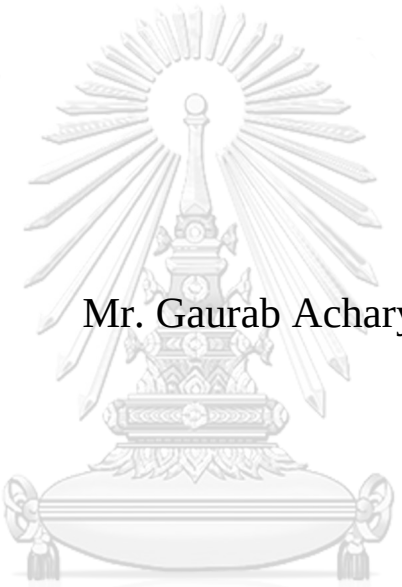
PREVALENCE AND FACTORS ASSOCIATED WITH ANEMIA AMONG PREGNANT WOMEN ATTENDING AMDA HOSPITAL OF EASTERN NEPAL

Mr. Gaurab Acharya



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ความชุกและปัจจัยที่เกี่ยวข้องกับภาวะโลหิตจางในสตรีตั้งครรภ์ที่เข้ารับบริการโรงพยาบาลเอเอ็มดีเอ ในเนปาลตะวันออก

นายกวารับ อาชายา

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสาธารณสุขศาสตรมหาบัณฑิต
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Thesis Title	PREVALENCE AND FACTORS ASSOCIATED WITH ANEMIA AMONG PREGNANT WOMEN ATTENDING AMDA HOSPITAL OF EASTERN NEPAL
By	Mr. Gaurab Acharya
Field of Study	Public Health
Thesis Advisor	Wandee Sirichokchatchawan, Ph.D.

Accepted by the College of Public Health Sciences, Chulalongkorn University in Partial Fulfillment of the Requirement for the Master of Public Health

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กวารับ อาชายา : ความชุกและปัจจัยที่เกี่ยวข้องกับภาวะโลหิตจางในสตรีตั้งครรภ์ที่เข้ารับบริการโรงพยาบาลเอเอ็มดีเอ ในเนปาลตะวันออก. (PREVALENCE AND FACTORS ASSOCIATED WITH ANEMIA AMONG PREGNANT WOMEN ATTENDING AMDA HOSPITAL OF EASTERN NEPAL) อ.ที่ปรึกษาหลัก : อ. ดร.วันดี ศิริโชคชัชวาล

ปัญหาภาวะโลหิตจางเป็นปัญหาสาธารณสุขที่สำคัญทั่วโลก และพบสูงถึงประมาณร้อยละ 40 ในสตรีตั้งครรภ์ในประเทศเนปาลพบภาระโรคโลหิตจาง ด้วยความชุกสูงถึงร้อยละ 46 ในสตรีตั้งครรภ์ การศึกษานี้มีวัตถุประสงค์ เพื่อสำรวจความชุกและปัจจัยที่เกี่ยวข้องกับภาวะโลหิตจางในสตรีตั้งครรภ์ที่เข้ารับบริการโรงพยาบาลเอเอ็มดีเอ ในเนปาลตะวันออก การวิจัยแบบภาคตัดขวางในสถานบริการสุขภาพ ดำเนินการระหว่างเดือนกันยายนถึงตุลาคม 2018 โดยศึกษาจากกลุ่มตัวอย่างสตรีตั้งครรภ์ อายุ 18-19 ปี ที่เข้ารับบริการโรงพยาบาลเอเอ็มดีเอ ในเนปาลตะวันออกทั้งหมด 420 คน ใช้แบบสอบถามที่พัฒนาขึ้นเพื่อเก็บรวบรวมข้อมูลโดยการสัมภาษณ์ตัวต่อตัว และวิเคราะห์ข้อมูลด้วยสถิติ ค่าร้อยละ ค่าเฉลี่ย ส่วนเบี่ยงเบนมาตรฐาน การทดสอบไคว์สแควร์หรือฟิชเชอร์ และใช้การวิเคราะห์พหุตัวแปรในการทดสอบสมการถดถอยโลจิสติกที่ค่าความเชื่อมั่น $p<0.05$ เพื่อหาความสัมพันธ์ ผลการศึกษาพบความชุกของภาวะโลหิตจางในกลุ่มตัวอย่างคิดเป็นร้อยละ 42.1 โดยร้อยละ 13.6 มีภาวะโลหิตจางรุนแรง ภาวะโลหิตจางปานกลางคิดเป็นร้อยละ 40.7 และภาวะโลหิตจางรุนแรงน้อยคิดเป็นร้อยละ 45.8 ปัจจัยที่มีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติ (AOR>1) ต่อภาวะโลหิตจางในกลุ่มตัวอย่างสตรีตั้งครรภ์ ได้แก่ สตรีตั้งครรภ์อายุน้อยกว่า 20 ปี (AOR = 5.499, 95%CI: 1.172-25.792) สตรีตั้งครรภ์ช่วงอายุ 30-34 ปี (AOR = 0.175, 95%CI: 0.042-0.735) ศาสนาอื่นๆ (ได้แก่ ศาสนาพุทธ คริสเตียน มุสลิม และ kirant) (AOR = 3.217, 95%CI: 1.152-8.982) และ กลุ่มชาติพันธุ์ Janajati (AOR = 0.337, 95%CI: 0.134-0.848) อาชีพกรรมกรและเกษตรกร (AOR = 3.267, 95%CI: 1.121-9.522) รวมถึงความไม่เพียงพอของผลผลิตจากสวนผัก (AOR = 10.648, 95%CI: 2.702-41.961) การซื้อผักนานครั้งๆ (AOR = 7.042, 95%CI: 1.049-47.277) และบางครั้ง (AOR = 7.653, 95%CI: 2.308-25.371) การเป็นมังสวิรัติ (AOR = 6.264, 95%CI 1.646-23.830) การรับประทานผักใบเขียวอาทิตย์ละครั้ง (AOR = 8.139, 95%CI 1.714-38.680) ความไม่หลากหลายของอาหารที่รับประทาน (AOR = 6.741, 95%CI: 2.528-17.975) และการมีประจำเดือนที่นานกว่าปกติ (AOR = 2.696, 95%CI: 1.351-5.380) สรุปผลการศึกษาพบว่า ปัจจัยที่กล่าวมาข้างต้น (AOR>1) มีความสัมพันธ์เชิงบวกอย่างมีนัยสำคัญต่อภาวะโลหิตจางในสตรีตั้งครรภ์ การศึกษานี้จึงเสนอว่า ควรมีการเพิ่มความรู้เกี่ยวกับโภชนาการ และการรับประทานอาหารที่เหมาะสมต่อสตรีตั้งครรภ์ โดยเฉพาะการรับประทานผักใบเขียว และความหลากหลายของประเภทอาหารที่รับประทานขณะตั้งครรภ์ต่อไป

สาขาวิชา	สาธารณสุขศาสตร์	ลายมือชื่อนิสิต .....
ปีการศึกษา	2561	ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

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Gaurab Acharya : PREVALENCE AND FACTORS ASSOCIATED WITH ANEMIA AMONG PREGNANT WOMEN ATTENDING AMDA HOSPITAL OF EASTERN NEPAL. Advisor: Wandee Sirichokchatchawan, Ph.D.

Anemia in pregnancy is a global public health problem, affecting nearly 40% of the pregnant women worldwide. The higher burden of anemia was found in Nepal with 46% prevalence among pregnant women. This study is a health facility-based cross-sectional study carried out from September to October 2018. A total of 420 pregnant women of reproductive age group (18-49 years) attending the antenatal check-up in AMDA Hospital of Damak, Jhapa were recruited in this study. Data was collected through a validated semi-structured questionnaire. Collected data was analyzed in SPSS 22. Both descriptive and inferential statistics were employed in data analysis. Chi-square test was applied for the test of association between anemia and designated variables. Later, the variables with a p-value <0.20 obtained in bivariate was processed for multivariate analysis and considered significant with p-value <0.05. Finally, the adjusted odds ratio (AOR) with 95% confidence interval (CI) was reported.

The prevalence of anemia was 42.1% in which 13.6% were severely anemic, 40.7% moderate and 45.8% were mild anemic. The study explored age group <20 and between 30-34 years (AOR 5.499, 95%CI: 1.172-25.792), (AOR 0.175, 95%CI: 0.042-0.735), pregnant with other religion (Buddhist, Christian, Kirant, Muslim) (AOR 3.217, 95%CI: 1.152-8.982), Janajati ethnicity (AOR 0.337, 95%CI: 0.134-0.848) were the factors associated with anemia. In addition, pregnant women working as laborer/peasant farmer (AOR 3.267, 95%CI: 1.121-9.522), Insufficient kitchen garden products (AOR 10.648, 95%CI: 2.702-41.961), vegetables brought rarely and sometimes (AOR 7.042, 95%CI: 1.049-47.277), (AOR 7.653, 95%CI: 2.308-25.371) had higher likelihood of having anemia. Correspondingly, vegetarian (AOR 6.264, 95%CI 1.646-23.830), DGLV once a week (AOR 8.139, 95%CI 1.714-38.680), no dietary diversity (AOR 6.741, 95%CI: 2.528-17.975) and prolong menstruation (AOR 2.696, 95%CI: 1.351-5.380) were independently associated with anemia as well.

Field of Study:	Public Health	Student's Signature .....
Academic Year:	2018	Advisor's Signature .....

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Gaurab Acharya

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF ACRONYMS

ANC	Antenatal Care
AOR	Adjusted Odds Ratio
BMI	Body Mass Index
CI	Confidence Interval
DDS	Dietary Diversity Score
DGLV	Dark Green Leafy Vegetable
DoHS	Department of Health Service
FANTA	Food and Nutrition Technical Assistance Project
FAO	Food and Agriculture Organization
FHI	Family Health International
GoN	Government of Nepal
Hb	Hemoglobin
IDA	Iron Deficiency Anemia
IFA	Iron Folic Acid
IOM	Institute of Medicine
NDHS	Nepal Demographic Health Survey
NHRC	Nepal Health Research Council
MDG	Millennium Development Goals
MDD-W	Minimum Dietary Diversity for Women of Reproductive Age

MPH	Master in Public Health
SDG	Sustainable Development Goal
WHO	World Health Organization
WRA	Women of Reproductive Age

CHAPTER I: INTRODUCTION

1.1. Background and rationale

Anemia is a condition when the number and size of red blood cells or, the concentration of the hemoglobin in blood falls down and consequently impair oxygen transporting capacity of blood whole over the body (1). Anemia has been identified as a public health problem whole over the world which has a significant adverse health consequences as well as creates unfavorable atmosphere for the social and economic development (2). Anemia are found at all age groups, other than it is most common among the pregnant women and young children (3, 4). World Health Organization (WHO) defined anemia in pregnancy if the concentration of hemoglobin in blood is below 11 g/dl (5). The severity of anemia in pregnancy by WHO has graduated, mild anemia if hemoglobin is 10.0-10.9 g/dl, similarly 7-9.9 g/dl as moderate and < 7 g/dl as severe (6).

According to the estimation by the WHO, around 800 million both children and women are affected by anemia globally. Similarly, 29.4 % of women at reproductive age group (15-49) suffered from anemia and among them 38.2 % pregnant women are anemic (2). More than 80% countries are facing burden of pregnancy anemia, as a moderate or severe public health problem (5). Anemia is serious health issue especially in least develop and developing countries and is allied with undesirable outcomes in pregnancy. Global data reveals about 56% of pregnant women are having anemia in low as well as middle income countries (7). In South East Asia, the prevalence of anemia among pregnant women is highest with 48.7% which accounts for 11.5 million pregnant women (2). Similarly, in Nepal anemia is found as serious public health problem (8). 41% of Nepalese women in the reproductive age group (15 to 49) are anemic; among them 34% are mild anemic, 7% moderately anemic, and less than 1% severely anemic. According to the NDHS 2016, prevalence of anemia among pregnant women was found 46% which was slightly decreased from 48% in 2011 (9).

During pregnancy, anemia highly amplified risk of maternal mortality, morbidity also fetal morbidity, mortality along with intrauterine growth retardation and low birth weight (10). It is estimated that due to anemia above 11, 5000 maternal and

59, 1000 peri-natal deaths occur per year globally and magnitude of the problem is high in low socioeconomic groups. Correspondingly, due to the anemia's adverse health consequences, it also has an economic effect on human capital which results the loss of billions of dollars annually (11). Despite the fact those deaths among pregnant women, children and adolescents are preventable but still deaths are in excess of one third of the global burdens of premature mortality. So, WHO has adopted the reduction of maternal mortality as a crucial health related targets which is mentioned on the Sustainable Development Goals (SDG) with an emphasis (12). Previously recognizing anemia is correlated to morbidity and mortality in specific groups like pregnant women, World Health Assembly 2012 legitimate a comprehensive implementation plan on maternal, infant and young child nutrition, with a commitment to achieve 50% reduction of anemia among the women of reproductive age group and children by 2025. Similarly, Nepal has also set its national targets accordingly (13).

Anemia is considered as an indicator of poor nutrition and poor health (14). Anemia has a multiple causal factors; nevertheless, the most ordinary cause of anemia is iron deficiency, which is due to inadequate diet iron intake or defective absorption of iron by blood. It is estimated that, from the deficiency of iron 50% women are suffering from anemia globally (15). There is increased needs of iron during pregnancy. Additional factors that contribute anemia are other nutritional deficiencies particularly vitamins A, B12, C and foliate plus also from the worm infestations. Anemia is also caused by the genetic conditions like sickle cell disease, thalassemia and other chronic inflammations. Pregnant women are highly susceptible to anemia because of high iron requirement for their own growth and the growth of the fetus. At the same time they also have less access to antenatal care (1). Along with these factors there are other predicting risk factors like age of marriage, birth spacing, antenatal checkup, hemodilution, parity, gestational week, length of menstrual bleeding, gastritis with ulcer, literacy along with frequency of consumption of meat or organ of meat (16). The maternal anemia either in the period of pregnancy or after the delivery is strongly associated with child anemia (11).

Anemia is a prioritized public health problem in Nepal. Ministry of Health had setup the target to reduce iron deficiency anemia among pregnant women to 15% in

second long term health plan. Similarly, now in Nepal Health Sector Strategy (NHSS) 2015-2020, they have set the target to decrease prevalence of anemia among WRA to 30% by 2020 (13, 17). Ministry of Health and Population (MOHP) had targeted to reduce the prevalence of anemia less than 40% by 2017. After then, MOHP and the stakeholders developed National Anemia Prevention & Control Strategy 2015-2020 to reduce the anemia in coming days. Ministry of Health and Population is implementing combined iron folic acid supplementation program for pregnant and lactating women to prevent from anemia. Combined Iron and folic acid tablets are recommended to intake for at least 180 days at pregnancy stage, as sooner from first trimester to 45 days of delivery (18). Including it to improve maternal and child nutrition Ministry of health have national routine programs such as, vitamin A, and de-worming, and other promoting activities by health workers and Female Community Health Volunteers (FCHV) (17). However, different routine cares are executing whole over the Nepal with a target to reduce the anemia but it is not going on the desired way. According to NDHS, the prevalence of anemia among women remained almost stable from 2006 to 2011 at around 35% but in 2016 it has increased to 41%. Commencing the same survey on 2016 prevalence of anemia among pregnant women was 46% which seems slightly decreased from 48% in 2011 but not decreased significantly (9). According to NDHS survey 2016 in three ecological zones (Mountain, Hill, Terai) a higher proportion of women living in Terai (52%) were anemic compared with women from mountain (35%) and hill (29%).

