oxygen delivery to every tissue in the body, anemia can cause a variety of signs and symptoms. It can also worsen the symptoms of almost any other underlying medical condition. If anemia is mild, it may not cause any symptoms. If anemia is slowly ongoing (chronic), the body may adapt and compensate for the change; in

this case there may not be any symptoms until the anemia becomes more severe (Evans, 2016).

Symptoms of anemia may include the following:

a. Fatigue;
b. Decreased energy;
c. Weakness;
d. Shortness of breath;
e. Lightheadedness;
f. Palpitations (feeling of the heart racing or beating irregularly); and
g. Looking pale.
h. Change in stool color, including black and tarry stools (sticky and foul smelling), maroon-colored, or visibly bloody stools if the anemia is due to blood loss through the gastrointestinal tract;
i. Rapid heart rate;
j. Low blood pressure;
k. Rapid breathing;
l. Pale or cold skin;
m. Yellow skin called jaundice if anemia is due to red blood cell breakdown;
n. Heart murmur; and
o. Enlargement of the spleen with certain causes of anemia (Evans, 2016).

Symptoms of severe anemia may include:

a. Chest pain, angina, or heart attack;
b. Dizziness;
c. Fainting or passing out; and
d. Rapid heart rate (Evans, 2016).

### 2.4 Causes of anemia

Many medical conditions cause anemia. Common causes of anemia include the following:

a. Anemia from active bleeding: Loss of blood through heavy menstrual bleeding or wounds can cause anemia. Gastrointestinal ulcers or cancers such as cancer of the colon may slowly ooze blood and can also cause anemia (Nabili, 2016).

b. Iron deficiency: The bone marrow needs iron to make RBCs. Iron plays an important role in the proper structure of the hemoglobin molecule. If intake is limited or inadequate due to poor dietary intake, anemia may occur as a result. (Nabili, 2016).

c. Anemia related to kidney disease: The kidneys release a hormone called the erythropoietin that helps the bone marrow make RBCs. In people with chronic kidney disease, the production of this hormone is diminished, and this, in turn, diminishes the production of RBCs, causing anemia (Nabili, 2016).

d. Anemia related to pregnancy: Water weight and fluid gain during pregnancy dilutes the blood, which may be reflected as anemia since the relative concentration of red blood cells is lower (Nabili, 2016).

e. Anemia related to poor nutrition: Vitamins and minerals are required to make red blood cells. In addition to iron, vitamin $B_{12}$ and folate are required for the proper production of hemoglobin. Deficiency in any of these may cause anemia because of inadequate production of RBCs. Poor dietary intake is an important cause of low folate and low vitamin $B_{12}$ levels. Strict vegetarians who do not take sufficient vitamins are at risk to develop vitamin $B_{12}$ deficiency known as PA (Nabili, 2016).

f. Alcoholism: Poor nutrition and deficiencies of vitamins and minerals are associated with alcoholism. Alcohol itself may also be toxic to the bone marrow and may slow down the RBC production. The combination of these factors may lead to anemia in alcoholics (Nabili, 2016).

g. Bone marrow-related anemia: Anemia may be related to diseases involving the bone marrow. Some blood cancers such as leukemia or lymphomas can alter the production of RBCs and result in anemia. Other processes may be related to a cancer from another organ spreading to the bone marrow (Nabili, 2016).

h. Anemia related to medications: Many common medications can occasionally cause anemia as a side effect in some individuals. Common medications that can cause anemia include some seizure medications, transplant medications, HIV medications,

some malaria medications, some antibiotics (penicillin, chloramphenicol), antifungal medications, and antihistamines (Nabili, 2016).

i. Other less common causes of anemia include thyroid problems, cancers, liver disease, autoimmune diseases (lupus), lead poisoning, AIDS, malaria, viral hepatitis, mononucleosis, parasitic infections (hookworm), bleeding disorders, and insecticide exposure (Nabili, 2016).

## 2.5 Diagnosis of anemia

Anemia can be easily detected by drawing a blood sample for a complete blood count. Based on the test results and patient evaluation, further tests can be done to determine the exact cause of anemia (Nabili, 2016).

Physical examination and medical history also play a crucial role in diagnosing causes of anemia. Some of the important features in medical history cover questions about family history, previous personal history of anemia or other chronic conditions, medications, color of stool and urine, bleeding problems, and occupation and social habits (such as alcohol intake). While performing a complete physical examination, the physician focus on general appearance (signs of fatigue, paleness), jaundice (yellow skin and eyes), paleness of the nail beds, enlarged spleen (splenomegaly) or liver (hepatomegaly), heart sounds, and lymph nodes (Nabili, 2016).

Lab tests for anemia generally include the following:

a. A routine blood count: Blood sample taken from a vein in the arm is assessed for blood counts. Anemia is detected if the level of haemoglobin is lower than normal. There may be fewer RBCs than normal. The RBCs may appear smaller and paler than usual in case of IDA. The small size is termed microcytic anemia. In vitamin $B_{12}$ or folate deficiency the RBCs may appear pale but larger than their usual size. This is called macrocytic anemia.
b. Ferritin stores: Ferritin is a protein that stores iron. If the blood levels of ferritin are low it indicates low iron stores in the body and helps detect IDA.
c. Reticulocyte count is a measure of young RBCs. This shows if the RBC production is at normal levels.

d. Vitamin $B_{12}$ and folate levels in blood help detect if the anemia if due to deficiency of these vitamins.
e. Bone marrow analysis to detect too many immature RBCs as seen in aplastic anemia or blood cancers. Lack of iron in bone marrow also points towards IDA (Mandal, 2012).
f. Transferrin saturation can be used as a gauge of iron supply to the tissues. Levels less than 16 percent are considered inadequate for erythropoiesis (Srilakshmi, 2014).
g. Total iron binding capacity: Total iron binding capacity measures the blood's capacity to bind iron with transferrin. It measures the maximum amount of iron that it can carry, which indirectly measures transferrin (Cirino, 2016).

**Table 2.2** Hemoglobin levels to diagnose anemia (gm/dl)

| Age Group | Non-anemia | Mild Anemia | Moderate Anemia | Severe Anemia |
|---|---|---|---|---|
| Children (6-59 months) | ≥11 | 10-10.9 | 7-9.9 | <7 |
| Children (5-11 years) | ≥11.5 | 11-11.4 | 8-10.9 | <8 |
| Children (12-14 years) | ≥12 | 11-11.9 | 8-10.9 | <8 |
| Non pregnant women(≥15 years) | ≥12 | 11-11.9 | 8-10.9 | <8 |
| Pregnant women | ≥11 | 10-10.9 | 7-9.9 | <7 |
| Men (≥15) | ≥13 | 11-12.9 | 8-10.9 | <8 |

Source: WHO (2011)

## 2.6 Iron needs in women

Iron is a mineral that works with other substances to create hemoglobin, the compound that carries oxygen in the blood. Women and men metabolize iron from food at roughly the same rate. Women need more iron than men to make up for the amount of iron they lose in their menstrual period. Around 1 mg of iron is lost for every day of bleeding.

That's why women from ages 15 to 50 need to get 18 mg of iron each day, while men the same age can get away with just 8 mg. After menopause, a woman's iron needs drop as her menstrual cycle ends. After a woman begins menopause, both men and women need the same amount of iron - 8 mg each day. Iron deficiency is the most common nutrient deficiency in women. This can deplete their energy levels and cause fatigue (Swan, 2015).

## 2.7 Prevalence of anemia

Globally, anemia affects 1.62 billion people which correspond to 24.8% of the population. The highest prevalence is in PSAC (47.4%), and the lowest prevalence is in men (12.7%). However, the population group with the greatest number of individuals affected is NPW (468.4 million). WHO regional estimates generated for PSAC and pregnant and NPW indicate that the highest proportions of individuals affected are in Africa (47.5–67.6%), while the greatest number affected is in South-East Asia 315 million (WHO, 2008).

**Table 2.3** Global anemia prevalence and number of individuals affected

| Population group | Prevalence of anemia (%) | Population affected (millions) |
|---|---|---|
| PSAC | 47.4 | 293 |
| School age children | 25.4 | 305 |
| PW | 41.8 | 56 |
| NPW | 30.2 | 468 |
| Men | 12.7 | 260 |
| Elderly | 23.9 | 164 |
| Total Population | 24.8 | 1620 |

Source: WHO (2008)

**Table 2.4** Anemia prevalence and number of individuals affected in PSAC, PW and NPW in each WHO region

| WHO region | PSAC | | PW | | NPW | |
|---|---|---|---|---|---|---|
| | Prevalence (%) | Affected (millions) | Prevalence (%) | Affected (millions) | Prevalence (%) | Affected (millions) |
| Africa | 67.6 | 83.5 | 57.1 | 17.2 | 47.5 | 69.9 |
| America | 29.3 | 23.1 | 24.1 | 3.9 | 17.8 | 39.0 |
| South-East Asia | 65.5 | 115.3 | 48.2 | 18.1 | 45.7 | 182.0 |
| Europe | 21.7 | 11.1 | 25.1 | 2.6 | 19.0 | 40.8 |
| Eastern Mediterranean | 46.7 | 0.8 | 44.2 | 7.1 | 32.4 | 39.8 |
| Western Pacific | 23.1 | 27.4 | 30.7 | 7.6 | 21.5 | 97.0 |
| Global | 47.4 | 293.1 | 41.8 | 56.4 | 30.2 | 468.4 |

Source: WHO (2008)

Prevalence of anemia among WRA (% of women ages 15-49) in South Asia was 47.23 as of 2011. Similarly among children (% of children under 5) was 58.17 and NPW (% of women aged 15-49) was 46.95 (Stevens *et al.*, 2013). Anemia is particularly prominent in South Asia. In India, for example, upto 88% of PW and 74% of NPW are affected (MoHP, 2011).