The previous studies conducted in Nepal shows the variety of factors are contributing to increase the anemia in pregnancy. A case-control study among Nepali pregnant women with the presence of low serum vitamin A, elevated serum C-reactive protein or hookworm infection had significantly associated on increasing the risk of severe anemia with an adjusted odd ratios (95% CI) 8.38 (1.99, 35.30), 4.91 (1.22, 19.67) and 5.43 (1.20, 24.61), respectively(19). According to the study among pregnant women attending Patan Hospital, Kathmandu, revealed high prevalence of anemia was found among teenagers, farmers and the women with short height. In the same study the researcher identified high anemia among the pregnant women of ethnic groups like; Lama, Sherpa, Tamang, and the women married to the industrial workers or illiterate

men. Furthermore, the risk of anemia found increased with gestation age (20). A cross-sectional survey among lactating women in peri-urban area of Nepal explored the dietary habits in women not being good enough. The mean usual micronutrients intakes were below to the estimated average requirement among the women. The diet of lactating mothers was found monotonous (MDDS was 3.9) and 60% energy yielding food was contributed by rice (21) As well as the frequency of foods consumed regularly and weekly were rice, potatoes, legumes and vegetable oil. Animal products, fruits and vegetables were infrequently consumed one or less than one time per week. From this study it can be concluded the women in the Terai part of Nepal have less diversity and inadequacy in nutrition (22).

1.2. Statement of the problem

Anemia is a global public health problem and it is estimated about 40% of the pregnant women are anemic worldwide. The low income countries are having higher burden of anemia than high income countries. In 2011, the WHO South-East Asia, Eastern Mediterranean and African Regions had the highest prevalence of anemia across the various population groups like pregnant, children and non-pregnant women. Among the 6 regions by WHO, anemia prevalence among pregnant women was found highest in South-East Asia with nearly by 50% (2). In Nepal, according to NDHS 2016, prevalence of anemia among pregnant women was found 46% which is a serious public health problem. During pregnancy, anemia increases the risk of maternal and fetal mortality and morbidity including intrauterine growth retardation and low birth weight of new born baby (10). There are multiple factors that directly or indirectly attribute to anemia during pregnancy. In pregnancy anemia is more likely caused by a combination of inadequate dietary intake, low absorption of iron and other nutrients, infectious diseases, malaria, helminthes infestation and increased requirements during childhood and pregnancy etc. (23). The anemia adversely affects in the use of energy sources by muscles so reduces the physical capacity and work performance and also adversely affects immune system and increases morbidity from infections (3).

Unfortunately, diets of pregnant women in low and middle income countries (LMICs) are monotonous and predominantly plant-based with little consumption of

micronutrient-dense animal source foods, fruits, and vegetables (24). In south Asia dietary diversity is the matter of concern. Traditionally vegetarian diets, low intake of animal source foods, high intake of inhibitors of iron and other mineral absorption, and low dietary diversity are considered most important contributors to micronutrient deficiencies and anemia (25). According to a study conducted in peri-urban area of Nepal, the mean micronutrient intake by lactating women were below the estimated average requirements for all micronutrients and the percentage of energy intake form protein, fat and carbohydrates was 11%, 13% and 76% respectively (21).

In the direction of reducing anemia routine cares are providing during the time of ANC visit for pregnant women. The 65th world health assembly held in 2012 endorsed a comprehensive nutrition plan for maternal, infant and young child and set six specific global nutrition targets for 2025. On that comprehensive nutritional plan, of 50 % reduction of anemia prevalence was targeted for the women of reproductive age group (1, 26). With the aim of preventing pregnancy anemia and to achieve the targets Nepal is also working with different national and community health education programs along with other routine cares. Health post are counseling and providing the supplementation of iron with folic acid tablets from the second trimester up to 45 days after delivery at time of ANC/PNC follow-up. Likewise, de-worming tablets are also providing after completion of first trimester and vitamin A supplements during the postpartum period (27). According to NDHS, during the time of pregnancy 42% of women took the recommended dose of iron (at least 180 tablets) comparing with 2011 the shape was 38% along with seven in 10 women (69%) took de-worming medication during pregnancy. Despite, increasing coverage and compliance of iron supplementation, anemia in pregnancy is not decreasing significantly (9).

AMDA hospital is the community referral hospital with specialty services of anesthesiology, general medicine, surgery, gynecology, radiology, pediatrics, orthopedics, ENT, dental, eye etc. along with high number of ANC visits. However, the hospital does not have the records on the exact number of pregnant mothers with anemia (28). Even though, in the national routine recording and reporting system (Health management and information system) the anemic pregnant women are not

tallied. Only, the number of pregnant mothers received iron folic acid and total tablets of iron folic acid supplement to individual pregnant women are recorded and reported.

According, to the previous report and from the few studies, it insights that the prevalence of anemia is still high in Nepal. From the literature review it illustrates that very few studies have been done to identify the prevalence and the associated factors of anemia among the pregnant women along with the inconsistent findings. The possible associated factors for anemia in pregnant women known from various literature reviews came up with inconsistent findings; showing positive as well as no association between anemia and factors like caste, ethnicity, education, residence, parity, gestational age, diet diversity etc. The rate of anemia during pregnancy is still of public health importance and the factors responsible are not well studied and addressed. Additionally, in Nepal there are diversified people with their own life style and culture. Therefore, it is important to estimate the magnitude of anemia and to identify the major contributing factors in specific areas in order to act on it and improve the existing situation. As well as, it is necessary to fill up the knowledge gap observed on the previous studies.

1.3. Research questions

- What is the prevalence of anemia among pregnant women attending for antenatal care (ANC) at AMDA Hospital of Eastern Nepal?
- What are the factors associated with anemia among pregnant women attending for ANC at AMDA Hospital of Eastern Nepal?

1.4. Research objectives

1.4.1. General objective

- To identify the prevalence and associated factors of anemia among pregnant women attending ANC at AMDA Hospital of Eastern Nepal.

1.4.2. Specific objectives

- To identify the prevalence of anemia in pregnancy attending ANC at AMDA Hospital of Eastern Nepal

- To identify the association of socio-demographic, economic and cultural factors with anemia in pregnancy
- To find out the association of reproductive factors and health service utilization with anemia in pregnancy
- To find out the association of dietary practice and diversity with anemia in pregnancy
- To identify the association of agricultural factors with anemia in pregnancy

1.5. Statistical hypotheses

1.5.1. Null hypothesis

There is no association between the factors being studied and anemia among pregnant woman attending ANC at AMDA hospital of Eastern Nepal.

1.5.2. Alternate hypothesis

There is an association between the factors being studied and anemia among pregnant woman attending ANC at AMDA Hospital of Eastern Nepal.

1.6. Study variables

1.6.1. Dependent variable:

- Anemia in pregnancy

1.6.2. Independent Variables:

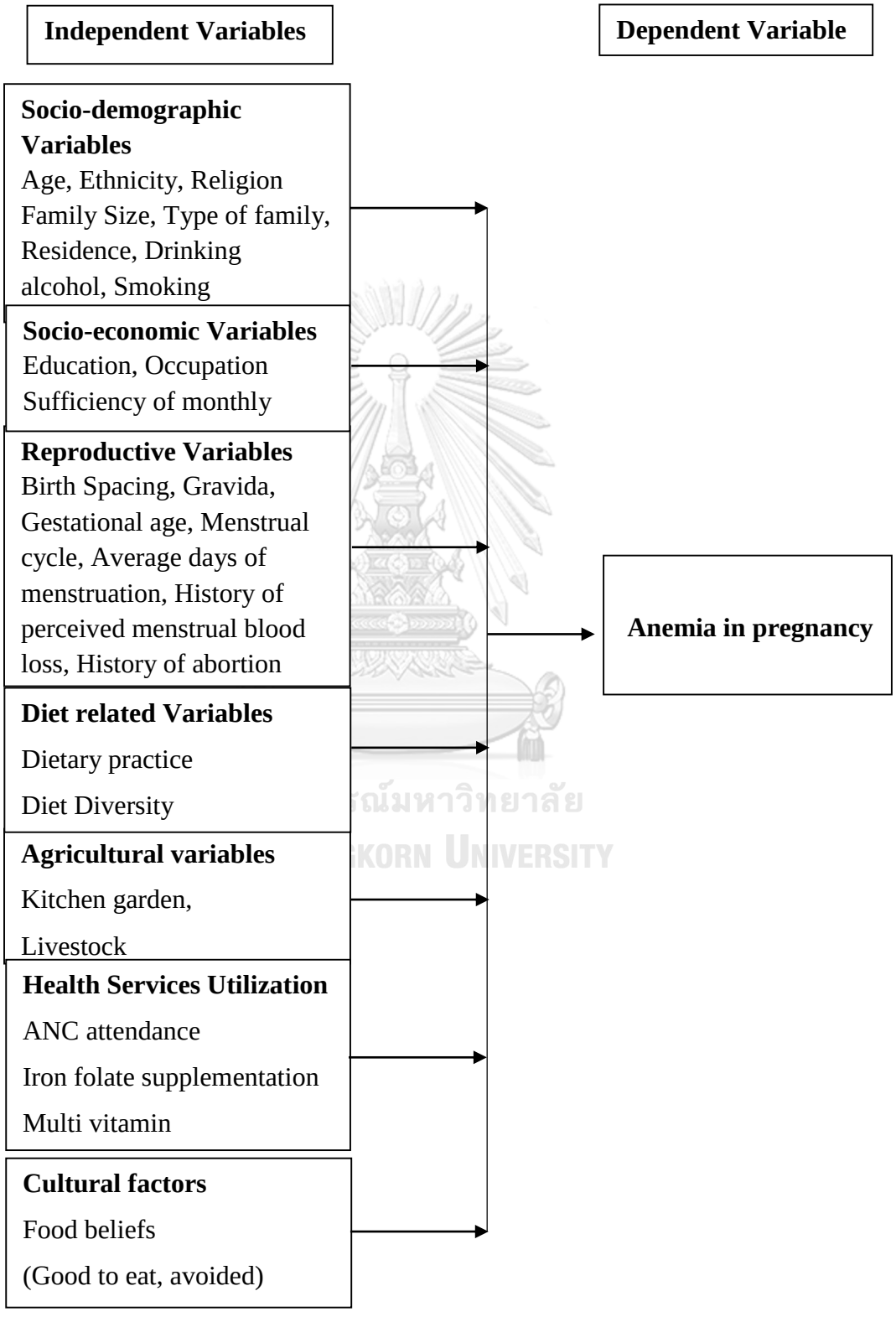
- **Socio-demographic factors**
  - Age
  - Religion
  - Ethnicity
  - Residence
  - Family size
  - Family type
  - Smoking

- Drinking alcohol

- **Socio-Economic factors**
  - Education
  - Occupation
  - Sufficiency of family monthly income
- **Agricultural factors**
  - Kitchen garden
  - livestock
- **Cultural factors**
  - Beliefs on food good to eat
  - Food avoidance
- **Reproductive factors**
  - Gravida
  - Gestational age (1^{st}, 2^{nd}, 3^{rd} trimester)
  - Birth spacing
  - Menstrual cycle
  - History of perceived menstrual blood loss
  - Average days of menstruation
  - History of Abortion
- **Health service utilization**
  - ANC attendance
  - Iron foliate supplementation
  - De-worming
  - Multi vitamin intake
- **Diet related variables**
  - Dietary practice
  - Dietary diversity
  - Body Mass Index

1.7. Conceptual framework

Figure 1: Conceptual framework



1.8. Operational definition

Anemia: Hemoglobin level of mother less than 11.0 gm/dl at the time of pregnancy as per available individual laboratory report from the AMDA Hospital refers for anemia. The severity of anemia in pregnancy was graduated, as mild anemia if hemoglobin is 10.0-10.9 g/dl, similarly 7-9.9 g/dl as moderate and < 7 g/dl as severe.

Type of Family: It represents the composition of the family which is categorized as;

- **Nuclear**: Parents and their children living together
- **Joint/Extended**: Living with grandparents and other relatives

Gravida: It means total number of pregnancies including the current pregnancy, irrespective of the period of gestation.

Gestational age: It refers to the duration of pregnancy from the first day of last menstrual period and it is measured in trimester.

Trimester: Pregnancy is measured in the trimesters from the first day of last menstrual period, totaling 40 weeks. The first trimester of pregnancy is week 1 through week 12, or about 3 months. The second trimester is week 13 to week 27. And the third trimester of pregnancy spans from week 28 to the birth. Which was calculated on the basis of last menstrual period of particular women.

History of abortion: Experience of expulsion or extraction of an embryo or fetus before 22 weeks of gestation either induced or spontaneous is known as history of abortion. For the measurement it was dichotomized into Yes or No.

Pregnancy Interval: The interval between the last two pregnancies, measured in number of months.

Menstrual cycle: It was measured in two forms regular and irregular.

Regular menstrual cycle: The menstrual cycles less than 21 days or more than 45 days and repeats without differing more than 4 days in every month according to menstrual diaries was measured as regular menstrual cycle.

Irregular menstrual Cycle: The menstrual cycles less than 21 days or more than 45 days and differs more than 4 days in every month according to menstrual diaries was measured as irregular menstrual cycle.

History of perceived menstrual blood loss: Perceived quantity of menstrual bleeding by a women occurred over several repeated cycles before their pregnancy. For analysis, it was measured as very heavy, heavy, moderate and low but, further for logistic regression very heavy and heavy was weighted as excess menstrual bleeding.

Ethnicity: It was categorized as Dalit, Janajati, Terai caste, Bhramin/Chhetri and others.

Education: The formal and informal education achieved by the pregnant women. This is categorized as illiterate, informal, primary, and secondary and higher education. It is measured in terms of numbers of grade. And later in bivariate categorized in primary or below and secondary and higher.

- **Illiterate:** pregnant women not having any formal education.
- **Informal education:** Education gained beyond the formal education settings.
- **Primary education:** Formal education up to grade 5.
- **Secondary education:** Education from grade 6 to 10 (SEE).
- **Higher education:** Education from high school (11 -12) and above.

Monthly Income: Monthly income corresponds to their experience on sufficiency of income of the family spending for their daily needs.

Agricultural Characteristics: Agricultural characteristics corresponds to the kitchen garden and the livestock available in the family for the consumption. Under the kitchen garden availability and sufficiency of kitchen garden products is measured.

ANC attendance: Number of antenatal care visits during the time of current pregnancy.

Iron folate supplementation: Combined Iron folic acid tablets received by pregnant mothers during her ANC visit. For the measurement it was dichotomized into Yes or No.

De-worming: Anti helminthes tablets received by pregnant women during current pregnancy, which was measured by dichotomizing with yes or no.