In the context of Nepal, Overall, 46% of Nepalese children aged 6-59 months are anemic. The majority of children who suffer from anemia are classified as having mild or moderate anemia (27% and 19%, respectively) while less than 1 % are severely anemic. Anemia is less common among women; 35 % show evidence of anemia, and the majority is mildly anemic (29%) (MoHP, 2011). There are many studies on anemia in pregnancy in Nepal. Bondevik *et al* (2000) showed prevalence of anemia 62.2% out of which 3.6% with severe anemia in a study done in Kathmandu, Nepal. Similarly high prevalence (50%-60%) of anemia were noted in various studies particularly important study carried out by Shah

and Gupta (2002) showed that prevalence of anemia in adolescent girls in Dharan, a town in eastern region of the country was 68.8% (Marahatta, 2008).

According to a study conducted on PW for determination of hemoglobin level in Central laboratory of Biochemistry, Nepalgunj Medical College 41.02% were anemic, majority (67.14%) of them were mildly anemic, whereas 28.57% were moderately and 4.29% were severely anemic (Khan and Mittal, 2012). A study conducted in Biratnagar, Morang reveals 28.36% of women (age 21-40 years) to be anemic (A.K Sinha *et al.*, 2011). The highest prevalence among NPW of reproductive age is observed for Far-Western terai (67.1%) followed by Mid-Western terai (59.4%), Central terai (55.5%) and Western terai (47.15%). Mean hemoglobin (Hb) level is found to be less than 12 gm/dl at these regions (Bhandary and Shrestha, 2011). The prevalence of severe anemia among NPW of reproductive age at national and eco-development regions is less than 2%, moderate anemia is 5.6% (Bhandary and Shrestha, 2011).

### 2.8 Assessing anemia through hemocue

Hemoglobin (Hb) assessments are the most reliable indicator widely used to screen individuals for anemia (S. S. Morris *et al.*, 1999). Hb concentration is measured routinely using automated hematology analyzers. Although these counters are very accurate and reliable, they are expensive and transport of the samples to the laboratory delays the process (Jahr *et al.*, 2002). In resource poor settings where automated hematology analyzers are not available, the Hemocue photometer has been widely used for these purposes in recent years because it is portable, requires only a small sample of capillary/venous blood, is relatively inexpensive and simple to use, does not require access to refrigeration or even electricity, and gives immediate, digitally displayed results (Jahr *et al.*, 2002).

In this study Hemocue Hb $201^{+}$ was used to determine the total amount of hemoglobin in study participants. The system consists of the analyzer and specially designed cuvettes containing dried reagents. The cuvette serves as a pipette, reaction vessel and a measuring cuvette. No dilution is required. The hemoglobin measurement takes place in the analyzer and is factory calibrated against the Haemiglobincyanide (HiCN) method, the international reference method. Sodium deoxycholate hemolyses the erythrocytes and hemoglobin is released. Sodium nitrite converts hemoglobin to methaemoglobin which, together with

sodium azide gives azidemethaemoglobin. The absorbance is measured at two wavelengths (570 and 880 nm) in order to compensate for turbidity in the sample (Plummer, 2016).

### 2.9 Determination of frequency of intake of iron

Different methods are designed to measure food and/or nutrient intakes such as: weighed food records, estimated food records, 24 hour recall, FFQ. Among these FFQ was used in this study. FFQ consists of a list of foods and a selection of options relating to the frequency of consumption of each of the foods listed (e.g. times per day, daily, weekly, monthly). It is designed to collect dietary information from large numbers of individuals (100 individuals or more) and are normally self-administered, though interviewer administered and telephone interview are possible modifications. FFQs normally ask about intake within a given time frame (e.g. in the past 2-3 months, 1 year or longer) and therefore aim to capture habitual intake. The length of the food list can vary depending on the nutrients or foods of interest. Although there are difficulties implicit in calculating the absolute nutrient intake of individuals from food frequency questionnaires, they are useful for gathering information on groups of individuals as well as for looking at habitual intake of a range of foods (Wrieden *et al.*, 2003).

Eating habits of the study participants were evaluated through a qualitative pretested FFQ that included iron rich foods in which frequency was characterized as: daily, once a week, twice a week, thrice a week, four times a week, once in two week and rarely/never. The study evaluated the consumption of iron natural sources of animal origin (meat, poultry, fish and eggs) and vegetable origin (beans, pulses; foods that stimulate iron absorption (fruits) and potential inhibitors of iron absorption (tea).

### 2.10 Assessment of nutritional status through BMI and WHR

The condition of health of a person that is influenced by the intake and utilization of nutrients is called nutritional status. Nutritional anthropometry can be defined as the measurements of the physical dimensions and gross composition of the human body as a means of assessing nutritional status (WHO, 2012).

### 2.10.1 BMI

BMI is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in meters ($kg/m^2$) (WHO, 2006).

**Table 2.5** BMI cut offs for Asian

| Classification | BMI ($kg/m^2$) cut offs |
|---|---|
| Underweight | <18.5 |
| Severe thinness | <16 |
| Moderate thinness | 16.00-16.99 |
| Mild thinness | 17.00-18.49 |
| Normal | 18.5-24.99 |
| Overweight | 23.00-27.49 |
| Obese | ≥27.50 |

Source: WHO (2004)

Being obese puts strain on heart and can lead to serious health problems. These include: arthritis, heart disease, high blood pressure, type 2 diabetes. BMI appears to be as strongly correlated with various metabolic and disease outcome as are these more direct measures of body fatness (CDC, 2015).

### 2.10.2 WHR

WHR is a health risk indicator given by the ratio of the waist circumference to the hip circumference. It is a crude estimate of the relative amount of abdominal fat: the higher waist circumference compared to hip circumference, the greater proportion of abdominal fat. Waist circumference measures the circumference of waist at its smallest point, usually just above the navel. Hip circumference measures the circumference of hips at the widest point (Bethesda, 1998).

For men, a waist-to-hip ratio of 0.9 or less, and for women 0.85 or less are considered safe. For both men and women, an increased risk for type 2 diabetes, hypertension and CVD and other problems are associated with being overweight i.e. with a higher WHR (WHO, 2011b).

## 2.11 The *Dhimals*

*Dhimal* people are regarded to be the oldest ethnic group of east Nepal. They are mainly found in the districts of Jhapa and Morang, then a few in Illam, Sunsari, Kathmandu and Nepalgunj area in Banke districts of Nepal. Nationwide distribution of *Dhimal* people demarcates the geographical area of their settlements as east of Chisang (Lohondra) river, west of Mechi river, north of Babiya Birta Leti Govindapur and south of the border of Malhaka (Dhimal, 2010).

Until some time ago they were rather nomadic, practicing shifting cultivation. But this kind of activity has stopped completely for some time as there are few areas left where they can move around. The sources of income for *Dhimal* society are mainly the products of agriculture. Almost all of the populations (99.34 %) have 'subsistence economy'. Ninety eight percent of them are mainly agriculturists. So they are engaged for about nine months in agricultural activities, but they also pursue some subsidiary occupations to add to their income, and thus they maintain a balance between the income and expenditure. They save some cash by hunting, fishing and weaving the clothes for them. They grow and eat rice and wheat. They supplement their diets by hunting and fishing occasionally. They so do not keep many cattle, sheep or goats nor are they very fond of milking. But there are a few people nowadays who keep bullocks for ploughing and for pulling carts. *Dhimal* food as a whole is very simple. It consists mainly of *Bhat* (rice), *Dal* (pulse), and *Tarkari* (curry). They do not include pickle in their diet (Dhimal, 2010).

*Dhimals* are very backward in every sector of development in Nepal. They are not found in the high-level government posts. Most of them do the labor jobs for their livelihood. Only a very few of them are educated and have found no number in the high government ranks. According to CBS, Nepal: 2001, the literacy rate of the *Dhimals* has been mentioned 52.44%. But according to the book, "*Janajati Serophero*: 2004"(Gurunga, 2004), the literacy rate has been mentioned between 30-50% i.e. 58.8%. Even in this 21$^{st}$ century world, the *Dhimals* are surviving very hard life. Many *Dhimals* have been landless, jobless. As a result, they are facing difficult to maintain daily hand to mouth problem in life. They are having deplorable and plight situation in Nepal (Dhimal, 2010).

It has been found that the overall average age at marriage of women of this community is 18.2 years which is lower than National figure. This trend of early marriage creates

chances of more number of births by the women. Out of the literate females, the highest proportion (33.2) is found in incomplete primary level (<5 class) and 20.5 percent, 14.8 percent, 9.2 percent and 3.3 percent in primary, lower secondary and S.L.C. and above respectively which indicate the reduction of involvement of females in education with the increment of level of education. The rate of reduction with each upper level of education is comparatively higher of females than males which indicate less favorable condition to gain educational achievement for the females in the community. Most of the *Dhimals* have conservative thoughts. They still believe on *Dhami, Ojha,* Ghost and spell. Because of the lack of education and low socio-economic status, they are compelled to go to *Dhami, Ojha* rather than hospitals. *Dhimal* societies are just like Nepalese Societies as well as Hinduism because they want at least one son in their family as a generation representative due to the social believes. They take their daughters as a second class human beings; so they give birth in high tendency until not to gain son in their lives. If they were hopeless or disappoint to gain son, they follow the polygyny system i.e. husband marriages with other lady, which helps to increase the level of fertility. According to a study conducted, 86 percent accepted the need of at least a son in their lives as a basic requirement which indicates the high preference of son in the *Dhimal* community (Tamang, 2007).

# Part III

## Materials and methods

### 3.1 Research design

A community based cross-sectional study was conducted among NPW of reproductive age (15-49) years of *Dhimal* community of Damak municipality to find out the prevalence of anemia through the measurement of blood hemoglobin levels and the causable factors along with the measurement of height and weight of the participants.

### 3.2 Study site

The study was conducted in *Dhimal* community of Damak municipality. Mahendra Highway crosses this municipality nearly bisecting it. This municipality is divided into 19 wards with *Dhimal* households in 18 of it. The total population of *Dhimal* is 4980 with 2479 males and 2501 females (DCDC, 2013).

### 3.3 Target population

The target population of the study was NPW of reproductive age (15-49 years) of *Dhimal* community at Damak municipality.

### 3.4 Sampling technique

From 19 wards of Damak municipality four wards (ward number 2,9,15 and 19) were randomly selected. Equal number of samples were taken from each randomly selected wards assuming equal number of target population in each ward. The basic criterion for the selection of sample was the household containing at least one NPW of reproductive age which was included in the sample. For household containing more than one NPW, only one woman was taken as unit of sample.

### 3.5 Sample size calculation

The sample size was determined by using a single proportional formula finding out the prevalence rate of anemia to be 28.36% in the survey area, 95% confidence interval (CI),

8% margin of error (d) and 10% non-response rate was added to the total calculated sample size.

Calculation of sample size for infinite population:-

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

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

p= estimated prevalence of anemia (28.36%)

d= margin of error (8%)

Now

$n= (1.96)^2 \times 0.2836 \times (1-0.2836)/ (0.08)^2$

$= 121.95$

$\approx 122$

Thus calculated sample size was adjusted for non-response. Considering non-response rate as 10%, the adjusted sample size was calculated to be 134.

### 3.6 Criteria for sample selection

**a. Inclusion criteria:** all NPW of reproductive age (15-49 years) of *Dhimal* community within the chosen 4 wards of Damak municipality.

**b. Exclusion criteria:**

1. The study participants who were seriously ill or who were not available at household during the time of survey.
2. Women who had given birth within the 2 months.
3. Those women who were taking iron supplements.

### 3.7 Research variables

The different variables of the study are shortly described as below.

1. Dependent variable: Blood hemoglobin level.
2. Independent variables:

a. Socio-economic and demographic variables: Family size, family type, income, occupation.

b. Individual/sample characteristics: Age, marital status, number of births, education, health and disease conditions such as malaria, diarrhea.

c. Anthropometric characteristics: Height, weight, BMI, WHR.
d. Menstrual Characteristics: Menstrual status, age at menarche, bleeding period.
e. Hygiene and Sanitation practices: Source and treatment of drinking water.
f. Dietary practices: Frequency of consumption of iron rich foods, tea and lemon.

### 3.8 Pretesting

The prepared sets of questionnaire and FFQ was pre-tested among few non pregnant women of reproductive age (15-49 years) of the study community in order to maintain accuracy and clarity of questionnaire, to check the consistency in interpretation of questions by respondents and to identify ambiguous item. After pre-testing all the ambiguous, misleading and wrongly interpreted questions were omitted and questionnaire was revised in accordance with the findings of pre-testing.

### 3.9 Validity and reliability

To ascertain the degree to which the hemocue kit measured what it is was purposed to measure, 5 blood samples were taken to the standard laboratory for measuring the hemoglobin levels and thus obtained results were statistically compared with the results of hemocue kit. With the f value (1.1) it was found that Hb readings had no significant difference. The questionnaire was pre-tested prior to data collection to ascertain content and face validity. Stadiometer, digital weighing balance and measuring tape were calibrated by comparing with the known standards.

**Table 3.1** Validity of hemocue

| **Method** | **Hb readings (gm/dl)** | | | | | **Mean±SD(gm/dl)** | **f- value** |
|---|---|---|---|---|---|---|---|
| Standard lab | 11.2 | 13.4 | 12.7 | 11.7 | 11.6 | 12.12±0.90 | 1.1 |
| Hemocue | 11.2 | 13.3 | 12.7 | 11.8 | 11.6 | 12.12±0.85 | |

### 3.10 Data collection techniques

The materials used for data collection were:

a) Hemocue: A well standardized hemocue Hb $201^{+}$ with lancets and micro cuvettes to measure the blood hemoglobin levels.

b) Questionnaire: A well designed and pretested set of questionnaire to collect information regarding nutritional education, economic conditions, hygiene and sanitation conditions of the target population.
c) FFQ: A well designed and pre tested FFQ to study the dietary habits of the women under study.
d) Stadiometer: A well calibrated stadiometer to measure the height with minimum and maximum measuring capacity of 1 cm and 196 cm respectively.
e) Weighing balance: A digital weighing balance manufactured by Microlife, USA to measure the weight with minimum and maximum measuring capacity of 0.1 kg and 150 kg respectively.
f) Measuring tape: For the measurement of hip as well as waist circumference with minimum measurement capacity of 0.1 cm.

Using above materials, data collection was carried out in the following way:

a. For Hemoglobin estimation

Blood hemoglobin level was determined on the spot using hemocue kit during the study. Procedure followed during blood hemoglobin estimation is as follows:

1. At first the tip of middle finger to be pricked was gently cleaned by alcohol swab.
2. The tip was wiped dry by cotton.
3. Using slight pressure blood was accumulated towards tip.
4. The tip was then pricked by using the lancet.
5. First two drops was swiped away.
6. Then drop of blood was collected in the micro cuvette.
7. It was then placed into pre activated hemocue kit to obtain the hemoglobin levels.

b. Nutrients intake

Dietary assessment among the selected population was done by FFQ. The respondents were asked to recall the frequency with which they consumed the iron rich food items which are included in the FFQ.

c. BMI

First, height and weight of participants were determined using stadiometer and weighing balance and those records were used to calculate their respective BMI.

Measurement of height:

Following steps were carried out for measurement of height:

a. Stadiometer was placed on a smooth surface.

b. Participant was asked to stand on the base without slipper.

c. It was confirmed that the back of the head, shoulder, hips and legs were touching the wall of stadiometer.

d. Head of the participant was positioned so that the ear is parallel to the ground.

e. The index was brought up to the head of the participant and height was then noted.

Measurement of weight:

Following steps were carried out for the measurement of weight:

a. Weighing balance was placed on a smooth surface and activated.

b. Participant was asked to step on the scale without their slipper and light clothes.

c. The measurement was noted.

d. WHR

Waist as well as hip circumference was taken by using measuring tape and their ratio was calculated to get the respective WHR. Waist circumference was measured at the level of the umbilicus to the nearest 0.5 cm. The participant was asked to stand erect with relaxed abdominal muscles, arms at the side, and feet together. Hip Circumference was measured at the point of greatest circumference around hips & buttocks to the nearest 0.5 cm.

Other variables

Marital status, yearly income, occupation, education, age, family type, family size, number of births, menstrual status, health and diseased conditions, hygiene and sanitation etc. were done using the questionnaire. Questionnaire was used for collection of data regarding these variables.

### 3.11 Logistical and ethical considerations

Ethical approval was obtained from Nepal Health Research Council (NHRC) and permission to conduct research was obtained from Damak municipality office. Verbal as well as written consent from participants was obtained and by explaining the motives and benefits of the study. Participants were ensured confidentiality of the collected information at all levels.

### 3.12 Data analysis

The data was checked for completeness and consistency. The collected data was first edited, organized, coded and entered in SPSS version 20.0. Qualitative data were transcribed and coded by assigning labels to various categories. The collected data was analyzed by using both descriptive and inferential statistics.