Multi vitamin intake: Intake of multi vitamin in any forms (tablets/syrups) during the time of pregnancy which was measured by dichotomizing into Yes or No options.

Dietary diversity: Dietary diversity corresponds to the number of variety of foods or foods groups that are consumed over 24 hours. Here in the study, dietary diversity score was based according to the guideline by FAO and FHI 360, 2016. The participants were asked to describe their foods and drinks consumed in the past 24 hours. It was started from food or drink in the morning, during day and night before going to sleep (breakfast, snack, lunch and dinner). Food or drinks both consumed at home and outside was placed accordingly on the 10 food groups mentioned on the table 1. Finally, diet diversity was known if pregnant women have consumed at least five out of ten groups of food similarly, less than five food groups consumption was known as no diversity.

Minimum Dietary Diversity for Women (MDD-W): MDD-W is a dichotomous indicator of food group diversity for the women of reproductive age group of 15–49 years. MDD-W was measured as per the consumed food at least five out of ten defined food groups within 24 hours from the previous day or night. The ten MDD-W food items and food groups are explained below on the table 1. Here, the dietary diversity of pregnant women is studied in the base of MDD-W.

Description Food Groups and their examples

Table 1: Description of food groups and their examples

Sn.	Food Groups	Examples of 10 food groups in MDD-W	
A	Foods made from grains	1	Corn/maize, rice, wheat, sorghum, millet, porridge, bread or there foods made from grains
B	White roots and tubers and plantains		White potatoes, white yams, white cassava or other foods made from roots
C	Pulses (Beans, peas and lentils)	2	Mature beans or peas, lentils or bean
D	Nuts and seeds	3	Tree nut, groundnut/peanut or certain seeds
E	Milk and milk products	4	Milk, cheese, yoghurt or other milk products
F	Organ meat	5	Liver, kidney, heart or other organ meats or blood-based foods
G	Meat and poultry		Buff, pork, lamb, goat, rabbit, chicken, duck
H	Fish and seafood		Fresh or dried fish, shell fish or seafood
I	Eggs	6	Eggs from poultry or any other bird
J	Dark green leafy vegetables	7	Dark green leafy vegetables including wild forms including locally available vitamin A rich leaves such as amaranth, kale, spinach, cassava leaves
K	Vitamin A-rich vegetables, roots and tubers	8	Pumpkin, carrots, squash or sweet potatoes that are yellow or orange inside,
L	Vitamin A- rich fruits		Ripe mango, ripe papaya, dried peach

Table 1 : Description of food groups and their examples continued

Sn.	Food Groups	Examples of 10 food groups in MDD-W	
M	Other vegetables,	9	Other vegetables,
N	Other fruits	10	Other fruits

Diversity Score: Diversity score is calculated by summing the number of set of 10 unique food groups consumed by the pregnant women in the 24 hours' period. If pregnant women consumed any one food among 10 groups, then it was calculated as Dietary diversity score (DDS) "1".

No Dietary Diversity: Dietary Diversity Score less than 5.

Dietary Diversity: Dietary Diversity Score greater or equal to 5.

Meat: It refers to the edible flesh of animals, fish or poultry when it is used as food.

Cultural factors: It refers to the set of cultural values and beliefs accepted by a community for individuals on food during the time of pregnancy.

Food avoidance: It denotes to avoidance of a food item for reasons to pregnant mother other than simple dislike.

Food good to eat: It refers to the feeling of certainty about food consumption during pregnancy that is good for their health.

CHAPTER II: LITERATURE REVIEW

2.1. Definition of Anemia

Anemia is defined as a condition in which the number and size of red blood cells, or the hemoglobin concentration, falls below an established cut-off value, consequently impairing the capacity of the blood to transport oxygen around the body (1).

2.2. Definition of Anemia in pregnancy

World Health Organization (WHO) defined anemia in pregnancy if the concentration of hemoglobin in blood is below 11 g/dl (5).

The WHO has graduated severity of anemia in pregnancy on three groups:

Table 2: Severity of anemia in pregnancy

Severity of Anemia in pregnancy	**Hemoglobin threshold**
No Anemia	≥11g/dl
Mild Anemia	10.0-10.9 g/dl
Moderate Anemia	7-9.9 d/dl
Severe Anemia	<7g/dl

Source: adopted from reference (3, 29)

Classification of anemia as a problem of public health significance

Anemia has classified the countries by the level of public health problem according to the existing prevalence of anemia on population-specific hemoglobin threshold as in table 3.

Table 3: Classification of anemia as a problem of public health Significance

Category of Public health Significance	**Prevalence of anemia/10,000**
No public health problem	≤4.9
Mild public health problem	5.0 to 19.9
Moderate public health problem	20.0 to 39.9
Severe public health problem	≥40.0

Source: adapted from reference (30)

2.3. Overview of Anemia

Anemia is the worldwide issue on public health. It occurs at all age groups moreover is most common among the pregnant women and young children (2-4). More than 80% countries are facing burden of anemia in pregnancy, as a moderate or severe public health problem (5). The WHO estimated, around 800 million children and women are affected by anemia all over the world. 29.4 % of women of reproductive age group (15-49) are suffered from anemia and among them 38.2 % pregnant women are anemic. In South East Asia, the prevalence of anemia in pregnant women age of 15 to 49 is highest with 48.7% (11.5 million) (2). In Nepal, overall 41% of Nepalese women in the reproductive age (15 to 49) are anemic and among them 46 % suffered from anemia in the pregnancy period (9). Anemia is known as the most common micronutrient deficiency disorder in the world (15). In pregnancy, the common causes of anemia are inadequate dietary intake, low absorption of the nutrients, infectious disease, malaria, helminthes infestation and increased requirements of nutrition during the time of pregnancy (23). Along with these there are other predicting risk factors like age of marriage, birth spacing, antenatal checkup, hemodilution, parity, gestational week, duration of menstrual bleeding, gastritis with ulcer, literacy and frequency of consumption of meat or organ of meat (16). Anemia in pregnancy highly increased the risk of maternal mortality, morbidity also with fetal morbidity, mortality along with intrauterine growth retardation and low birth weight (10).

2.4. Effects of Anemia in Pregnancy

2.4.1. Anemia and maternal health

Anemia has well understood as a leading cause of maternal morbidity as well as maternal death from the different studies and from the global figures. An estimated above 11, 5000 maternal deaths occurred per year globally due to the pregnancy anemia (11). The study on "The Impact of Anemia on Maternal Mortality" suggests that the 1 g/dl amount of hemoglobin in blood even can greatly reduce the risk of maternal mortality by 25% in the time of pregnancy (31). Anemia reduces the physical capacity as well as effects on immune system which consequently affects in health of pregnant women and increases the chances of having other health problems (32). Anemic pregnant women highly develop the chances of increasing infections, results low-work productivity and similarly increased the risk of depression and fatigue. (33). The study among the African mothers at post-partum period also identified IDA increases the risk of getting depression, anxiety and cognitive function (34). Likewise IDA increases the risk of perinatal complication like pre-eclampsia which is one of the major cause of perinatal mortality (35). Anemia also has chances to induce maternal and fetal stress, which stimulates the synthesis of corticotropin-releasing hormone (CRH). The increase of CRH is threats for preterm labor, pregnancy-induced hypertension and eclampsia, as well as it also lead for the premature rupture of the membranes (36).

2.4.2. Anemia and fetal development and birth outcomes

Anemia among pregnancy results adverse pregnancy out comes. The pregnant women suffered by anemia or an IDA encompass high chance of having intrauterine growth retardation as well as results to preterm delivery. Similarly, the increase level of CRH by anemia in pregnant women results for the longitudinal growth of the fetus which is the danger sign for both mother and the baby (33, 36). According to the 1:1 case control study of 400 pregnant mothers in comparison to non-anemic controls, 36% were preterm birth, 39 % gave birth of baby having low birth weight and 24 % new born had intrauterine growth retardation. So on, nearly 17% of newborn child were born with complications which were treated in Neonatal Intensive Care Unit (NICU) and about 3 % of new born baby found death than non-anemic controls (37).

2.5. Factors associated with anemia among pregnant women

2.5.1. Socio demographic factors and anemia

The majority of the previous studies conducted in different areas with different study design show the associations between socio demographic factors and anemia. From the NDHS survey it came to know that 44% of women age of 15 to 19 are anemic compared with 36% among women age 40 to 49 (9). A hospital-based, cross-sectional study with randomly selected pregnant women of Lhasa, Tibet exemplify that ethnic Tibetans women had low hemoglobin level as compared to non-Tibetans (Coeff=8.09, CI: 1.68-14.50) (38). A Cross-sectional study from Patan Hospital, Kathmandu found that prevalence of anemia was higher among the ethnic groups like Lama, Sherpa and Tamang furthermore severe anemia was found significantly high on Gurung, Rai, Magar, Limbu ethnic groups (20). Pregnant of adolescent age are more likely to be vulnerable to anemia because they need iron both; for their own growth and the growth of the fetus at a same time (1). Facility based cross-sectional study among pregnant women in Southern Ethiopia established the significant association between anemia and residence. Pregnant women living in rural area have 0.17 times more chances of getting anemia then the pregnant women staying on the urban area (39). The study by Derso, Abera et al. in Northwest Ethiopia observed pregnant women living in rural areas (AOR=3.303, 95% CI 1.17, 7.82) and households without latrine (AOR= 4.75, 95% CI 1.15, 9.43) have 3.3 and 4.8 times more chances of having anemia respectively. Along with this the same study also found that household income is directly associated with the anemia (40). Nevertheless the study conducted by Bondevik showed that there is not any significant difference between anemia and residence (20).

The cross-sectional study in regional hospitals of Uganda explore the below described socio-demographic factors are associated with anemia. They found house wife is an independent risk factor for anemia because they have to depend on the earnings of their husband. Similarly, the magnitude of anemia was found high with the women who have low monthly family income. The anemia was also found more on the pregnant women who were staying in the big households of more than 5 family members. The pregnant women with no education were found more anemic in

comparison to the educated and having the low level education which is also associated with unemployment (41). In a cross sectional study by Swarnlatha on 300, newly registered pregnant women in 12-20 weeks of gestation attending the antenatal clinic of Government Maternity Hospital in India revealed type of family, education of pregnant women and per capita monthly income of the family were significantly associated with anemia (42). A community-based cross-sectional study carried out among 446 pregnant women from July 2013 to June 2014 in the rural population of India revealed socioeconomic status and literacy of women being strongly associated with anemia (43).

Findings from the study on rural Indian pregnant population showed significant association of anemia with the mother‘s age group ($\chi2=28.38$, $p<0.001$) educational($\chi2=19.58$, $p<0.001$) and socio-economic status ($\chi2=32.09$,$p<0.001$) and religion ($\chi2=68.03$, $p<0.001$) (44).

2.5.2. Agricultural factors

In a very common understanding agricultural activities means to grow crops and livestock for foods but it is not adequate. The main purpose of agriculture is to grow healthy and well-nourished people. Agricultural production yields people to get food and essential nutrients needed for their body (45). Home gardens are extremely anticipated as an important supplemental source to contribute the food and nutritional security and livelihoods globally. Production of necessary foods on small plots near to their home is the oldest and most followed form of cultivation (46).

Similarly, household agriculture is very well known practice that impacts nutrition and health of individuals and families. An un-blinded cluster-randomized controlled trial study in Baitadi, Nepal became an evidence to show anemia has low significant among the mothers having homestead food production as compared with control group (OR=0.62, CI: 0.48-0.82) (47). The study on home gardens and the energy and nutrient intakes of women and preschoolers in rural Puerto Rico found the kitchen gardens increases the availability of green vegetables plus increases in intake of several nutrients finally improve in the overall diet of women and children (48). A

study from Afghanistan found that household with livestock's asset ownership had lower risk of getting anemia. The authors mentioned that sheep ownership has a protective effect in reducing anemia (OR=0.83, CI: 0.73-0.94) (49). Correspondingly the study from Baitadi district of Nepal also supports livestock's asset ownership had lower risk of getting anemia (47).

2.5.3. Reproductive factors

Various studies established significant association of reproductive factors such as parity, gestational age, history of excess menstrual bleeding and inter-pregnancy interval with anemia at the time of pregnancy. According to the study on Mekelle town of Ethiopia, parity (AOR 2.3 95% CI 1.4, 3.8) significantly and independently affects anemia (50). A cross sectional study conducted on government maternity hospital in Sudan, showed direct association of multi gravida and birth-interval less than 36 months with anemia (42). Similarly, a community-based cross-sectional study carried out among 446 pregnant women from July 2013 to June 2014 in the rural population of India also supports the gravida, and birth interval as major factors that directly contribute to the problem of anemia in the time of pregnancy. Wherein anemia was found high in third trimester of pregnancy (43). The health facility based unmatched case control study on Northern Central Ethiopia had found the chance of developing anemia being higher on 1st trimester pregnancy (AOR 2.07 95 % CI 1.12, 3.84) and in 3rd trimester pregnancy (AOR 2.96 95% 1.53, 5.72) (51). The study in Ethiopia identified the perceived history of excess menstrual bleeding (AOR: 9.82, 95%CI: 3.27-21.35) as one the independent predictors of anemia in pregnancy (52).

The WHO and other international organizations have recommended that at least 2–3 years of spacing between the pregnancies benefits maternal health including health of new born child. Similarly from the studies supported by the United States Agency for International Development (USAID) have suggested that it might be more advantageous if birth spacing is longer from 3 to 5 years (53). The studies from the systematic review of 58 observational studies explored that, the short spacing intervals between pregnancies causes' maternal nutritional depletion and foliate depletion (54). Likewise, statistically significant association was observed between birth spacing and

anemia in pregnancy (OR=3.1, 95% CI: 6.01-10.23) where pregnant women with birth spacing more than 2 years had less risk of anemia than those with birth spacing of less or equal to 2 years (55).

2.5.4. Dietary factors

Essential nutrients can be obtained by consuming the variety of foods from various food groups. To ensure adequate essential nutrition intake, the dietary guidelines in US and internationally recommend to increase the food diversity across and within food groups (56). Equally, diverse diet is essential to improve micronutrient nutrition of WRA and the promotion of diverse diets is known as the one among several approaches to achieve (57) . The pregnancy period of the women is known as the most nutritional demanding period so they are recommended to have a variety of food to meet their nutritional demands (58). To achieve adequate nutrition during the period of pregnancy, dietary factors, including dietary diversity and frequency of intake of food plays the crucial role. At the time of pregnancy nutrients are needed more to the body both; for the health and well-being of the mother and for the growing fetus and newborn child (59). Dietary diversity can be used as good proxy indicator for micronutrient adequacy in pregnant mothers as well as dietary diversity score helps to indicate whether an individual is having adequate or inadequate nutrition intake through the diet (60, 61). Dietary diversity is also considered as a key indicator for assessing the access, utilization and quality of diet of an individual or household (62). The iron from vegetarian diets are generally less bio-available than from non-vegetarian diets due to the reduced meat intake as well as the tendency to consume more phytic acid and other plant-based inhibitors of iron. Vegetarians are likely to have lower iron stores than omnivores; they appear to have no greater incidence of iron deficiency anemia (63).

Among the pregnant women anemia was found significantly associated with dietary diversity. The study among pregnant women in Ethiopia identified that the pregnant women having low level of dietary diversity (AOR: 12.82, 95% CI: 6.42, 25.62) are 13 times more likely to develop anemia and similarly with medium level (AOR: 2.42, 95% CI: 1.22, 4.79) are 2 times more likely to develop than those who are having high food diversity (50). Similarly in a community based cross sectional study

in southern Ethiopia low dietary diversity (AOR 3.18, 95% CI: 1.37, 7.37) provide and additional evidence of statistically significant association with anemia among pregnant women (64).

A cross-sectional survey among lactating mothers in peri urban area of Nepal found the mean usual micronutrients intake was below to the estimated average requirement. The diet of lactating mothers was found monotonous (MDDS was 3.9) and 60% energy yielding food was contributed by rice (21) According to the study among women of Terai part of Nepal revealed the incidence of foods consumed regularly and weekly were rice, potatoes, legumes and vegetable oil. Animal products, fruits and vegetables were infrequently consumed one or less than once per week. Diets of women in the Terai of Nepal have less diversity and inadequacy in nutrition (22).

2.5.5. Cultural factors

The impression of culture on beliefs and mythology, traditions and rituals, institutions and doctrines, has individual and social implications (65). Food taboos refer to the restriction of specific foods as a result of social or religious customs. The nutritional status of women before and during pregnancy can be determined by maternal knowledge, attitudes, and perceptions towards certain foods. In many traditional societies, cultural norms and customs govern behaviors including during critical life stages like pregnancy (66) . In various studies it has been found that pregnant mothers in various part of the world are forced to abstain from nutritious food as a part of their traditional food habits. Most common foods that were avoided during pregnancy like ghee, bitter gourd, mangoes, papaya, fish, meat, eggs, pickles and reasons for such avoidance were perceived as cause of abortion, weight gain during pregnancy in fear of obstetric complications associated with the delivery of a bigger baby (61, 66).

2.5.6. Health Service Utilization

A maternal health care service has received a significant recognition in reducing maternal mortality and morbidity. Majority of maternal deaths can be prevented if the woman has access to basic antenatal, natal and postnatal care (67). Ante Natal Care (ANC) has highlighted the importance of providing effective communication about

physiological, biomedical, behavioral and socio-cultural issues, and effective support, including social, cultural, emotional and psychological support, to pregnant women in a respectful way. These communication and support functions of ANC are keys to save and improve mothers and newborn lives (68) In the time of pregnancy, WHO has recommended at least 4-ANC visit and National Anemia Control and Prevention Strategy (2015-2020) incorporated access to 4 ANC services as an indicator to monitor the progress of anemia status through improving access to quality services (13).

There are total 49 recommendations on ANC by WHO and they are grouped into 5 topics in which nutrition intervention is the one. The WHO has recommended taking daily oral iron and folic acid supplementation with 30 mg to 60 mg of elemental iron and 400 g (0.4 mg) of folic acid for pregnant women to prevent maternal anemia, puerperal sepsis, low birth weight, and preterm birth (68). Similarly, Health ministry of Nepal is also implementing combined iron folic acid tablets supplementation for pregnant and lactating women (13). According to the Multiple Indicator Cluster Survey (MICS) 2014 significant regional variations was found on taking iron/folic acid at least 180 days. Range was from 10% in Mid-Western Mountainous region to 53% in Central Terai region of Nepal. Similarly, iron folic acid supplementation was found higher in urban as compare to the rural women which was 51% and 40% respectively (18).

A cross-sectional study design concerning study population of 400 pregnant women in rural areas of Northern Ghana identified; women who attended at least 4 ANC had mean hemoglobin concentration significantly higher than women who attended less than 4 times (69). Similar study in Southern Ethiopia, supports the same evidence. They found the odds of anemia among pregnant women who had ANC follow-up were 0.92 times less likely to have anemia in comparison to not having ANC follow-up (39). According to the study from predictors of anemia in Jamaica, women who had 4 ANC were 0.7 times less likely to be anemic than who had less than 4 ANC visits (70).

The study on interventions for maternal and child under nutrition and survival found the IFA supplementation to the pregnant mothers leads to 73% reduction in the risk of anemia(RR 0.27, CI: 0.12-0.56) (71). The pregnant women who did not take

iron supplementation are 5.63 times more likely to have anemia in comparison those who received iron supplementation (40). Intestinal parasites particularly hookworm infestation is recognized as one of the major cause of anemia in rural and poor communities. A community based cross sectional study in Ethiopia shows that the women who are infected with hookworm were 2.69 times more likely to have anemia than those who were not infected by any other intestinal parasites (64).

2.6. Policy on regarding anemia control

In the "Global Nutrition Targets 2025", WHO has suggested the policy for the member states and their partners to increase attention, to invest and to set the cost effective action to reduce the global problem on anemia. The WHO has set target for 50 % reduction of anemia in women of reproductive age group by 2025. To achieve 50% reduction of anemia by 2025 the prevalence of anemia should be reduced more than 6% per year by establishing effective strategies, an integrated, multi-factorial and multi-sectoral approach in every nation (1). Therefore, to achieve the target WHO has recommended the actions for prevention, control and treatment i.e. activities directed to improve dietary diversity of WRA have to be implement and provision of iron fortified food should available. During the antenatal care, daily oral iron and folic acid plus other vitamins and minerals supplementation are recommended to the pregnant women according to the United Nations Multiple Micronutrient Preparation (UNIMAP). Deworming tablets are suggested in second and third trimester for prevention of intestinal helminthes. Similarly, in malaria prone area malaria have to be controlled by chemoprophylaxis and by providing insecticide treated nets (1).

Similarly, Ministry of Health in "Nepal Health Sector Strategy (NHSS) 2015-2020", they have set the target to decrease prevalence of anemia among WRA by 30% till 2020 (13, 17). To achieve the targets, Nepal is also working with different national and community programs. With the aim of preventing pregnancy anemia, health workers and Female Community Health Volunteers (FCHV) are counseling and providing the supplementation of mixed iron and folic acid tablets as soon as possible from the first trimester till 45 days of delivery. Intakes of iron/folic acid tablets are recommended by MOHP for at least 180 days during their pregnancy. Women require

taking 225 iron/folic acid tablets from early 1st trimester to 45 days of delivery (18). However, FCHV provides only for those pregnant women following health facility for ANC checkup. Likewise, single dose of de-worming tablets is providing after completion of first trimester and vitamin A supplements during the postpartum period. In malaria prone area insecticide treated nets are also providing to pregnant women at the time of ANC visit (27).

CHAPTER III: METHODOLOGY

The aim of this chapter is to present the details on the research methodology together with the research deign, study area, study population, sample size, research instruments, data collection procedure, ethical consideration, and data analysis.

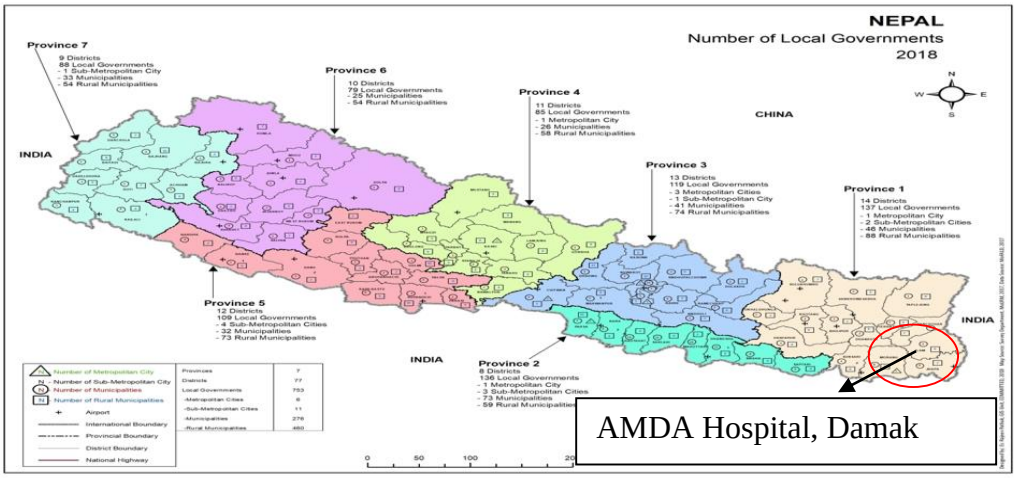
3.1. Research design

A health facility based cross-sectional study was conducted to identify the prevalence and associated factors of anemia among pregnant women.

3.2. Study area

The study was carried out at AMDA Hospital of Damak, Jhapa, located at the eastern part of Nepal. The Hospital was established in November 1992 as a referral center with 15 beds and at the moment it is upgraded to more than 100 beds. AMDA Hospital is very popular in eastern part of Nepal with a high catchment area. Services are not only for the local people in the municipality but also to the refuses and for people of remote neighboring districts. The ANC visit was high in fiscal year (2073/2074 BS). According to the hospital record average number of ANC visit in a month was 903 pregnant women (28).

Figure 2: Study area



3.3. Study population

All the pregnant women of age (18 to 49 years) attending the antenatal check-up in AMDA Hospital, Damak, Jhapa during the period of September to October 2018 were the study population.

3.3.1. Inclusion criteria

Pregnant women age of 18 to 49 years attending ANC in AMDA Hospital, Damak, Jhapa with ANC card along with hemoglobin test report were included in the study.

3.3.2. Exclusion criteria

Pregnant women with known medical conditions/diseases such as diabetes, HIV/AIDS and tuberculosis were excluded in the study. Those pregnant women who were seriously and mentally ill were also excluded.

3.4. Sample size

The sample size for this study was calculated from n4studies by estimating an infinite population proportion (72). According to the NDHS survey 2016 the prevalence of anemia among pregnant women was 46% (9). Considering the proportion 0.46, 5 % margin of error and 95 % confidence interval sample size was calculated as follow:

$$n = \left(\begin{matrix} Z \\ 1 - \frac{\alpha}{2} \end{matrix} \right)^2 \left(\frac{P(1-P)}{d^2}\right)$$

Where, n = sample size

P = Proportion 0.46

d = margin of error (0.05)

α =0.05

$n = 382$

By adding 10 % attrition rate, $n = 382 \times 10\% + 382 = 420.2$

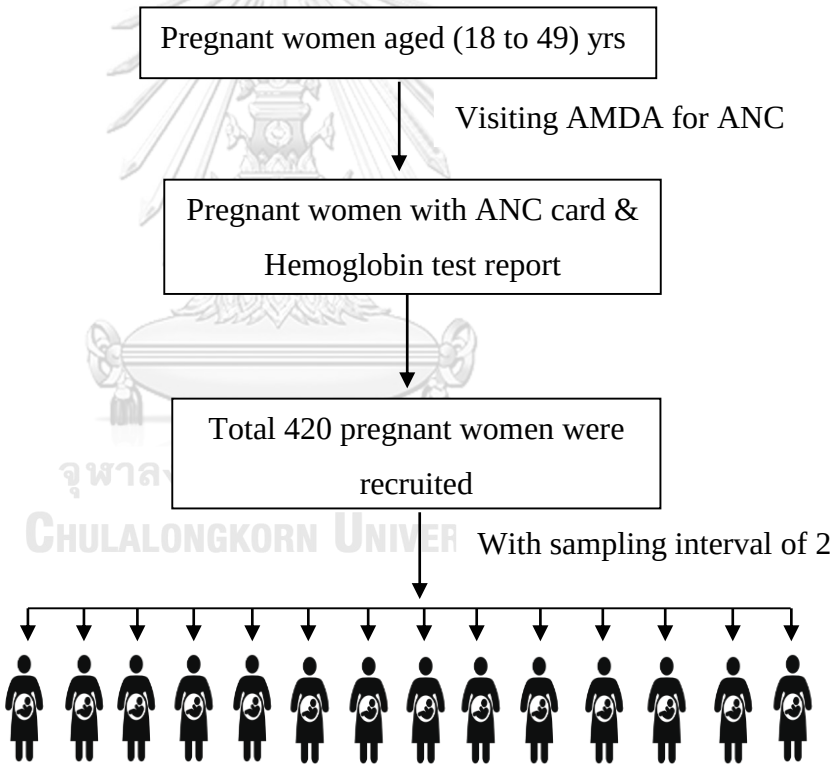
After rounding up the total sample size was 420.

3.5. Sampling technique

AMDA hospital was selected purposively as study area. Study population was selected through systematic random sampling. For this, on the basis of last year records average number of pregnant women in a month was identified which was 903 pregnant women. Then after sampling interval was calculated to determine the study participants which was 2. Pregnant women who entered first for ANC visit was the first participant of the study and other were recruited in the sampling interval of 2 as mentioned in the figure 3.

3.5.1. Sampling flow chart

Figure 3: Sampling flow chart



3.6. Study period

Data was collected from September to October 2018.

3.7. Measurement tools

Socio-demographic, cultural, economic, agriculture, reproductive, diet and health service utilization information was collected by semi- structured questionnaire. Questionnaire was developed after the widespread literature review and reading concepts and theories related to anemia and pregnancy. For the dietary diversity, standard and already tested and valid questionnaires-modified by FANTA- III project for 24-hour recall tool was used. Individual ANC card and laboratory report of pregnant women was used to record the hemoglobin level. However, height and weight were measured during the time of interview. Similarly, age and trimester of pregnancy was also cross verified from maternal record (ANC card).

Anemia

Anemia in pregnant women was recorded on the basis of the laboratory report done by the AMDA Hospital. Cyan methemoglobin method was used in laboratory of hospital to identify the hemoglobin concentration.

Dietary diversity

The Dietary Diversity Score (DDS) was computed from a single 24 hours dietary recall data by Minimum Dietary Diversity for WRA (MDD-W) tools and indicators developed by FAO, Food and Nutrition Technical Assistance III Project in a dichotomous outcome (60). The individual dietary diversity score was measured by asking the participants to report all the foods and drinks consumed inside or outside the home. All of the reported foods and beverages consumed a day before (within 24 hours) the survey on their own interest was categorized into 10 food items as recommended by (FANTA III, FAO and FHI 360). Not understandable consumed foods were placed in category after asking the raw materials used to prepare the food. Participants who have consumed at least one food from each food group was scored 1 in each group if

not score was 0. The dietary diversity was known if the total score was equal to 5 or more likely, less than 5 score was counted as no dietary diversity (60).

Health service utilization and reproductive factors

Health service utilization and reproductive factors was measured from the list of questions adopted from the previous studies. The questions on health service utilization was focused on service utilization during the time of antenatal care visit in hospital i.e. time of antenatal care visit, iron folic acid supplement intake and de-worming tablet intake. Similarly, under the reproductive health history, gestation age, birth spacing, history of abortion and menstrual bleeding was inquired.

3.8. Validity

3.8.1. Internal validity

Construct validity was ensured by reading enough literatures and guidelines on the topic of anemia and pregnancy or from the similar studies. Conceptual frame work and operational definitions was mentioned well. Consultation was done with experts on methodology and while developing the tools. According to the nature of the variables, questions were classified in the different sections in questionnaire.