Descriptive analysis was used to describe the percentages and number distributions of the respondents by socio-demographic characteristics and other relevant variables in the study. Hemoglobin concentration obtained was compared to the WHO hemoglobin level to diagnose anemia at sea level. Dietary data obtained by FFQ was first categorized as plant and animal sources of iron and the frequency of consumption as frequent, regular and rare. Plant sources included various food items such as cereals and legumes: wheat flour, rice flakes, bengal gram, soyabean, lentils, fruits and vegetables: apple, pomegranate, leafy vegetables while animal sources included meat, chicken, fish and eggs. The frequency of consumption frequent defined daily consumption, regular included 2-4 times a week while rare included once a week and less than that. The frequency of consumption of iron rich food was studied and chi-square test was used to test association with grades of anemia.

# Part IV

## Results and discussions

Present study was conducted to find out the prevalence of anemia and factors associated with it among NPW of reproductive age (15-49 years) of *Dhimal* community of Damak municipality. The total number of participants in this study was 134 NPW of reproductive age (15-49 years) of *Dhimal* community residing in Damak municipality.

### 4.1 Prevalence of anemia

Out of the 134 participants, 87 (64.92%) were found to be anemic. Categorizing into various degrees, 37.3% (50) were mildly anemic, 26.10% (35) moderately anemic and 1.50% (2) of them were severely anemic. The mean Hb level was 11.53±1.42 gm/dl and the median was 11.65 gm/dl. Similarly the maximum and minimum values were 15.7 gm/dl and 7.00 gm/dl.

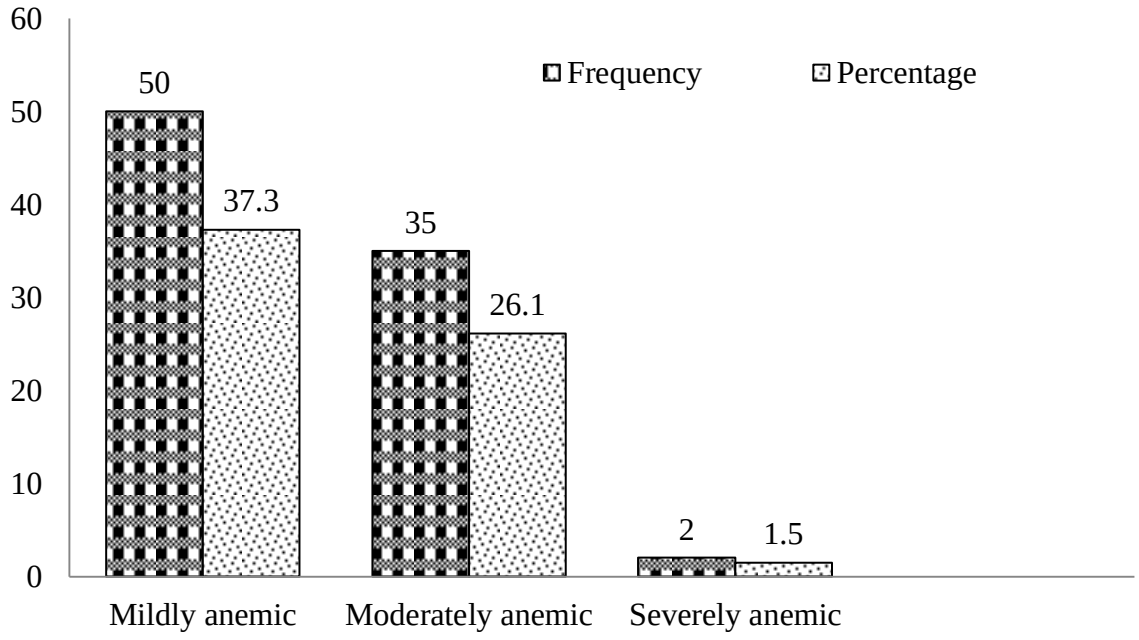


**Figure 4.1** Classification of anemia among study participants (n=134)

According to Sinha et *al.* (2013) the prevalence of anemia amongst women in reproductive age group of Morang district was 67.3%. This was similar to the present study. Similarly PoSHAN community study baseline summary report on Nepal by Manohar *et al.* (2014) mentioned that 66% of non-pregnant women had anemia around whole Terai region is similar to our findings. However, the data from NDHS 2011 showed

41.9%. This variation may be due to the economic, education, nutritional as well as other associated factors.

### 4.2 Sample characteristics and anemia

Age of the study group was categorized as 15-20, 21-30, 31-40 and 41-49 years. About 29.10% (39) of the participants were form 21-30 age category while 21.64% (29), 24.62% (33) and 24.62% (33) from 15-20, 31-40 and 40-49 years of age respectively. Anemia was mostly prevalent in 41-49 years of age followed by 31-40 years and least in 15-20 years. This may be supported by the fact that young women have more knowledge regarding proper nutrition. Similar results were found in a study at South India given by Raghuram *et al.* (2012) where anemia was more prevalent among women of age greater than 40 years. Age had no significant association with anemia which was in inverse relation to a study given by Muhangi *et al.* (2007).

Among the study participants, 72.38% (97) were found to be married and 27.61% (27.61) unmarried. Prevalence of anemia was found comparatively higher i.e. 67.01% (65) in married females than unmarried ones. More number of married ones were anemic which might be due to factors such as pregnancy and birth of children. Similar results were found in a study in Bangladesh by Kamruzzaman *et al.* (2015). There was no significant association between marital status and anemia ($p=0.118$). The present results were in accordance to the results of Pala and Dundar (2008) where no relation was seen between anemia and the factors: marital status and age of target population. Number of births given by the married women was classified as 0, 1-3 births and 4 or more. High number of (83.50%) women gave 1-3 births and 10.31% (10) gave 4 or more. Among the women giving 1-3 births, the prevalence of anemia was 62.96% (51) and among 0 births were 66.66% (4). Number of women in this category of 4 or more births was 100% which proves that number of births increases the prevalence of anemia in women. The results told that there was no significant association ($p=0.413$) between number of births and grades of anemia. Similar results were found in a study by Alene and Dohe (2014).

The education level was categorized as university, high school, school and illiterate. Highest percentage of participants (37.31%) studied up to school levels and 36.56% (49) were illiterate while a least of them (4.47%) were from university levels. Among the illiterate participants 71.42% (35) were anemic. This study did not find association

between anemia and educational level of the participants which was supported by a study by Alene and Dohe (2014).

Disease history of past 3 months of the study participants was taken. The categories were malaria, diarrhea and none of them. Among them, 0.74% (1) were suffering from malaria, 9.70% (13) from diarrhea and 89.55% were not suffering from any diseases. Among the participants who were suffering from diarrhea 46.15% (6) were anemic. In this study, it was found that a high percent i.e. 79.10% (106) of women had not taken deworming tablets in past 6 months while 20.89% had taken the tablets. Among the ones who had not taken deworming tablets, majority i.e. 62.26% (66) were anemic. There was no significant association between anemia and various associated factors such as disease history and deworming. A Konishi *et al.* (2011) also found no association between anemia and deworming within 6 months.

Table 4.1 shows more than half i.e. 52.23% (70) of the study participants had not taken iron supplements during pregnancy while 47.76% (64) had taken. Among the ones who had not taken supplements the prevalence of anemia was 75.71% (53). Ones who had no iron supplements were more anemic. This due to the fact that low intake of iron is a determinant cause of anemia. A statistically significant association was found between iron supplementation during pregnancy and anemia as $p=0.006$. This result was supported by studies given by Alene and Dohe (2014) and Gebre and Mulugeta (2015). Place those women choose for treatment firstly after they get sick was also taken as a factor. Almost all (97.01%) went to doctors for the treatment while the rest (2.98%) selected *Dhami* and *Jhankri*. This also had no significant association with anemia.

**Table 4.1** Sample characteristics and anemia among study participants (n=134)

| Variables | Frequency (%) | Non anemic (%) | Anemic (%) | p-value |
|---|---|---|---|---|
| **Age (years)** | | | | |
| 15-20 | 29(21.64) | 11(37.93) | 18(62.06) | 0.118 |
| 21-30 | 39(29.10) | 19(48.71) | 20(51.28) | |
| 31-40 | 33(24.62) | 9(27.27) | 24(72.72) | |
| 41-49 | 33(24.62) | 8(24.24) | 25(75.75) | |
| **Marital status** | | | | |
| Unmarried | 37(27.61) | 15(40.54) | 22(59.45) | 0.413 |
| Married | 97(72.38) | 32(32.98) | 65(67.01) | |
| **No of births** | | | | |
| 0 | 6(6.18) | 2(33.33) | 4(66.66) | 0.063 |
| 1-3 | 81(83.50) | 30(37.03) | 51(62.96) | |
| 4 or more | 10(10.31) | Nil | 10(100) | |
| **Education** | | | | |
| University | 6(4.47) | 1(16.66) | 5(83.33) | 0.398 |
| High School | 29(21.64) | 11(37.93) | 18(62.06) | |
| School | 50(37.31) | 21(42) | 21(58) | |
| Illiterate | 49(36.56) | 14(28.57) | 35(71.42) | |
| **Disease history** | | | | |
| Malaria | 1(0.74) | Nil | 1(100) | 0.258 |
| Diarrhea | 13(9.70) | 7(53.84) | 6(46.15) | |
| None of them | 120(89.55) | 40(33.33) | 80(66.66) | |
| **Deworming** | | | | |
| Yes | 28(20.89) | 7(25) | 21(75) | 0.209 |
| No | 106(79.10) | 40(37.73) | 66(62.26) | |

| | | | | |
|---|---|---|---|---|
| **Iron supplements** | | | | |
| Yes | 64(47.76) | 30(46.87) | 34(53.12) | 0.006* |
| No | 70(52.23) | 17(24.28) | 53(75.71) | |
| **Place for treatment** | | | | |
| *Dhami/Jhankri* | 4(2.98) | 2(50) | 2(50) | 0.525 |
| Doctor | 130(97.01) | 45(34.61) | 85(65.38) | |

* Statistically significant ($p<0.05$)

### 4.3 Anthropometric characteristics and anemia

The mean and median age of the study participants were 30.62 ± 10.70(years) and 29 years. Mean and median heights were 154.39 ± 5.19(cm) and 154.20 cm. The minimum height was 140.90 cm and maximum was 166.20 cm. Similarly the mean and median weights were 55.37 ± 11.30 (kg) and 54.10 kg. The minimum and maximum weights were 35.50 kg and 110.50 kg. BMI was categorized as underweight, normal, overweight and obese under the Asian classification. Dividing the study population among these categories, 11.9% (16) were underweight, 39.55% (53) normal, 34.32% (46) overweight and 14.17% (19) obese respectively. Anemia was comparatively found higher among overweight participants i.e. 67.39% (31) and then in normal ones (66.03%) followed by obese (63.15%) and underweight (56.25%). No significant association was found between BMI and anemia in this study as $p>0.05$ which was supported by a study among women of reproductive age in Turkey according to Pala and Dundar (2008) and in inverse relation to the results of Kamruzzaman *et al.* (2015).

Majority of study participants i.e. 67.16% (90) had WHR 0.85 or greater. Among the two categories of WHR, anemia was more prevalent among those women who had WHR equal to or greater than 0.85. The results of this study where no association was found between WHR and anemia were in contrast to the results of N. K. Sinha and Haldar (2015) conducted on women of reproductive age in West Bengal.

**Table 4.2** Anthropometric characteristics and anemia among study participants (n=134)

| Variables | Frequency (%) | Non anemic (%) | Anemic (%) | p-value |
|---|---|---|---|---|
| **BMI** | | | | |
| Underweight | 16(11.9) | 7(43.75) | 9(56.25) | 0.872 |
| Normal | 53(39.55) | 18(33.96) | 35(66.03) | |
| Overweight | 46(34.32) | 15(32.60) | 31(67.39) | |
| Obese | 19(14.17) | 7(36.84) | 12(63.15) | |
| **WHR** | | | | |
| >0.85 | 44(32.83) | 17(38.63) | 27(61.36) | 0.546 |
| ≥ 0.85 | 90(67.16) | 30(33.33) | 60(66.66) | |

### 4.4 Knowledge about iron/ anemia and anemia

Knowledge among the study participants was also taken and studied as one of the factors in the study. The categories were yes and no. About 26.86% (36) of the participants knew what iron was and 73.13% (98) did not know. Anemia were found higher i.e. 68.36% (67) among ones who did not know about iron. The education of women may eliminate the ignorance about the various health problems (Tashara *et al.* (2015)). No association was found between knowledge about iron and grades of anemia. Majority (94.77%) had no knowledge regarding anemia. No significant relation was found between variables knowledge about anemia and various grades of anemia as $p>0.05$. Results of Tashara *et al.* (2015) were in inverse relation to the present results which said that there was statistically significant correlation ($p=0.002$) between knowledge and anemia. The study inferred that the woman who has adequate knowledge on iron deficiency anemia has better practices for prevention of anemia.

**Table 4.3** Knowledge about iron/ anemia and anemia among study participants (n=134)

| Variables | Frequency (%) | Non anemic (%) | Anemic (%) | p-value |
|---|---|---|---|---|
| **Knowledge about iron** | | | | |
| Yes | 36(26.86) | 16(44.44) | 20(55.55) | 0.168 |
| No | 98(73.13) | 31(31.63) | 67(68.36) | |
| **Knowledge about anemia** | | | | |
| Yes | 7(5.22) | 1(14.28) | 6(85.71) | 0.236 |
| No | 127(94.77) | 46(36.22) | 81(63.77) | |

## 4.5 Demographic and socioeconomic characteristics and anemia

### 4.5.1 Economic characteristics and anemia

The main occupation of the family of sample participants was categorized as agriculture, labour, business, service and foreign employment. Similarly the annual income of the family was categorized as: below 60 thousand , 60 thousand to 1 lakh 20 thousand, 1 lakh 20 thousand to 1 lakh 80 thousand and 1 lakh 80 thousand and above according to study done by Tamang (2007). Out of 100, 41.04% (55) of the participants had an annual income between 1 lakh 20 thousand to 1 lakh 80 thousand. A very low number of participants (2.23%) had annual income below 60 thousand. Highest prevalence of anemia was found in the group with an annual income of 60 thousand to 1 lakh 20 thousand and lowest in 1 lakh 80 thousand and above. The prevalence of anemia has decreased as the annual income increased. This might be due to increased quality and quantity of food eaten along with the increase in income.

Majority (44.77%) of them were involved in agriculture followed by labour (30.59%) and least 4.47% (6) were involved in service. Most of the study participants whose main source of income was agriculture were anemic followed by labour while the prevalence of anemia was comparatively low among participants whose main source of income were business and foreign employment. Association between hemoglobin level and yearly income was not statistically significant (p-value>0.05). Similarly, no significant association between hemoglobin level and income source was found in the result. Thus we

conclude that this study, there was no association between anemia and economic status of participants. This result has been supported by Ghose *et al.* (2016) who found out that economic status of the family had no significant relation among women but was in inverse relation with the association of Muhangi *et al.* (2007).

**Table 4.4** Economic status of family and anemia among participants (n=134)

| Variables | Frequency (%) | Non Anemic (%) | Anemic (%) | p-value |
|---|---|---|---|---|
| **Yearly Income** | | | | |
| <60,000 | 3(2.23) | 1(33.33) | 2(66.66) | 0.422 |
| 60,000-1,20,000 | 34(25.37) | 10(29.4) | 24(70.58) | |
| 1,20,000-1,80,000 | 55(41.04) | 17(30.9) | 38(69.09) | |
| ≥1,80,000 | 42(31.34) | 19(45.2) | 23(54.76) | |
| **Income Source** | | | | |
| Agriculture | 60(44.77) | 19(31.66) | 41(68.33) | 0.862 |
| Labour | 41(30.59) | 14(34.14) | 27(65.85) | |
| Business | 12(8.95) | 5(41.66) | 7(58.33) | |
| Service | 6(4.47) | 3(50) | 3(50) | |
| Foreign employment | 15(11.19) | 6(40) | 9(60) | |

### 4.5.2 Family characteristics and anemia

Table 4.5 shows that the majority of participants (72.38%) belong to nuclear family while only about one fourth rest (27.61%) of them were from joint family. A high number of women 68.04% (66) in nuclear family were found to be suffering from anemia. Similarly, 56.75% (21) from joint family were anemic. Looking at the size of family, 44.02% (59) of the women were from family with members less than and equal to 4 while 55.97% (75) from the families with size greater than 4. Comparatively anemia was mostly prevalent in women with nuclear family and family size less than and equal to 4. This may be due to fewer incomes source of the family. The p-value was >0.05, therefore the test was not statistically significant. Hence, type and size of family was not significantly associated to anemia in this study. Similar results have been found in a study of Eastern Ethiopia according to Alene and Dohe (2014).

**Table 4.5** Family characteristics and anemia among study participants (n=134)

| Variables | Frequency (%) | Non anemic (%) | Anemic (%) | p-value |
|---|---|---|---|---|
| **Type of Family** | | | | |
| Nuclear | 97(72.38) | 31(31.9) | 66(68.04) | 0.221 |
| Joint | 37(27.61) | 16(43.24) | 21(56.75) | |
| **Family Size** | | | | |
| ≤ 4 | 59(44.02) | 20(33.89) | 39(66.10) | 0.800 |
| >4 | 75(55.97) | 27(36) | 48(64) | |

### 4.6 Menstrual characteristics and anemia

Menstrual status among the study participants were classified as menstruating and menopause. About 96.2% (129) were menstruating while 3.73% (5) had attained menopause. The prevalence of anemia among the menstruating women was 64.34% (83). Similarly, 80% (4) of the menopausal women were anemic. There was no significant association between menstrual status and anemia ($p<0.05$).