Operational definition is clearly explained how the variable was measured. Anemic and non-anemic pregnant women were ensured from the laboratory reports performed by the hospital. Similarly, age, gestation and gravida of pregnant women was validated from ANC report of the pregnant women. A standard tool recommended by FAO was used to measure the dietary diversity and additional questions were developed to measure other variables from the literature review and from the experts' recommendation. At the end of each day's data collection, editing and compilation was done as well as every questionnaire was checked to assure completeness of the data.

To measure the content validity, three experts were asked to evaluate the content of the questionnaire by Item-Objective Congruence (IOC) Index and from them the average score was 0.877. The IOC was determined as: +1 for the agreement between

item and the study variable, 0 was indicated as undecided and -1 for disagreement between item and the study variable.

3.8.2. External validity

Study population was clearly mentioned with inclusion and exclusion criteria. Sample size was calculated by using formula of estimating an infinite population proportion. Sampling technique was clearly mentioned together with sampling flow chart. As well as all these were followed in the study.

3.9. Reliability

Orientation on tools was provided for the assigned data enumerators before the data collection. All data enumerators were registered nurse. Probing on a question was done to bring the reliable response from the participants as per need. Data was collected under the close supervision by the researcher himself. As well as, forward and backward translation was done to assure the accuracy of translated tools. Consistency and accuracy of the collected data was checked by researcher daily. Pretesting was done on 10% of the sample size and Cronbach's Alpha value was 0.708.

3.10. Ethical consideration

The ethical approval was received from the Nepal Health Research Council (NHRC), Ministry of Health and Population (MOHP). The letter introducing the researcher and stating the study objectives and methodology was received from NHRC and that was shared with the Medical Superintendent (MS) of AMDA Hospital. After receiving the formal permission from hospital authority, data collection was immediately started. Written consent was obtained from each respondent before interviewing. The individual autonomy and the dignity of the participants were highly respected. Similarly, the information obtained from the study population was kept very confidential.

3.11. Data Collection

Data was collected through the face to face interview immediately after their antenatal checkup and hemoglobin test from laboratory. Coordination was done with antenatal clinic staffs of AMDA Hospital for identification and sampling of study population as well as their support was asked for the entire period of data collection. Four data enumerator with nursing background were recruited for the data collection and two days' orientation on tools was provided to them by the researcher. Data was collected with continuous monitoring of the researcher. Probing was done as per need to bring the reliable response from the participants. Data editing was done in the field to ensure the completeness and accuracy in recording responses.

3.12. Data Analysis

After completing the data collection, data was entered in EpiData and analyzed in SPSS 22 licensed by Chulalongkorn University. Both descriptive and inferential statistics were used to give a clear picture on anemia and to show association and direction of dependent and independent variables.

For descriptive statistics, categorical data was analyzed by frequency and percentage plus continuous data was reported in mean, range and standard deviation (S.D). Intended for inferential statistics, bivariate analysis was performed to determine the association between the independent variables and dependent variable – anemia (Yes/No) using Chi-square test. However, those how do not meet the assumption for Chi-square test; fisher's exact test was used. Later, the variables with p-value $0<0.20$ were selected to perform multivariate analysis. Before the multivariate binary logistic regression correlation was checked between the statistically significant variables. Multicollinearity was found between family size and types of family so family size was removed from the fitted model. To test the goodness of fit for the regression model Hosmer and Lemeshow Chi square test was used with setting null hypothesis that the model adequately fits the data. The p- value of Hosmer and Lemeshow test was acquired $0.200 > 0.05$. Designed for multivariate analysis, the statistical association was

considered significant if p-value was <0.05 and reported with the adjusted odd ratio (AOR) with 95% of confidence interval (CI).

3.13. Limitations of the study

Study was conducted in one hospital and only with the pregnant women visited for ANC checkup so, it may not be generalizing in the whole population. History questions like 24 hours' dietary recall and questions targeted to explore the situation before pregnancy might not be free from recall bias. Similarly, menstrual blood loss was not quantified. This study did not consider the other factors like complications, diseases in the time of pregnancy, and parasitic infestations so unable to determine their contribution in developing anemia. In addition, other micronutrients like Vitamin A, Vitamin B12, and folic acid were not individually studied. Alcohol and smoking habits of pregnant women were only assed during their pregnancy with a dichotomous indicator (Yes/No). Similarly, number of ANC visit also might be affected by the trimester although more than 70% respondent were from 3rd trimester.

CHAPTER IV: RESULTS

This chapter comprises the findings of the study which are analyzed by using both descriptive and analytical studies.

4.1. Descriptive Analysis

4.1.1. Socio demographic Characteristics

The socio-demographic characteristics of study population are illustrated in table 4. A total of 420 pregnant women between the ages of 18 to 49 were included in the study with 100% response rate. The mean age of pregnant women was 25.39 ± 5.13. The pregnant women in an age group of 20-24 years were found high with 39.5% and ≥ 35 years were few in number with 7.4%. More than half (69.8%) of study population were following Hindu religion. The ethnicity of Brahmin/ Chhetri were high (46.4%) in comparison to other caste. Besides, more than half (56.9%) pregnant women had nuclear family. Nearly 61% of pregnant women were from urban area. Nearly almost (93.3%) of the pregnant women were not taking alcohol in the time of pregnancy as well as 91.9 % were nonsmokers.

Table 4: Socio-demographic characteristics of study population

n=420

Variables	n	%
Age Group		
<20	46	11.0
20 – 24	166	39.5
25 – 29	117	27.9
30 – 34	60	14.3
≥ 35	31	7.4
Mean (±)SD, (Min-Max) age	25.39 (±5.13), (18-39)	

Table 4: Socio-demographic characteristics of study population continue.

Variables	n	%
Religion		
Hindu	293	69.8
Buddhist	26	6.2
Muslim	22	5.2
Kirant	64	15.2
Christian	15	3.6
Ethnicity		
Dalit	30	7.1
Brahmin/Chhetri	195	46.4
Janajati	152	36.2
Terai Caste	43	10.2
Type of family		
Nuclear	239	56.9
Extended	181	43.1
Family size		
≤2	60	14.3
3 - 5	168	40.0
≥5	192	45.7
Residence		
Urban	255	60.7
Rural	165	39.3
Alcohol consumption		
Yes	28	6.7
No	392	93.3
Smoking habit		
Yes	34	8.1
No	386	91.9

4.1.2. Socio-economic Characteristics

The table 5 presents socio-economic characteristics of the respondent. Pregnant women with secondary education were found higher (42.9%) as compared the illiterate pregnant women were only 3.8%. Similarly, education of the husbands of pregnant women found 49.3% having higher education. More than one third (40.2%) pregnant women were working as housemaid and their 38.1% husband/partner were in foreign employment, which was high in comparison to other jobs. Nearly, three forth (74.8%) conveyed that they have sufficient family income for their daily foods and activities.

Table 5: Socio economic characteristics of the study population

n=420

Variables	***n***	**%**
Education of the pregnant women		
Illiterate	16	3.8
Informal education	26	6.2
Primary education	57	13.6
Secondary education	180	42.9
Higher education	141	33.6
Education of respondent's husband		
Illiterate	1	0.2
Informal education	15	3.6
Primary education	41	9.8
Secondary education	156	37.1
Higher education	207	49.3

Table 5: Socio economic characteristics of the study population continued

Variables	***n***	**%**
Occupation of the pregnant women		
Unemployed	3	0.7
Student	11	2.6
Daily laborer	20	4.8
Housemaid	169	40.2
House wife	120	28.6
Civil service	23	5.5
Employed at private sector	26	6.2
Business	47	11.2
Agriculture	1	0.2
Occupation of the respondent's husband		
Daily laborer	56	13.3
Housemaid	7	1.7
Foreign Employment	160	38.1
Civil service	38	9.1
Employed at private sector	35	8.3
Business	115	27.4
Agriculture	9	2.1
Family Income		
Insufficient	9	2.1
Barely sufficient	52	12.4
Sufficient	314	74.8
Enough sufficient	45	10.7

4.1.3. Agricultural Characteristics

Table 6 presents the agricultural characteristics of the pregnant women. Two third (68.1%) pregnant women did not have their own kitchen garden. Out of 134 pregnant women having kitchen garden, more to half (59.7%) have sufficient kitchen garden products for their daily needs of family meals. Similarly, more than half (62.6%) often brought vegetables for consumption. Only 26.9% of respondent were rearing animal/poultry for own consumption.

Table 6: Agricultural characteristics of the study population

n=420

Variables	***n***	**%**
Availability of kitchen garden		
Yes	134	31.9
No	286	68.1
Sufficiency of kitchen garden product *n=134*		
Yes	80	59.7
No	54	40.3
Household brought vegetables for consumption		
Rarely	39	9.3
Sometimes	118	28.1
Often	263	62.6
Animals/Poultry available in home		
Yes	113	26.9
No	307	73.1

4.1.4. Diet related Characteristics

Diet related characteristics of the study population are illustrated on table 7. Dietary practice and diet diversity was also assessed, in which most of the pregnant women (90.5%) were non-vegetarian and 92.6% pregnant women used rice as their staple food. More than half participants (62.1%) were eating Dark Green Leafy Vegetables (DGLV) every day. Only one third (36.4%) of the pregnant women were found having fruits every day. Half of the participants (50.2%) ate meat once a week and 48.2% ate eggs once a week. Majority of the participants (77.4%) were drinking tea/coffee. Over the 24 hours immediate before the interview, diet diversity was found in 75.5% of pregnant women. More than half (52.6%) pregnant women had BMI between (20 - 24.9) kg/m². The mean BMI of the pregnant women was 24.0 (±) 3.4.

Table 7: Diet related characteristics of the study population

n=420

Variables	***n***	**%**
Dietary habits		
Vegetarian	40	9.5
Non vegetarian	380	90.5
Staple Food		
Rice	389	92.6
Wheat	28	6.7
Maize	3	0.7
Frequency of eating DGLV		
Every day	261	62.1
Every other day	117	27.9
Once a week	42	10.0

Table 7: Diet related characteristics of the study population continued

Variables	***n***	**%**
Frequency of eating fruits		
I don't eat	6	1.4
Every day	153	36.4
Every other day	127	30.2
Once a week	130	31.0
Once a month	4	1.0
Frequency of eating meats		
I don't eat	40	9.5
Every day	13	3.1
Every other day	126	30.0
Once a week	211	50.2
Once a month	30	7.1
Frequency of eating eggs		
I don't eat	57	13.6
Every day	35	8.3
Every other day	106	25.2
Once a week	203	48.3
Once a month	19	4.5

Table 7: Diet related characteristics of the study population continued

Variables	***n***	**%**
Tea/coffee consumption		
Yes	325	77.4
No	95	22.6
Dietary diversity		
No dietary diversity	103	24.5
Dietary diversity	317	75.5
Body Mass Index		
<18.5 kg/m²	11	2.6
18.5 - 24.9 kg/m²	262	62.4
>24.9 kg/m²	147	35.0
Mean (±)SD,(Min-Max) BMI	24.0 (±) 3.4, (15.1-38.1)	

4.1.5. Reproductive characteristics

The reproductive characteristics are illustrated below in Table 8. More than half of the participants (56.7%) were gravida 1. Pregnancy interval among the women got pregnant before were 13.7% with pregnancy interval less than two years. Twenty-five percentage of pregnant women had experience of abortion before pregnancy and among 46 participants, 84.8% of participants had abortion less than two times. Majority of the participants (84%) had regular menstruation cycle. More than half (54.8%) of the participant's menstruation lasts on less than in an average of 5 days. Majority of the participants (84.4%) had moderate menstrual blood loss and maximum participants (75.2%) were from third trimester.

Table 8: Reproductive characteristics of study population

n=420

Variables	***n***	**%**
1st Pregnancy		
Yes	238	56.7
No	182	43.3
Gravidity		
1 Gravida	238	56.7
2 Gravida	127	30.2
≥3 Gravida	55	13.1
Pregnancy interval (n= 182)		
< 2 years	25	13.7
≥2 years	157	86.3

Table 8: Reproductive characteristics of study population continued

Variables	***n***	**%**
Experience of abortion (n=182)		
Yes	46	25.3
No	136	74.7
Number of abortion (n=46)		
<2	39	84.8
≥2	7	15.2
Menstruation cycle		
Regular	353	84.0
Irregular	67	16.0
Days of bleeding during menstruation		
<5 days	230	54.8
≥5 days	190	45.2
Flow of menstruation		
Very heavy	4	1.0
Heavy	37	8.8
Moderate	355	84.5
Low	24	5.7
Trimester of pregnancy		
First trimester	2	0.5
Second trimester	102	24.3
Third trimester	316	75.2

4.1.6. Health service utilization characteristics

Health service utilization characteristics of the participants are mentioned in Table 9. Maximum participants (62.9%) had visited health facility ≥4 times for their antenatal checkup. All most of the participants (98.1%) were currently taking iron folic supplementation and among them 85.2% of the participants were taking regularly. Most of the pregnant women (93.3%) took deworming tablets on their current pregnancy and only 18.3% of participants were taking multivitamin in any forms.

Table 9: Health service utilization characteristics of study population

n=420

Variables	*n*	%
ANC visit		
<4 visit	156	37.1
≥4 Visit	264	62.9
Currently taking combined Iron folic tablets		
Yes	412	98.1
No	8	1.9
Combined iron folic tablets consumed as prescribed (n=412)		
Regular	358	85.2
Irregular	54	12.9
Deworming tablets intake		
Yes	392	93.3
No	28	6.7
Multi vitamin intake		
Yes	77	18.3
No	343	81.7

4.1.7. Cultural characteristics

Food Beliefs good to eat during pregnancy

Among 420 participants only 14 participants responded regarding their cultural food beliefs that they are having foods which are good to eat during pregnancy. Among them Almonds, Beans, Dairy products, DGLV, Fish, dried and fermented DGLV or

Carrots (*Gundruk*), Cashew nut, Fenugreek, Peanuts, Pomegranates, pumpkin, Red leafy vegetables, Thyme soup, Walnut were the foods those they believe good to eat during pregnancy.

The reasons for good to eat were;

- Proper growth of fetus
- Increases the blood
- Prevents anemia during pregnancy
- Highly nutritious to pregnant women
- Prevents from cold and flue

Avoided foods by pregnant during pregnancy

During the time of pregnancy out of 420 respondents 17 respondents respond that they are avoiding the foods like; Ash gourd, Papaya, Colocassia Leaf, meat of Pigeon, Fish, Jack fruit, Brinjal and Mushroom.

Reasons for avoiding those foods were;

- Causes infection
- Causes miscarriage
- Harms fetus
- Baby head get big

4.1.8. Prevalence of Anemia

Table 10 discloses the prevalence and severity of anemia among the pregnant women. The total of 420 pregnant women of the study 42.1% were found as anemic during the time of September to October 2018. The mean and standard deviation of hemoglobin concentration was 10.9 ± (2.1). Among 177 anemic pregnant women 45.8% were mild anemic besides 13.6% were severely anemic. The minimum and maximum hg concentration was 3.4 and 16.0 dg/l. Only one pregnant women had 16.0dg/l hemoglobin concentration.