Another variable was age at menarche. This was classified as less than or equal to 12 years, 13-15 years and 16 or above. About 67.16% of the study participants fell under 13-15 years while an exactly equal number 16.41% (22) in other two groups. It also had no significant association with anemia. The bleeding period during menstruation was classified as 4 days or less and 5 days or more. Among them, 65.89% (85) of the participants had bleeding period of 4 days or less and 34.10% (44) for 5 days or more. Prevalence of anemia in both categories were 64.70% (55) and 63.63% (28) respectively. No association was found between bleeding period during menstruation and anemia which was in contrast to the results of study by Pala and Dundar (2008) and also with Bernardi *et al*. (2016) where a relationship between menstrual flow and anemia ($p= 0.021$) was found.

**Table 4.6** Menstrual characteristics and anemia among study participants (n=134)

| Variables | Frequency (%) | Non anemic (%) | Anemic (%) | p-value |
|---|---|---|---|---|
| **Menstrual status** | | | | |
| Menstruating | 129(96.2) | 46(35.65) | 83(64.34) | 0.472 |
| Menopause | 5(3.73) | 1(20) | 4(80) | |
| **Age at menarche (years)** | | | | |
| ≤12 | 22(16.41) | 10(45.45) | 12(54.54) | 0.502 |
| 13-15 | 90(67.16) | 29(32.22) | 61(67.77) | |
| ≥16 | 22(16.41) | 8(36.36) | 14(63.63) | |
| **Bleeding Period (days)** | | | | |
| ≤4 | 85(65.89) | 30(35.29) | 55(64.70) | 0.904 |
| ≥5 | 44(34.10) | 16(36.36) | 28(63.63) | |

### 4.7 Dietary habits of the participants and anemia

Table 4.7 shows that 84.32% (113) of the study participants frequently consumed plant sources of iron while 14.17% (19) and 1.49% (2) consumed regularly and rarely. Among them participants who consumed foods rarely all of them were anemic. Frequency of consumption of iron from animal sources was also studied as frequent, regular and rare according to Sato *et al.* (2010). It was found that, 17.91% (24) of them were frequent consumers while 73.13% (98) and 8.95% (12) regular and rare. The prevalence of anemia was 54.16% (13), 67.34% (66) and 66.66% (8) respectively. The prevalence of anemia was low among the ones consuming plant and animal iron rich foods on regular and frequent basis. The consumption of plant and animal sources of iron had no significant association with the grades of anemia.

Cups of tea consumed per day by the participants was categorized as 0, 1-3 cups and 4 or more. More than half (52.98%) of them consumed 1-3 cups per day while 44.02% did not consume tea. Among the ones who did not consume tea, 74.57% (44) were anemic. Prevalence of anemia among the participants consuming more cups of tea was less. Anemia depends on various other factors such as menstrual flow and iron intake other than inhibitors. There was no statistical association between number of cups of tea consumed per day and various degrees of anemia. These results were supported by Mikki *et al.* (2011)

where no association was found between consumption of iron rich foods and tea with anemia. Kefiyalew *et al.* (2014) also found no association of consumption of iron rich food from plant and animal sources with anemia. Consumption of lemon was recorded as yes or no. Among them, 66.41% (89) replied yes while rest of them (33.58%) did not consume lemon. The prevalence of anemia among the participants who didnot consume lemon was 55.55% (25) and among those who consumed was 69.66% (62). Consumption of lemon also had no statistical relation with anemia. In spite of the fact that vitamin c helps in iron absorption, it cannot prevent anemia unless there is adequate iron intake.

**Table 4.7** Dietary habits and anemia among study participants (n=134)

| Variables | Frequency (%) | Non anemic (%) | Anemic (%) | p-value |
|---|---|---|---|---|
| **Plant sources** | | | | |
| Frequent | 113(84.32) | 38(33.62) | 75(66.37) | 0.294 |
| Regular | 19(14.17) | 9(47.36) | 10(52.36) | |
| Rare | 2(1.49) | Nil | 2(100) | |
| **Animal sources** | | | | |
| Frequent | 24(17.91) | 11(45.8) | 13(54.16) | 0.475 |
| Regular | 98(73.13) | 32(32.65) | 66(67.34) | |
| Rare | 12(8.95) | 4(33.33) | 8(66.66) | |
| **Cups of tea/ day** | | | | |
| 0 | 59(44.02) | 15(25.42) | 44(74.57) | 0.110 |
| 1-3 | 71(52.98) | 30(42.25) | 41(57.74) | |
| 4 or more | 4(2.98) | 2(50) | 2(50) | |
| **Consumption of lemon** | | | | |
| Yes | 89(66.41) | 27(30.33) | 62(69.66) | 0.106 |
| No | 45(33.58) | 20(44.44) | 25(55.55) | |

### 4.8 Environmental characteristics and anemia

All the households used tube well as the source of drinking water. Table 4.8 shows the methods that study participants used for treatment of drinking water. The categories were straining, boiling, filtration and no treatment. Majority i.e. 85.07% (114) of them drank water directly from tube well without any treatment, 7.46% (10) filtrated, 5.97% (8)

strained and 1.49% (2) boiled water before drinking. The prevalence of anemia was found low i.e. 50% among ones who drank boiled water. Hookworm and tapeworm infections contribute to anemia by causing blood loss directly through ingestion and mechanical damage of the mucosa, and indirectly by affecting the supply of nutrients necessary for erythropoiesis Kefiyalew *et al.* (2014). There was no significant relationship (p=0.371) between treatment of drinking water and anemia which were in accordance to (Kamruzzaman *et al.* (2015)).

**Table 4.8** Treatment of drinking water and anemia among study participants (n=134)

| **Variables** | **Frequency (%)** | **Non anemic (%)** | **Anemic (%)** | **p-value** |
|---|---|---|---|---|
| **Treatment of drinking water** | | | | |
| Strain | 8(5.97) | 3(37.5) | 5(62.5) | 0.371 |
| Boil | 2(1.49) | 1(50) | 1(50) | |
| Filtration | 10(7.46) | 1(10) | 9(90) | |
| No treatment | 114(85.07) | 42(36.84) | 72(63.15) | |

# Part V

## Conclusions and Recommendations

### 5.1 Conclusions

The results of this study conclude that anemia is one of the major public health problem in *Dhimal* women as indicated by high prevalence of anemia in them (64.92%). Categorizing into different grades 37.3%, 26.1%, 1.5% were mildly, moderately and severely anemic.

a. In sample characteristics, highest number of participants were from age group 21-30 years and least form 15-20 years. Anemia was mostly prevalent among older age groups. Similarly, anemia was found comparatively higher in married women. Considering the education levels anemia was slightly higher in illiterate and women who attended universities.
b. Anthropometric characteristics had no association with anemia as p=0.872. Knowledge about iron and anemia were also considered. Both the factors had no association with anemia. Economic status (yearly income and main income source) of the family had no significant relation with various categories of anemia. About 66% of the people with yearly income less than 60,000 were anemic. Similarly women involved in agriculture and labour were comparatively more anemic than ones in service and business. The results confirmed that type of family and family size also had no association to the dependent variable (p=0.221).
c. The menstrual characteristics (i.e. menstrual status and bleeding period) were not associated with anemia. However, age at menarche was not associated with anemia. Among the study participants 96.2% were menstruating while 3.73% attained menopause. All of the study participants drank water from tube well. Among them 85.07% drank the water without any treatment while others used boiling, straining or filtration to purify it. Treatment method of drinking water also had no relation with anemia.
d. These results can act a useful guide for the local, government as well as international sectors for careful planning, management, monitoring and evaluation of intervention and programs targeting the study population to address this problem.

## 5.2 Recommendations

The conclusions of this study suggest the following recommendations:

a. Women themselves as well as their families should be made aware about the role of food and nutrition in health of target population.
b. The results can be useful for planning and initiation of interventions and programs to improve the nutritional status of women of the target community.
c. More detailed and descriptive studies can be conducted to determine the distribution and type of anemia and other probable causes of anemia.

# Part VI

## Summary

Anemia is a condition that develops when our blood lacks enough healthy red blood cells or hemoglobin. Hemoglobin is a main part of RBCs and binds oxygen. It is a widespread public health problem associated with an increased risk of morbidity and mortality, especially in women and young children. Reproductive age of woman covers 15-49 years of age and is the transition period of life. Anemia is a common problem at this age group which may be due to inadequate iron intake, chronic blood loss or disease, malabsorption, or a combination of all these factors.

A community based cross-sectional study was carried out to determine the prevalence of anemia in non-pregnant women of reproductive age (15-49 years) in *Dhimal* community of Damak municipality and factors associated with it. From 19 wards of the municipality, 4 wards were selected randomly and equal number of samples was taken from each ward. Structured questionnaire was administered to the participants for socio-demographic and FFQs for dietary data. Hemocue kit was used to determine blood hemoglobin level. Anthropometric measurement was used to determine BMI as well as WHR. All the data were first coded and entered into SPSS version 20.0. Chi-square test of significance was performed to find out the factors associated with anemia at 95% confidence interval.