Table 10: Prevalence and severity of anemia among study population

Variables	***n***	**%**
Prevalence of Anemia *n*=420		
Anemic	177	42.1
Non anemic	243	57.9
Mean (±) SD, (Min-Max)Hg concentration	10.9 ± (2.1), (3.4-16.0)	
Severity of Anemia *n*=177		
Severe anemia	24	13.6
Moderate anemia	72	40.7
Mild anemia	81	45.8

4.2. Bivariate Analysis for Anemia among pregnant women

4.2.1. Association of Socio-demographic factors with anemia

After executing Chi square test on studied demographic characteristics with anemia among pregnant women, age (χ^2 = 22.161, p <0.001), religion (χ^2 = 7.208, p 0.007), ethnicity (χ^2 = 20.764, p 0.001), family size (χ^2 = 14.333, p <0.001), type of family (χ^2 = 17.097), p <0.001), residence (χ^2 = 5.381, p 0.020), alcohol consumption (χ^2 = 10.552, p 0.001) and smoking by pregnant women (χ^2 = 5.842, p 0.016) were found significantly associated with anemia. χ^2

Table 11: Association of Socio-demographic factors with anemia among pregnant women

Variables	**Anemia Status**		**Chi-square value**	**p-value**
	Yes ***n*** **(%)**	**No** ***n*** **(%)**		
Age group				
<20	31(67.4)	15(32.6)	22.161	<0.001*
20 - 24	75(45.2)	91(54.8)		
25 - 29	45(38.5)	72(61.5)		
30 - 34	14(23.3)	46(76.7)		
≥ 35	12(38.7)	19(61.3)		
Religion				
Hindu	111(37.9)	182(62.1)	7.208	0.007*
Others (Buddhist, Mushlim, Kirant, Christian)	66(52.0)	61(48.0)		
Ethnicity				
Brahmin/Chhetri	73(37.4)	122(62.6)	20.764	<0.001*
Janajati	61(40.1)	91(59.9)		
Dalit	11(36.7)	19(63.3)		
Terai Caste	32(74.4)	11(25.6)		

* = Statistically significant at p-value <0.2

Table 11: Association of Socio-demographic factors with anemia among pregnant women

Variables	Anemia Status		Chi-square value	p-value
	Yes (%)	No (%)		
Type of family				
Nuclear	80(33.5)	159(66.5)	17.097	<0.001*
Extended	97(53.6)	84(46.4)		
Family size				
<5	77(33.8)	151(66.2)	14.333	<0.001*
≥5	100(52.1)	92(47.9)		
Residence				
Urban	96(37.6)	159(62.4)	5.381	0.020*
Rural	81(49.1)	84(50.9)		
Alcohol consumption				
Yes	20(71.4)	8(28.6)	10.552	0.001*
No	157(40.1)	235(59.9)		
Smoking habit				
Yes	21(61.8)	13(38.2)	5.842	0.016*
No	156(40.4)	230(59.6)		

* = Statistically significant at p-value <0.2

4.2.2. Association of Socio-economic factors with anemia among pregnant women

From the Chi square test, education of pregnant women ($\chi^2 = 43.345$, $p < 0.001$), education of pregnant Husband/life partner ($\chi^2 = 29.986$, $p < 0.001$), occupation of pregnant women and their husband/life partner ($\chi^2 = 19.303$, $p < 0.001$), ($\chi^2 = 3.395$, $p < 0.001$) and family income ($\chi^2 = 39.091$, $p < 0.001$) were found significantly associated with anemia.

Table 12: Association of Socio-economic factors with anemia among pregnant women

Variables	**Anemia Status**		**Chi-square value**	**p-value**
	Yes ***n* (%)**	**No** ***n* (%)**		
Education of pregnant				
Primary and below	70 (70.7)	29 (29.3)	43.345	<0.001*
Secondary & higher	107 (33.3)	214 (66.7)		
Education of husband/life partner				
Primary and below	43 (75.4)	14(24.6)	29.986	<0.001*
Secondary & higher	134(36.9)	229(63.1)		
Occupation of pregnant women				
Not working	67(50.0)	67(50)	19.303	<0.001*
Laborer/peasant farmer	88(46.3)	102(53.7)		
Salaried/ Business	22(22.9)	74(77.1)		
Occupation of husband/life partner				
Laborer/peasant farmer	48(66.7)	24(33.3)	3.395	<0.001*
Salaried/ Business	129(37.1)	219(62.9)		
Family income				
Insufficient/barely sufficient	48(78.7)	13(21.3)	39.091	<0.001*
Sufficient/Enough Sufficient	129(35.9)	230(64.1)		

* = Statistically significant at p-value <0.2

4.2.3. Association of Agricultural factors with anemia among pregnant women

The association between agricultural factors and anemia among pregnant women are illustrated on table 13. Here from the Chi square test among the studied agricultural characteristics; sufficiency of kitchen garden (χ^2 = 10.237, p 0.001) and household brought vegetables for consumption (χ^2 = 19.642, p <0.001) were found significantly associated with anemia during pregnancy. However, availability of kitchen garden (χ^2 = 0.105, p 0.746) and animals/poultry available in home (χ^2 = 0.567, p 0.452) were not associated with anemia during pregnancy.

Table 13: Association of Agricultural factors with anemia among pregnant women

Variables	**Anemia Status**		**Chi-square value**	**p-value**
	Yes	**No**		
	***n* (%)**	***n* (%)**		
Availability of kitchen garden				
Yes	58(43.3)	76(56.7)	0.105	0.746
No	119(41.6)	167(58.4)		
Sufficiency of kitchen garden product (n=134)				
Yes	21(26.3)	59(73.8)	10.237	0.001*
No	156(45.9)	184(54.1)		
Household brought vegetables for consumption				
Rarely	29(74.4)	10(25.6)	19.642	<0.001*
Sometimes	51(43.2)	67(56.8)		
Often	97(36.9)	166(63.1)		
Animals/Poultry available in home				
Yes	51(45.1)	62(54.9)	0.567	0.452
No	126(41.0)	181(59.0)		

* = Statistically significant at p-value <0.2

4.2.4. Association of diet related factors with anemia among pregnant women

The table 14 here presents the association of diet related factors. After the Chi square test, dietary habits (χ^2 = 13.506, p <0.001), staple food (χ^2 = 8.911[a], p 0.006), frequency of eating DGLV (χ^2 = 66.454, p <0.001), frequency of eating fruits (χ^2 = 97.068, p <0.001), frequency of eating meats (χ^2 = 62.277, p <0.001) and frequency of eating eggs (χ^2 = 46.027, p <0.001), were found significantly associated with anemia during pregnancy. Similarly, dietary diversity (χ^2 = 109.664, p <0.001) and BMI (χ^2 = 8.603, p 0.014) were also found associated with pregnancy anemia. Nonetheless, drinking tea/coffee (χ^2 = 0.060, p 0.807) was not found associated with anemia.

Table 14: Association of diet related factors with anemia among pregnant women

Variables	**Anemia Status**		**Chi-square value**	**p-value**
	Yes ***n* (%)**	**No** ***n* (%)**		
Dietary habits				
Vegetarian	31(67.4)	15(32.6)	13.506	<0.001*
Non vegetarian	146(39.0)	228(61.0)		
Staple Food				
Rice	156(40.1)	233(59.9)	8.911[a]	0.006*
Wheat	19(67.9)	9(32.1)		
Maize	2(66.7)	1(33.3)		
Frequency of eating DGLV				
Every day	73(28.0)	188(72.0)	66.454	<0.001*
Every other day	68(58.1)	49(41.9)		
Once a week	36(85.7)	6(14.3)		

* = Statistically significant at p-value <0.2

[a]= Fisher exact test

Table 14: Association of diet related factors with anemia among pregnant women continued

Variables	Anemia Status		Chi-square value	p-value
	Yes (%)	No (%)		
Frequency of eating fruits				
≥2 times a week	71(25.4)	209 (74.6)	97.068	<0.001*
<2 times a week	106(75.7)	34(24.3)		
Frequency of eating meats				
≥2 times a week	21(15.1)	118(84.9)	62.277	<0.001*
<2 times a week	156(55.5)	125(44.5)		
Frequency of eating eggs				
≥2 times a week	27(19.1)	114(80.9)	46.027	<0.001*
<2 times a week	150(53.8)	129(46.2)		
Tea/coffee consumption				
Yes	138(42.5)	187(57.5)	0.060	0.807
No	39(41.5)	56(58.9)		
Dietary diversity				
No dietary diversity	89(86.4)	14(13.6)	109.664	<0.001*
Dietary diversity	88(27.8)	229(72.2)		
Body Mass Index				
<18.5 kg/m²	6(54.5)	5(45.5)	8.603	0.014*
18.5 - 24.9 kg/m²	123(46.9)	139(53.1)		
>24.9 kg/m²	48(32.7)	99(67.3)		

* = Statistically significant at p-value <0.2

4.2.5. Association of reproductive factors with anemia among pregnant

The results showed that, pregnancy interval, (χ^2 = 12.525, p 0.002), regularity of menstruation cycle (χ^2 = 10.080, p 0.001), average days of menstrual bleeding (χ^2 = 30.746, p <0.001) and quantity of perceived menstrual blood loss (χ^2 = 8.467, p 0.015) were significantly associated with anemia during pregnancy. But, gravidity (χ^2 = 0.735, p 0.391), experience of abortion (χ^2 = 3.156, p 0.076), number of abortion (χ^2 = 0.430[a], p 0.686) and trimester (χ^2 = 0.322[a], p 1.000) were not found associated with anemia.

Table 15: Association of reproductive factors with anemia among pregnant

Variables	**Anemia Status**		**Chi-square value**	**p-value**
	Yes ***n*** **(%)**	**No** ***n*** **(%)**		
Gravida				
<2	96(40.3)	142(59.7)	0.735	0.391
>2	25(58.1)	18(41.9)		
Pregnancy Interval				
No pregnant before	96 (40.3)	142(59.7)	12.525	0.002*
<2 Years	19(76.0)	6(24.0)		
≥2 Years	62(39.5)	95(60.5)		
Experience of abortion				
Yes	25(54.3)	21(45.7)	3.156	0.076*
No	152(40.6)	222(59.4)		
Number of abortion (n=46)				
<2	22(56.4)	17(43.6)	0.430[a]	0.686
≥2	3(42.9)	4(57.1)		
Menstruation cycle				
Regular	137(38.8)	216(61.2)	10.080	0.001*
Irregular	40(59.7)	27(40.3)		

* = Statistically significant at p-value <0.2, [a]= Fisher exact test

Table 15: Association of reproductive factors with anemia among pregnant continued

Variables	Anemia Status		Chi-square value	p-value
	Yes (%)	No (%)		
Days of menstruation last				
<5 days	69(30.0)	161(70.0)	30.746	<0.001*
≥5 days	108(56.8)	82(43.2)		
Menstrual blood loss				
Excess	26(63.4)	15(36.6)	8.467	0.015*
Moderate	141(39.7)	214(60.3)		
Low	10(41.7)	14(58.3)		
Trimester				
1st	1(50.0)	1(50.0)	0.322[a]	1.000
2nd	43(42.2)	59(57.8)		
3rd	133(42.1)	183(57.9)		

* = Statistically significant at p-value <0.2

[a]= Fisher exact test

4.2.6. Association of health services utilization factors with anemia among pregnant women

Association of reproductive factors with anemia among pregnant women are explained in the table 16. The results after the Chi- square test showed that ANC visit (χ^2 = 18.899, p <0.001), taking iron folic supplementation (χ^2 = 6.865[a], p 0.011), taking combined iron folic supplementation as prescribed (χ^2 = 77.661, p <0.001), and multivitamin intake during pregnancy (χ^2 = 38.989, p <0.001) were significantly associated with anemia among pregnant women. But, in the same way deworming tablets intake (χ^2 = 0.760, p 0.383) by pregnant during pregnancy was not associated with anemia.

Table 16: Association of health services utilization factors with anemia among pregnant women

Variables	Anemia Status		Chi-square value	p-value
	Yes *n* (%)	No *n* (%)		
ANC visit				
< 4 ANC visit	87(55.8)	69(44.2)	18.899	<0.001*
≥4 ANC visit	90(34.1)	174(65.9)		
Taking combined Iron folic tablets				
Yes	170(41.3)	242(58.7)	6.865[a]	0.011*
No	7(87.5)	1(12.5)		
Iron folic tablets as prescribed (n=412)				
Regular	118(33.0)	240(67.0)	77.661	<0.001*
Irregular	52(96.3)	2(3.7)		

* = Statistically significant at p-value <0.2

[a=] Fisher exact test

Table 16: Association of health services utilization factors with anemia among pregnant women continued

Variables	Anemia Status		Chi-square value	p-value
	Yes *n* (%)	No *n* (%)		
Deworming tablets				
Yes	163(41.6)	229(58.4)	0.760	0.383
No	14(50.0)	14(50.0)		
Multi vitamin				
Yes	8(10.4)	69(89.6)	38.989	<0.001*
No	169(49.3)	174(50.7)		

* = Statistically significant at p-value <0.2

4.2.7. Association of socio-cultural factors with anemia among pregnant women

Association between the socio-cultural factors and anemia among pregnant women are presented in the table 17. The food beliefs good to eat during pregnancy (χ^2 = 0.003, p 0.956) was not fond associated with anemia among pregnant women. But, the avoided foods during pregnancy (χ^2 = 2.022, p 0.155) found associated at p-value <0.2 with anemia among pregnant women attending for antenatal checkup.

Table 17: Association of socio-cultural factors with anemia among pregnant women

Variables	**Anemia Status**		**Chi-square value**	**p-value**
	Yes	**No**		
	***n* (%)**	***n* (%)**		
Food beliefs good to eat during pregnancy				
Yes	6(42.9)	8(57.1)	0.003	0.956
No	171(42.1)	235(57.9)		
Foods avoided during pregnancy				
Yes	10(58.8)	7(41.2)	2.022	0.155*
No	167(41.4)	236(58.6)		

* = Statistically significant at p-value <0.2

4.3. Adjusted relationship of explanatory variables with anemia

The association between anemia among pregnant women and the possible explanatory variables studied here were assessed through multivariate analysis at 95 % confidence interval and considered significant with p-value <0.05. Binary logistic regression using enter was executed to get the final model. Those variables which were associated with anemia during pregnancy in bivariate analysis at p-value <0.2 was considered for the multivariate analysis. The multicollinearity was also checked by the Pearson collinearity test within the variables found associated in bivariate analysis. Family size and type of family was found collinear with value greater than 0.7. So, family size was not selected in multivariate fit model although it was statistically significant in bivariate. Finally, to measure the actual effect size of the explanatory variables adjusted odds ratio was calculated. To test the goodness of fit for the regression model, Hosmer and Lemeshow Chi square test was used and acquired p-value 0.200 > 0.05.

From the output of binary logistic regression age, religion, ethnicity, occupation of pregnant women, sufficiency of kitchen garden product, frequency of vegetables brought for consumption, dietary status, staple food, frequency of eating DGLV, average days of menstruation, intake of iron folic acid tablets as prescribed and multivitamin intake were found significantly associated with anemia among the pregnant women which are described below.