The results told that the prevalence of anemia was high (64.92%). Further categorizing into grades 37.3% were mildly anemic, 26.1% moderately and 1.5% severely anemic respectively. The mean Hb level was 11.53±1.42 gm/dl and the median was 11.65 gm/dl. Similarly the maximum and minimum values were 15.7 gm/dl and 7.00 gm/dl. Forty one percent of the target population had annual income between 1 lakh 20 thousand to 1 lakh 80 thousand. The prevalence of anemia among the ones with annual income of 60 thousand to 1 lakh 20 thousand was 70.58% (24). Comparatively women involved in agriculture were found to have highly anemic (68.33%). Majority i.e. 71.38% (97) of the study participants were from nuclear family. The prevalence of anemia among the participants having nuclear and joint families were 68.04% (66) and 56.75% (21). In the study participants with family members equal to 4 or less than, the prevalence was 66.10% (39). Chi-square tests revealed no significant relation between anemia and factors: family size and type with $p=0.800$ and $p=0.221$ respectively.

Age was categorized as 15-20, 21-30, 31-40, 41-49 years with their target population found to be 21.64%, 29.10%, 24.62% and 24.62% respectively. About 72.38% of study participants were married while 27.61% were unmarried. Other factors such as number of births given by married women (p=0.063), education (p=0.398), BMI (p=0.872), deworming were not significantly (p=0.209) associated to dependent variable degrees of anemia. Majority (96.2%) of the participants were menstruating. Among them, 64.34% (83) were anemic. Menstrual status and bleeding period were not significantly associated to anemia as the corresponding p values were 0.472 and 0.502. Iron supplementation during pregnancy was significantly associated to anemia with p=0.006.

*Dhimal* being a very backward community the prevalence of anemia was very high and can be considered as a major health problem. Serious actions at local and national level should be carried out to address it.

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# Appendices

## Appendix-A

### Consent form

I am Kritee Niroula, a student of B.Sc. Nutrition and Dietetics at Central Campus of Technology, Dharan. For the completion of this bachelor's degree I need to carry out a dissertation and my topic is "Prevalence of anemia in non-pregnant women of reproductive age (15-49 years) and associated factors in *Dhimal* community of Damak municipality." This study will provide you beneficial information regarding your nutritional status. To conduct this work you need to coordinate with me. For this your blood sample along with other height, weight and other body measurements will be taken and questions will be asked regarding your socioeconomic conditions, education and dietary patterns. All the information taken from you will be kept confidentially. Conditions that will not allow you to take part in the study if you are:

a. Pregnant
b. If given birth within 2 months
c. Seriously ill
d. Taking iron supplements

Taking part in this study will be according to your wish. Are you interested? If yes:

I willingly agree to take part in this study by understanding above mentioned information.

Name of participant:

Signature:

Signature of investigator:

Date of survey:

If the participant is below 18 years:

Signature of guardian:

## मन्जुरीनामा पत्र

नमस्कार, मेरो नाम कृती निरौला हो । म केन्द्रिय प्रविधी क्याम्पस, धरानमा पढाई भई रहि आएको विषय पोषण तथा आहार विज्ञानमा अध्ययनरत विधार्थी हुँ । यस संकायको चौथो वर्षको पाठयक्रम अन्तरगत रहेको शोधकार्य गरिरहेको छु। मेरो शोधकार्यको विषय "दमक नगरपालिकामा रहेका १५-४९ वर्षका धिमाल महिलाहरु मा रक्तअल्पताको स्थिति साथै यसका सम्बन्धित कारकहरु" हो। यो शोधकार्यले हाम्रो अध्ययनकार्य पूरा गर्नुका साथै तपाईहरूको पोषण स्थितिबारे महत्वपूर्ण जानकारी दिन्छ। यसको लागि तपाईले पनि यस शोधकार्यमा सहभागी भई हामीलाई साथ दिनुपर्ने छ। यस कार्यको लागि तपाईको रगत जाँच गर्नुका साथै तपाईको नाप लिई केही प्रश्नहरू सोधिनेछ। तपाईले दिनु भएको जानकारी महत्वपूर्ण हुनेछ र यसलाई गोप्य राखिनेछ।

यस कार्यमा सहभागी हुन नसक्ने अवस्था:

क. गर्भवती भएमा

ख. सुत्केरी भएको दुई महिना सम्म

ग. कुनै प्राणघातक रोग लागेमा

घ. आइरन चक्की खाइरहेको अवस्थामा

यस शोधकार्यमा भाग लिनु वा नलिनु तपाईको आफ्नो इच्छा हुनेछ। के तपाई सहभागी हुन इच्छुक हुनुहुन्छ? यदि हुनुहुन्छ भने:

यस रक्तअल्पता शोधकार्य बारे माथि उल्लेखित सबै कुराहरू बुझि म स्वइच्छा आफ्नो रगत दिएर सहभागी हुन तयार छु।

सहभागीको नाम:

सहभागीको सही:

सर्वेक्षण गर्नेको सही:

सर्वेक्षण गरिएको मिति:

यदि सहभागी १८ वर्षभन्दा कम भएमा:

अभिभावकको सही:

**Appendix-B**

## Questionnaire

Code no: Ward no: Date:

**General information**

a) Name of participant:
b) Date of birth:
c) Age:
d) Religion:
e) Total number of family members:
f) Type of family:
   1) Small 2) Joint
g) Marital Status: 1) Married 2) Unmarried 3) Divorced 4) Widowed
h) If married, total number of births…….

**Socioeconomic status**

a) What is your level of education? 1) University degree 2) Secondary
   3) Higher Secondary 4) Illiterate

b) Occupation (main source of income) :
   1) Agriculture 2) Labour 3) Business 4) Service 5) Foreign employment

c) Total Income Of the Family: 1) Below 60,000 2) 60,000-1,20,000
   4) 1,20,000-1,80,000 4) 1,80,000 and above

**Household information**

a) House Type:
   1) Own 2) Rented 3) Others:…..……..

**Hygiene and sanitation**

a) What is the main source of drinking water for your household?
   1) Well 2) Tube well 3) Common tap 4) River 5) others …….

b) How do you typically treat your water before using it?

1) Strained through cloth 2) Boil 3) Filter

4) Bleach/ chlorine 5) Others …… 4) No Treatment

**Health**

a) How old were you at your first menstruation? …… years
b) Do you menstruate every month? ……
c) How much number of days do you bleed?
   1) 3 days 2) 4 days 3) 5 days 4) 6 days or more
d) Do you have any idea about iron? 1) Yes 2) No
e) Have you ever suffered from the following ever in last 3 months?
   1) Worms 2) Malaria 3) Diarrhea 4) None of them
f) Where do you go for treatment first when you get sick?
   1) Dhami-Jhankri 2) Doctor 3) FCHV 4) Others ……
g) Have you taken worms medication in past 6 months?
   1) Yes 2) No
h) If yes then when? …….
i) Did you take iron supplements during pregnancy? …….

**Knowledge about anemia**

a) Do you have any knowledge regarding anemia?
   1) Yes 2) No

**Food Consumption Pattern:**

a) Vegetarian/ non vegetarian:
b) How many cups of tea do you take in a day? …….. cups
c) Do you consume lemon along with your food?
   1) Yes 2) No

**Anthropometric measurements:**

Hemoglobin Level: gm/dl

Height: cm

Weight: kg BMI:

Waist Circumference: cm

Hip Circumference: cm WHR:

**Food frequency questionnaire**

| Food Groups | Food items | Daily | Once a week | Twice a week | 3 times a week | 4 times a week | Once in two week | Never |
|---|---|---|---|---|---|---|---|---|
| Cereals | Wheat flour | | | | | | | |
| | Rice flakes | | | | | | | |
| Legumes and pulses | Red lentil | | | | | | | |
| | Soyabean | | | | | | | |
| | Black lentil | | | | | | | |
| | Bengal gram | | | | | | | |
| Fruits | Pomegranate | | | | | | | |
| | Apple | | | | | | | |
| Vegetables | Latte saag | | | | | | | |
| | Raayo saag | | | | | | | |
| | Pumpkin | | | | | | | |
| | Beans | | | | | | | |
| Meat and egg products | Fish | | | | | | | |
| | Chicken | | | | | | | |
| | Meat | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Egg | | | | | | | |

**सर्वेक्षण प्रश्नपत्र**

कोड न: वडा न: मिति:

**सामान्य जानकारी**

१. सहभागीको नाम:

२. जन्म मिति:

३. उमेर:

४. धर्म:

५. परिवारको संख्या:

६. परिवारको प्रकार:

क. एकल ख. संयुक्त

७. वैवाहिक स्थिति:

क. विवाहित ख. अविवाहित ग. छोडपत्र भएको घ. विधुवा

८. यदि वैवाहित हुनुहुन्छ भने, जम्मा बच्चाको जन्म संख्या:

**सामाजिक तथा आर्थिक जानकारी**

१. शैक्षिक योग्यता:

क. विश्वविधालय तह ख. मा.वि ग. उच्च मा.वि घ. निरक्षर

२. पेशा (आम्दानीको मुख्य श्रोत):

क. कृषि ख. श्रम ग. व्यापार घ. सेवा ङ. वैदेशिक रोजगार

३. पारिवारको वार्षिक आम्दानी:

क. ६०,००० भन्दा कम ख. ६०,०००-१,२०,०००

ग. १,२०,०००-१,८०,००० घ. १,८०,००० वा सो भन्दा बढी

**घरको विवरण**

१. घरको प्रकार:

क. आफ्नो ख. बहाल ग. अन्य .....