4.3.1. Adjusted relationship of socio-demographic factors with anemia among pregnant women

After adjusting, women age below 20 years was found associated which increase 5.499-fold odds of having anemia (AOR 5.499,95%CI: .172-25.792), and in the age between 30-34 years also increased 0.175 fold- odds of having anemia (AOR .175, CI: 0.042-0.735) compared with the pregnant women in the age group of 35 years old or more. The pregnant women of other religion (Buddhist, Muslim, Kirant, Christian) increased 3.217 fold odds of having anemia as compared to Hindu religion (AOR 3.217, 95% CI: 1.152-8.982). In addition, the pregnant women from Janajati

ethnicity also increased 0.337 fold odds of having anemia as compared to Brahmin/Chhetri (AOR 0.337, 95% CI: 0.134-0.848). However, type of family, residence of pregnant, alcohol and smoking habits during pregnancy were not found significantly associated with the anemia among pregnant women.

Table 18: Adjusted relationship of socio-demographic factors with anemia among pregnant women

Variables	p-value	AOR	95%CI
Age Group			
<20	0.031*	5.499	1.172-25.792
20 - 24	0.571	1.426	0.418-4.868
25 - 29	0.242	0.483	0.142-1.635
30 - 34	0.017*	0.175	0.042-0.735
≥ 35	Ref.		
Religion			
Hindu	Ref.		
Others	0.026*	3.217	1.152-8.982
Ethnicity			
Brahmin/Chhetri	Ref.		
Janajati	0.021*	0.337	0.134-0.848
Dalit	0.289	0.463	0.111-1.925
Terai Caste	0.166	0.293	0.052-1.665
Type of family			
Nuclear	Ref.		
Extended	0.658	1.161	0.599-2.253

*Statistically significant at p-value <0.05

Table 18: Adjusted relationship of socio-demographic factors with anemia among pregnant women continued

Variables	p-value	AOR	95%CI
Residence			
Urban	Ref.		
Rural	0.360	.617	0.220-1.734
Alcohol Intake			
Yes	0.144	3.325	0.663-16-680
No	Ref.		
Smoking			
Yes	0.388	1.702	0.509-5.692
No	Ref.		

*Statistically significant at p-value <0.05

4.3.2. Adjusted relationship of socio-economic factors with anemia among pregnant women

The pregnant women working as laborer or peasant farmer found higher by 3.267 fold odds of getting anemia in comparison to salaried or business women (AOR 3.267, 95% CI: 1.121-9522). However, the other variables like sufficiency of family income, education of pregnant, education and occupation of their husband or life partner were not found associated with anemia in pregnancy.

Table 19: Adjusted relationship of socio-economic factors with anemia among pregnant women

Variables	p-value	AOR	95%CI
Family Income			
Insufficient/barely sufficient	0.782	0.775	0.127-4.721
Sufficient/Enough Sufficient	Ref.		
Education of Pregnant			
Primary and below	0.395	1.668	0.513-5.417
Secondary & higher Education	Ref.		
Husband/Life partner Education			
Primary and below	0.192	0.297	0.048-1.838
Secondary & higher Education	Ref.		
Occupation of Pregnant			
Not working	0.978	1.015	0.349-2.950
Laborer/peasant farmer	0.030*	3.267	1.121-9.522
Salaried/ Business	Ref.		
Husbands/Life partner Occupation			
Laborer/peasant farmer	0.474	0.650	0.200-2.115
Salaried/ Business	Ref.		

*Statistically significant at p-value<0.05

4.3.3. Adjusted relationship between agricultural factors and anemia during pregnancy

After performing the multivariate analysis both sufficiency of kitchen garden products and the frequency of vegetables brought for the consumption was significantly associated with anemia. Insufficient of kitchen garden products had higher by 10.648 fold odds of having anemia (AOR 10.648, 95%CI: 2.702-41.961) compare with the pregnant women having sufficient kitchen garden product. In a same way in comparison to the often bringing the vegetables for consumption, rarely and sometimes had greater 7.042, 7.650 fold odds of getting anemia among pregnant respectively (AOR 7.042, 95%CI: 1.049-47.277, AOR 7.653, 95%CI: 2.308-25.371).

Table 20. Adjusted relationship between agricultural factors and anemia

Variables	p-value	AOR	95%CI
Sufficiency of Kitchen garden products			
Yes	Ref.		
No	0.001*	10.648	2.702-41.961
Household brought vegetables for consumption			
Rarely	0.045*	7.042	1.049-47.277
Sometimes	0.001*	7.653	2.308-25.371
Often	Ref.		

*Statistically significant at p-value<0.05

4.3.4. Adjusted relationship between dietary factors and anemia

Pregnant women with vegetarian diets were found by 6.264 times higher odds of getting anemia in comparison to the non-vegetarian (AOR 6.264, 95%CI: 1.646-23.830). Having wheat as a staple food (AOR 6.511, 95%CI: 1.050-40.393) was found associated with higher odds of being anemic in comparison with rice. Eating DGLV once a week was also found strongly having higher odds of developing anemia (AOR 8.139, 95%CI 1.714-38.660). However, having fruits, eggs and meat less than 2 times a week were not found associated with anemia comparing with the pregnant women eating more or equal to 2 times in a week. Similarly, pregnant women without dietary diversity were found 6.741 times odds of having anemia (AOR 6.741, 95%CI: 2.528-17.975) in comparison with having dietary diversity.

Table 21. Adjusted relationship between dietary factors and anemia

Variables	p-value	AOR	95%CI
Dietary habits			
Vegetarian	0.007*	6.264	1.646-23.830
Non-vegetarian	Ref.		
Staple food			
Rice	Ref.		
Wheat	0.044*	6.511	1.050-40.393
Maize	0.740	0.423	0.003-67.925
Frequency of eating DGLV			
Every day	Ref.		
Every other day	0.229	1.643	0.732-3.686
Once a week	0.008*	8.139	1.714-38.660

*= Statistically significant at p-value<0.05

Table 21. Adjusted relationship between dietary factors and anemia continued

Variables	p-value	AOR	95%CI
frequency of eating Fruits			
≥2 times a week	Ref.		
<2 times a week	0.070	2.043	0.943-4.426
Frequency of eating meets			
≥2 times a week	Ref.		
<2 times a week	0.222	1.787	0.703-4.539
Frequency of eating Eggs			
≥2 times a week	Ref.		
<2 times a week	0.792	1.134	0.446-2.879
Dietary diversity			
No dietary diversity	<0.001*	6.741	2.528-17.975
Dietary diversity	Ref.		
BMI			
<18.5 kg/m²	0.330	0.298	0.026-3.408
18.5 - 24.9 kg/m²	0.496	1.287	0.622-2.662
>24.9 kg/m²	Ref.		

*= Statistically significant at p-value<0.05

4.3.5. Adjusted relationship between reproductive factors and anemia

The average days of menstrual bleeding before the pregnancy was found associated with anemia during pregnancy. In an average, menstrual bleeding ≥5 days had 2.697 times of odds of getting anemic in comparison to <5 days (AOR 2.696, 95%CI: 1.351-5.380). Though pregnancy interval experience of miscarriage, irregularity of menstrual cycle and perceived amount of menstrual bleeding before pregnancy were not found associated with anemia.

Table 22. Adjusted relationship between reproductive factors and anemia

Variables	p-value	AOR	95%CI
Pregnancy Interval			
No pregnant before	0.153	0.525	0.217-1.271
<2 Years	0.372	2.078	0.417-10.348
≥2 Years	Ref.		
Experience of abortion			
Yes	0.999	0.999	0.269-3.710
No	Ref.		
Menstruation Cycle			
Regular	Ref.		
Irregular	0.329	0.598	0.213-1.681
Menstrual bleeding last			
<5 days	Ref.		
≥5 days	0.005*	2.696	1.351-5.380

*= Statistically significant at p-value<0.05

Table 22. Adjusted relationship between reproductive factors and anemia

Variables	p-value	AOR	95%CI
History of menstrual bleeding			
Excess	0.705	0.638	0.062-6.549
Moderate	0.563	1.700	0.282-10.254
Low	Ref.		

*= Statistically significant at p-value<0.05

4.3.6. Adjusted relationship between health service utilization and anemia

Anemia is also known as disease by deficiency of iron. Similarly, the study found that combined iron folic acid tablets taking irregularly rather than the prescribed had strong association with having anemia in pregnant mothers (AOR 24.698, 95%CI: 3.861-157.978). As well as any forms of multivitamin intake was also highly associated with anemia. Pregnant women not having multivitamin were found 7.855 times higher odds of getting anemia (AOR 7.885, 95%CI: 1.963-31.427). But, times of ANC visit and taking combined iron folic acid tables were not found associated with anemia in this study.

Table 23. Adjusted relationship between health service utilization and anemia

Variables	**p-value**	**AOR**	**95%CI**
Times of ANC visit			
< 4 ANC visit	0.120	1.712	0.869-3.374
≥4 ANC visit	Ref.		
Taking combined Iron folic acid tablets			
Yes	Ref.		
No	0.413	0.235	0.007-7.541
Combined iron folic acid intake as prescribed			
Regular	Ref.		
Irregular	0.001*	24.698	3.861-157.978
Multivitamin Intake			
Yes	Ref.		
No	0.004*	7.855	1.963-31.427

*= Statistically significant at p-value<0.05

4.3.7. Adjusted relationship between cultural factors and anemia

Although in this study there was fewer response on having their own cultural beliefs regarding the foods during pregnancy. The study did not found any association with anemia and the cultural beliefs on avoiding the foods during pregnancy.

Table 24. Adjusted relationship between cultural factors and anemia

Variables	p-value	AOR	95%CI
Food avoided			
Yes	0.782	1.460	0.212-10.047
No	Ref.		

*Statistically significant at p-value<0.05

CHAPTER V: DISCUSSION

The pregnancy period is known as a very crucial time for the both mother and fetus or for the future child. All over the world and mostly in developing and least developed countries the maternal death is one of the serious problem. Similarly, Nepal is also facing the same problem of maternal death but succeeding to reduce with various interventions and activities. Anemia in the time of pregnancy is one of the cause of maternal death. From the previous studies various factors are identified which can cause anemia during pregnancy. Although, the factors associated with anemia and the prevalence of anemia during pregnancy were found differing from one context to another. That's why in this study an effort has been made to identify the prevalence of anemia and factors associated with anemia among the pregnant those attended for antenatal care in AMDA Hospital of Eastern Nepal.

Though considerable efforts have been carried out by the government to control anemia among pregnant women, still the findings of this study explore 42.1% of prevalence of anemia among the pregnant visiting AMDA Hospital. The findings is comparable with the prevalence mentioned by World Bank where it is 40 % of prevalence in 2016 (73) and also with the findings of the study conducted in Turkey (74). The prevalence from the NDHS has also a nearly comparable finding. However 46% of prevalence was identified in NDHS national survey 2016 (9). This may be because, the NDHS survey was done two years before and the status of anemia might have been decreased from the awareness and increase of iron supplementation during the time of pregnancy. The majority of pregnant women had secondary and higher education so it might also have played an important role for having good diet and increase for antenatal care. Contrast with this result fewer prevalence was found in the study done in Addis Ababa, Ethiopia (11.6 %) and North Shoa, Ethiopa (2.8%) among the pregnant attending hospital for ANC (75, 76). The prevalence of anemia in different areas was found differing from various studies. Either in some area prevalence of anemia among pregnant was found high and vice versa. This might be due to the dissimilarities of society, their foods related to the culture, education, dietary variations, available health services and utilization. Among 177 anemic pregnant women, 45.8%

were mild anemic, 40.5% found moderate and 13.6% were severely anemic which is comparable with study done in India (77).

Under the socio-demographic factors of pregnant women, age, ethnicity and the religion were found to be statistically significant with anemia during pregnancy. Age of pregnant below 20 years and in the age between 30-34 years had higher odds of having anemia. In which, there was a similar findings with the study done in Ethiopia where age < 20 years was significantly found associated with anemia (76). Similarly, high prevalence of anemia was fond with women age below 20 in NDHS national survey (9). Although, the age between 30-34 years is contrast from those studies. In this study age 30-34 years had risk of developing anemia it might be the number of pregnancy increases as the age increase. Peak age of pregnant women was 39 years though the study population had inclusion age till 49 years. It might be during the study period the age above 39 were not pregnant in that area. The education of pregnant and decreasing fertility rate of Nepal might be the reason behind it. Religion of the pregnant women was also found associated with anemia in this study. In comparison with Hindu religion pregnant women from other religions like Buddhist, Muslim, Kirat, Christian were found 3.217 times higher odds of having anemia. The study conducted in India agreed, religion as associated factors for anemia but in comparison to Muslim, prevalence of anemia was found higher in Hindu pregnant women (78). This might be due to the differences on the culture, food beliefs and access to the health services between the religions.

Moving ahead with the result of adjusted odds ratio Janajati ethnic group were found 3.217 fold odds of developing anemia in comparison to ethnicity Brahmin/chhetri. The similar findings was also found in a cross-sectional study done in Hospital of Nepal (20) and in Tibet where Tibetans pregnant mothers had lower level of hemoglobin than non-Tibetans (38). Although type of family, residence of respondent, alcohol and smoking were statistically significant in bivariate analysis but refuse to show association in multivariate. Agreeing with this result the study conducted on Kathmandu showed no significant association with the residence of pregnant women (19). But opposing result was found from the study of southern Ethiopia and Tibet, where anemia was found higher in women living in rural area (38, 39). This could be

due to the differences of dietary patterns, cultural factors and access of health services which was not mentioned on their study. The result from the study on rural Indian community has similar result on the type of family where it was found not associated with anemia (44). Similarly, on alcohol and smoking consistent result was found in the study among blacks of the United States where alcohol and smoking was not found associated with anemia among pregnant women (79). But in contrast alcohol and smoking helps to reduce the absorption of iron was identified in the study of micronutrients in pregnancy at United states (80). This might be because the quantity of alcohol intake and smoking a cigarette in a day was not assessed in this study and recommend to study on it in the future studies.

Out of the other factors occupation of pregnant was also found associated with anemia. Pregnant women with laborer and peasant farmer found 3.267 fold odds of having anemia in comparison with salaried or business workers. A consistent findings was reported in the study conducted among rural Nepali women (81) and study from China (82). This might be because the laborers and the peasant farmers work in the poor working environment with poorer pay as compared to the business and salaried workers.

Anemia is a preventable disease which can be prevent by eating adequate amount of green vegetables, fruits or iron containing foods and having diversified foods every day. This statement has proven by the findings of this study and other various previous studies. Frequency of foods was assessed based on the intake within the period of month just before the study. Dietary habit of taking vegetarian diet was appeared positively associated with developing of anemia in pregnancy. The results from the cross-sectional study conducted in rural Wardha had the comparable findings which supports vegetarian diets were highly associated with anemia (83). Iron and Zinc are supposed less bioavailable in the vegetarian diets as compared to non-vegetarian diets (63).That's why it might be the reason of having higher chances of anemia who follows the vegetarian diets in comparison to non-vegetarians.