**सरसफाई बारे जानकारी**

१. पानीको मुख्य श्रोत:

क. इनार ख. कल ग. धारा घ. खोला

ङ. अन्य:.....

२. तपाईले पिउने पानी कसरी शुध्दिकरण गर्नुहुन्छ ?

क. छानेर ख. उमालेर ग. फिल्टर घ. क्लोरिन हालेर

ङ. अन्य .....च. केही गर्दिन

**स्वस्थ्यबारे जानकारी**

१. पहिलो पटक महिनावारी कति वर्षमा भएको हो ? ..... वर्षमा

२. तपाईलाई अहिले महिनावारी हुन्छ कि हुँदैन? .....

३. कति दिनसम्म रगत जान्छ?

क. ३ दिन ख. ४ दिन ग. ५ दिन घ. ६ दिन वा बढि

४. तपाईलाई आइरन बारे ज्ञान छ कि छैन ?

क. छ ख. छैन

५. पछिल्लो ३ महिनामा तल मध्ये कुनै विरामी हुनु भएको थियो?

क. जुका लागेको ख. मलेरिया ग. झाडा पखाला घ. कुनै पनि हैन

६. विरामी हुँदा उपचारको लागि पहिलो पतककहाँ जानुहुन्छ ?

क. धामी- झाँक्री  ख. डाक्टर  ग. महिला स्वस्थ्य स्वंसेविका

घ. अन्य .....

७. पछिल्लो ६ महिनामा तपाईले जुकाको औषधी खानु भएको छ कि छैन?

क. छ  ख. छैन  ग. याद छैन

८. खानु भएको भए कहिले? .....

९. तपाईले गर्भवती अवस्थामा आइरन चक्की खानु भयो कि भएन?.....

**रक्तअल्पता बारे जानकारी**

१. तपाईलाई रक्तअल्पताबारे जानकारी छ?

क. छ  ख. छैन

**खाना बारे जानकारी**

१. तपाई साकाहारी की मांसाहारी हो?

क. साकाहारी  ख. मांसाहारी

२. तपाई दिनमा कति पटक चिया पिउनुहुन्छ? ..... पटक

३. तपाई खाने कुरा खाँदा कागतीको प्रयोग गर्नु हुन्छ?

क. गर्छु  ख. गर्दिन

**अन्य विवरण**

हेमोग्लोबिन:  gm/dl

उचाई:  cm

तौल:  kg  BMI:

Waist circumference:  cm

Hip Circumference: cm WHR:

**Food frequency questionnaire**

| खाद्य समूह | खानेकुरा | सँधै | हप्तामा एक पटक | हप्तामा दुई पटक | हप्तामा तीन पटक | हप्तामा चार पटक | दुई हप्तामा एक पटक | कहिल्यै नखाएको |
|---|---|---|---|---|---|---|---|---|
| अन्न | गहुँको पिठो | | | | | | | |
| | भुजा-चिउरा | | | | | | | |
| दाल वा गेडागुडी | मुसुरी दाल | | | | | | | |
| | भटमास | | | | | | | |
| | कालो दाल | | | | | | | |
| | चना | | | | | | | |
| फलफूल | अनार | | | | | | | |
| | स्याउ | | | | | | | |
| सागसब्जी | लट्टेको साग | | | | | | | |
| | रायो साग | | | | | | | |
| | फर्सी | | | | | | | |
| | सिमि | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| शिकार | माछा | | | | | | | |
| | चिकेन | | | | | | | |
| | मासु | | | | | | | |
| | अण्डा | | | | | | | |

**Appendix-C**

## Ethical approval from NHRC

Government of Nepal

**Nepal Health Research Council (NHRC)**

Estd. 1991

Ref. No.: 1237

**15 January 2017**

**Ms. Kritee Niroula**
Principal Investigator
Central Campus of Technology
Dharan, Sunsari

Ref: **Approval of Research Proposal** entitled **Prevalence of anemia in non-pregnant women of reproductive age (15-49 years) and associated factors in Dhimal community of Damak Municipality**

**Dear Ms. Niraula**

It is my pleasure to inform you that the above-mentioned proposal submitted on 19 December 2016 (**Reg. no. 454/2016** 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 budget that may be necessary in course of the implementation of the research proposal can only be made so and implemented after prior approval from this council. Thus, it is compulsory to submit the detail of such changes intended or desired with justification prior to actual change in the protocol.

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.

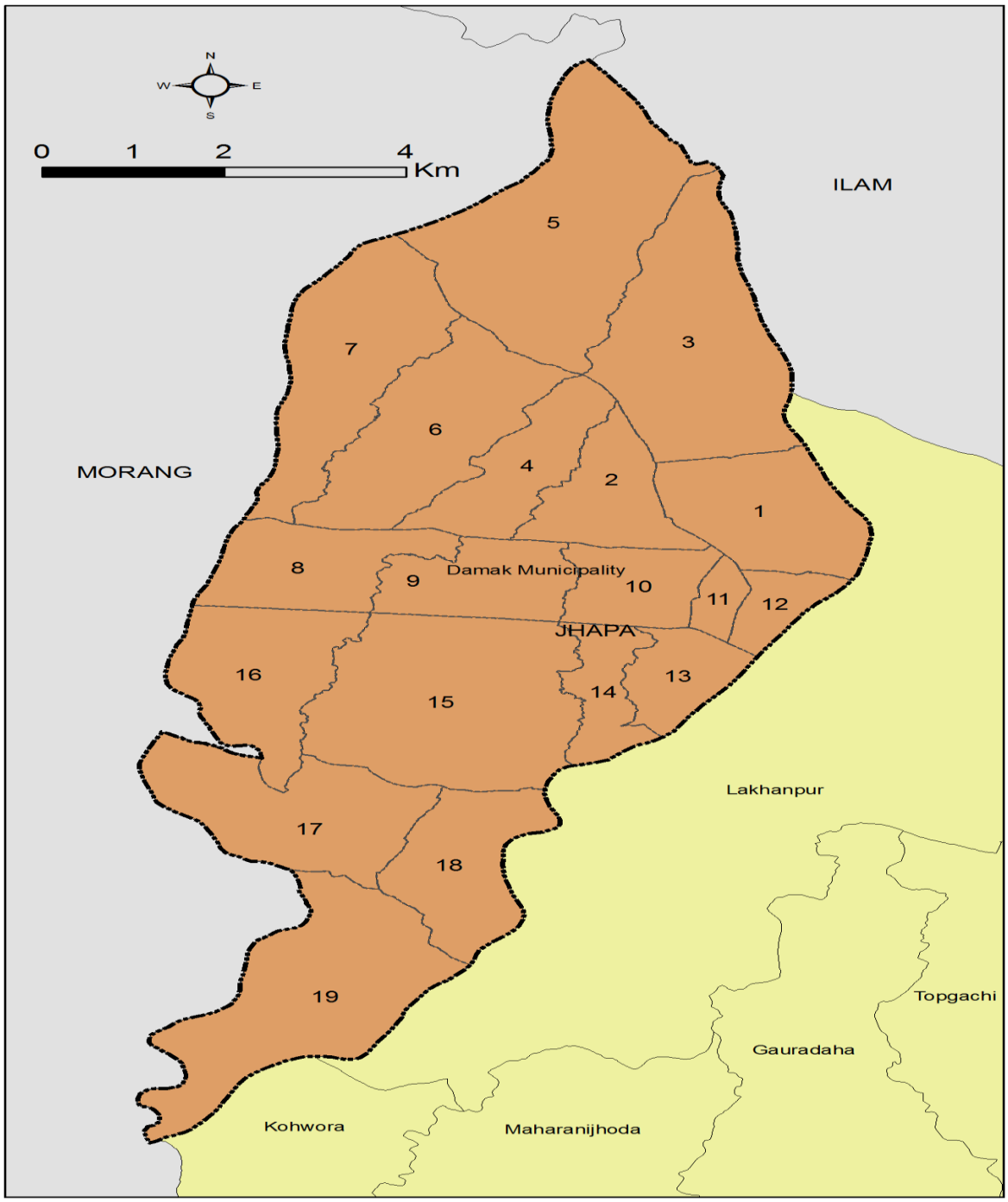
Thanking you,

**Dr. Khem Bahadur Karki**
**Member- Secretary**

Tel: +977 1 4254220, Fax: +977 1 4262459, Ramshah Path, PO Box: 7626, Kathmandu, Nepal
Website: http://www.nhrc.org.np, E-mail: nhrc@nhrc.org.np

**Appendix-D**

**Map of survey site (Damak municipality)**



## Appendix-E

### Photo gallery