Sufficiency of kitchen garden products and the frequency of bringing vegetables by household for consumption were found significantly associated with anemia in

pregnancy. Pregnant women having insufficient kitchen garden products in their home had higher odds of having anemia. The study in Baitadi, Nepal also showed the comparable findings. (47). Sufficient kitchen gardens increase the accessibility and availability of green vegetables plus increases in intake of several nutrients finally improve in the overall diet of pregnant women. In addition, with rarely and sometimes bringing vegetables was found associated with anemia in comparison to the often bring vegetables by household. In this study women were less employed then the men which is similar to the findings of NDHS (9) which means women has to be dependent to their households. Similarly, from the NDHS only 53 % of reproductive age group women make major household purchases. So because of it women have to be depend upon their household. Along with rarely and sometimes bringing vegetables reduces the availability of vegetables and compelled to have an inadequate vegetables diet. Thus, it might be the reason of developing anemia with the households bringing vegetables rarely and sometimes and also the knowledge of family on nutrition also effects on it.

In addition, dark green leafy vegetables (DGLV) having once in a week in comparison to every day was directly associated with developing anemia among pregnant women. Likewise, the previous studies on different parts of Ethiopia also explored that lower consumption of DGLV increases the risk of having anemia among pregnant (23, 51). The reason to lead anemia might be due to the less intake of DGLV which also reduces to get non-heme iron and vitamin A & C. Correspondingly, in this study multivitamin intake was found independently associated with anemia. Pregnant women not taking multivitamin in any forms had higher 7.855 fold odds of having anemia. The case control study in Hungary also reveals the same that multivitamin supplementation protects from developing anemia (84). In the other hand the previous study had also explored vitamin A & C helps to promote the absorption of non-heme iron (85). As well as vitamin A is also involved in formation of erythrocytes and in the mobilization of stored iron in the body (86). Thus, regular intake of DGLV and multivitamin supplementation might play a crucial role of reducing anemia among pregnancy.

Likewise, in this study combined iron folic acid supplementation during the pregnancy was found significant with anemia in bivariate analysis which was similar

to the study in North-west Ethiopia (40) and Vietnam (50) but, uncommon result shown in multivariate analysis. But, the irregularity of iron folic acid intake during pregnancy was found with higher odds of developing anemia. Systematic review and meta-analysis results and the study from Bangladesh also supports the same findings (87, 88). Along with deficiency of iron is identified as one of the causing factors of anemia (63) in which this study also strongly agrees. During pregnancy iron requirement increased by three times for the expansion of maternal red-cell mass and for the fetal development (89).The study done on western Nepal showed 55.7% of pregnant women follow the compliance rate of iron and folic acid which was fewer in comparison to this study (85.2%) (90). This might be due to the differences on education of pregnant women and access of health services which was found good in this study. Nonetheless, because of the small sample size and with skewed data, adjusted odds ratio was found very high with wide confidence interval (AOR 24.698, 95%CI: 3.861-157.978). So, further study in a large sample is recommended and might help to found the exact association between the variables.

Dietary diversity was found an independently associated with anemia among pregnant women. Those pregnant with low diversity diet were found with higher odds of developing anemia comparing with the high dietary diversity. The result is consistent with the study conducted in Ethiopia (91), Mekelle town (50) and also with the study in nine regional states of Ethiopia (58). The previous study done among women of Terai part of Nepal also explored diets of women have less diversity and inadequacy in nutrition (22). Diet with diversity foods or ingredients provides the number of essential nutrients. Specially, pregnant are more supposed to have adequate and numerous nutrients for their as well as fetus health and development. Contrary to this finding, surprisingly study from Northern Ghana concluded no association between dietary diversity and anemia among pregnant (69). Although, dietary diversity is considered as a key indicator for assessing the access, utilization and quality of diet of an individual or household (62). Pregnant women having wheat as a staple food has significant association of developing an anemia in this study. It is because the total daily intake of energy and nutrition are based on the staple food that the person consumed (89).

BMI was calculated to account the nutritional status of the pregnant which found significantly associated with anemia in bivariate but failed to show association in multivariate analysis. As a result, BMI in between 18.5 - 24.9 kg/m² as having normal BMI was found high among the pregnant women. The similar result was also found in the previous research conducted in Eastern Nepal. Pregnant women with normal BMI was also identified high in Southeast Ethiopia without any association with anemia (92). Contrast with findings of this study, BMI was found as an associated factors with anemia among pregnancy in the previous study conducted in Nepal (93). Similarly, A secondary data study of Ethiopian DHS also supports women with low BMI were highly associated with anemia (58). Although in this study, the BMI before the pregnancy was unknown. As the increase of gestation weeks of pregnant women the weight also gradually increases. According to Institute of Preventive Medicine (IOM) normal weight of pre-pregnancy women having BMI (18.5-24.9) are recommended to gain weight between (11.4 to15.9 kg) during pregnancy (94). So, while studying the BMI in such study the BMI before and after pregnancy might give the meticulous picture of association with anemia in pregnancy.

The multivariate results showed that the duration of menstruation had significant association with anemia. Average days of menstruation having 5 or more days before pregnancy had 2.696 fold odds of developing anemia which is similar to the findings of Ethiopia (91). Though, gravida, pregnancy interval, experience of abortion, irregularity of menstruation cycle before pregnancy and ANC visit were found significant in bivariate analysis but later no association was found in multivariate. Though, in the study of Ethiopia and Turkey gravida, birth spacing and trimester were found associated with anemia during pregnancy (52, 55). Those findings in this study could be because of decreasing fertility rate in the Nepal where the total fertility rate is 2.3 (9) and also due to the access of health services in where 60.7 % pregnant were from urban area in this study.

Cultural factors regarding the food beliefs, both good foods to eat and avoided foods during pregnancy was found within few pregnant women. In the same way, both were not found associated with anemia. Contrast with this result, food beliefs was found associated with anemia in the study conducted in eight developing countries (95),

Ghana (96) and India (97). It might be because the majority of pregnant women and their husbands/partner were educated in this study and were from urban area. Among them 76.4% pregnant women had secondary and higher education. So, education might have reduced on having the food beliefs and taboos with them.

This study may have its own limitations like, history before the time of pregnancy and 24 hours' diet consumption which might be affected by the memory of the women. The menstrual blood loss was not quantified and the BMI before and after pregnancy was not compared. As well as some biases might be have introduced from under reporting. The fact of this study was totally focused with the pregnant women visited AMDA hospital for ANC visit. This study has included the most important variables that contributed to anemia during pregnancy. Thus, it is important to consider these limitations while interpreting the study findings. Prominently for the local body in developing anemia control and reduction strategy, this study came up with the evidence that above factors are existed among the pregnant women visited to AMDA hospital of Eastern Nepal. Therefore, the above findings should be kept on mind while developing the policy and program regarding the reduction and control programs on anemia.

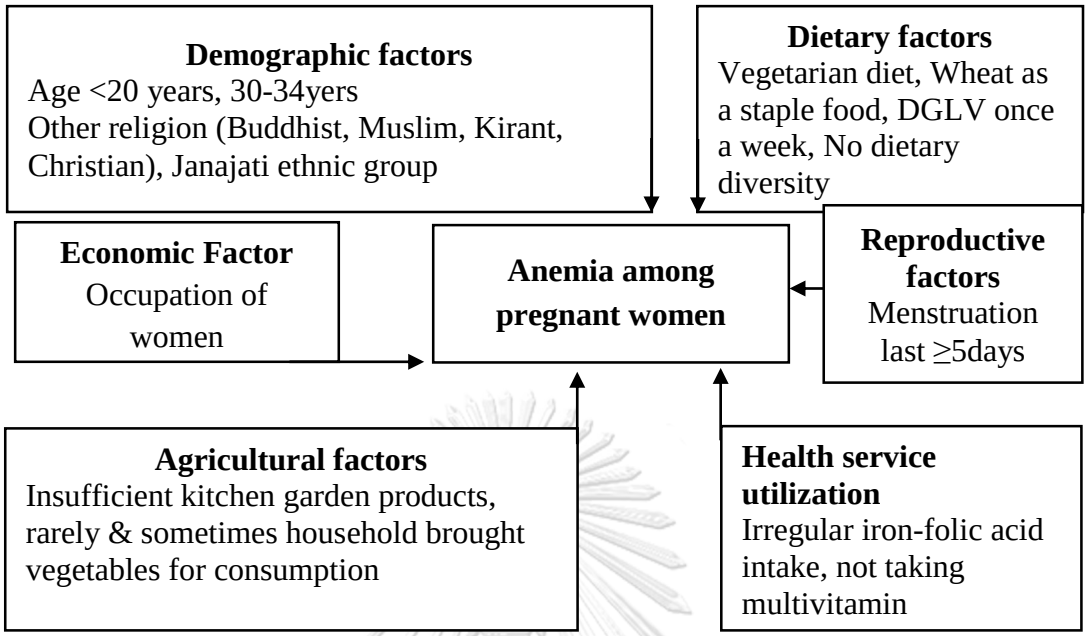
CHAPTER VI: CONCLUSION AND RECOMMENDATIONS

6.1. Conclusions

This study exposed anemia among pregnant women is severe public health problem. To identify the factors associated with anemia various characteristics of pregnant women were studied among them age below 20 years and between 30-34 years, other religions (Buddhist, Christian, Kirant & Muslim), Janajati ethnicity group, and occupation of the pregnant women were found as a factors associated with anemia. Similarly, insufficient kitchen garden products, vegetables bought rarely and sometimes for consumption, vegetarian dietary habit, wheat as a staple food and eating DGLV once a week were also found as the factors that amplifies on developing anemia. Low dietary diversity, prolonged menstruation 5 or more days, irregular iron intake and not taking any forms of multivitamins were associated in developing anemia too. The findings of the study help to the government and the stakeholders to understand the situation of anemia and to develop the anemia control and reduction programs with the basis of it in a particular studied area. Thus, the awareness program towards pregnant women including the information on the above factors seems very necessary for reducing anemia during pregnancy. Similarly, nutritional education and counselling by the health workers to the pregnant women during their ANC checkup needs to be done.

On the basis of the findings of the study, following framework could be drawn as demonstrated on figure 4;

Figure 4. Final working framework



6.2. Recommendations

On regarding the findings and conclusion of this study, the following recommendations were drawn:

Programmatic recommendation

The strategy and the programs for the anemia control should be developed to the focus group like pregnant women and should include the promotion of regular intake of DGLV. As well as education and promotion on diet diversity should also be endorsed.

Similarly, anemia control program should be targeted to the ethnic minority groups like Janajati. Sufficient kitchen garden productions for household and intake of diversified diet should be promoted through the community intervention programs. Proper education and counselling on anemia and nutrition seems mandatory by the health workers during the time of ANC visit.

The local government body and the other stakeholders should develop anemia reduction and control strategy on regarding the above findings of this study.

Research recommendation

Socio-cultural factors were tried to explore on this study in a quantitative study design within a small sample size so adequate information was not able to explore. Therefore, qualitative study is recommended on the future studies to explore more on the socio cultural factors of the pregnant women. The food beliefs and the taboos should be included trying to explore in details. Along with this I would also like to recommend to identify the vegetables available here which helps to prevent anemia during pregnancy in further research studies.

While studying BMI as a nutritional indicator of the pregnant it might be better if BMI of pregnant is studied before and after pregnancy or only studying the gradual weight gain in the gestations weeks.

At the last I would like to recommend for the further community based studies to explore more other factors associated with anemia in eastern part of Nepal.

WORK SCHEDULE

Research Activities	Time Frame (month)									
	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	
Literature review										
Proposal Writing										
Proposal Exam										
Ethical approval										
Respond to the comments from research ethic review										
Pre-test questionnaire										
Contact and train the research assistants for data collection										
Data collection										
Data entry										
Data analysis										
Thesis writing and thesis defense										
Total	9 months									

BUDGET

The budget required for the research is presented below.

S.N	Description	Quantity	Cost/Unit	Total Cost
1	Travel and daily allowance for Data Enumerator	2 persons	15000 BHT	30,000 BHT
2	Orientation for Data Enumerator	1 day	5000 BHT	5000 BHT
3	Ethical Approval in Nepal		3,300 BHT	3,300 BHT
4	Translators	1 person	10,000 BHT	10,000 BHT
5	Printing and photo copy cost	Wholesome		2,000 BHT
6	Pre-testing of questionnaires	3 days	1,000 BHT	3000 BHT
TOTAL				**53,300 BHT**

Appendix I: Consent Form

Informed consent
College of Public Health Sciences
Chulalonkgorn University
Bangkok, Thailand

Consent Form

NAMASTE,

I am Gaurab Acharya, currently studying Masters in Public Health in College of Public Health Sciences; Chulalongkorn University. For the partial fulfillment of the requirement of my course I am conducting a study on "PREVALENCE AND FACTORS ASSOCIATED WITH ANEMIA AMONG PREGNANT WOMEN ON EATERN NEPAL: HOSPITAL BASED CROSS-SECTIONAL STUDY".

Or

Namaste, my name is …… I am assisting Mr. Gaurab Acharya for his study on "PREVALENCE AND FACTORS ASSOCIATED WITH ANEMIA AMONG PREGNANT WOMEN ON EATERN NEPAL: HOSPITAL BASED CROSS-SECTIONAL STUDY" which is a part of his thesis study to complete his Master's degree in Public Health, from College of Public Health Sciences.

During study you will be asked some questions regarding your socio-demographic, obstetric history, dietary practices and utilization of health service after getting pregnant. Along with your laboratory report and ANC card will be observed to record your hemoglobin and to verify your age and gestational age. The information gathered from your answer will later analyze for outcome of the study. It may take approximately 25-30 minutes to accomplish it. The researcher would like to ensure you that, this study will not harm you and you will not be directly benefited as being a participant of this study. Nevertheless, your valuable time and your right answers will help the researcher to achieve the findings for the study and finally you will contribute for achieving the objectives of the study. Later, this study might contribute to the policy makers and program designer in preparing the intervention program to reduce anemia among pregnant women.

I would like to assure you that, your name will not be disclosed in the study and to any other. Your participation will be voluntary and you have full right to withdraw from the study at any time if you feel uncomfortable. All the information given by you will be kept confidential and will be used only for study purpose. I hope you will participate in this study with your authentic responses on the questions.

I read the above and I am ready to participate in this interview.

……..

Signature/Thumb print

Appendix II: Consent Form (Nepali)

सूचित मञ्जुरी
कलेज अफ पब्लिक हेल्थ साइन्सेस्
चुलालंकर्न विश्वविद्यालय
बैंकक, थाइल्याण्ड

मञ्जुरी फाराम

नमस्ते,

मेरो नाम गौरब आचार्य हो । म हाल कलेज अफ पब्लिक हेल्थ साइन्सेस्, चुलालंकर्न विश्वविद्यालय, थाइल्याण्डमा जनस्वास्थ्य विषयको स्नातकोत्तर तहमा अध्ययनरत छु । मैले पाठ्यक्रमको आंशिक परिपूर्तिका लागि "पूर्वी नेपालको आम्दा अस्पतालमा आएका गर्भावती महिलाहरुमा रक्तअल्पताको व्यापकता र कारक तत्वहरु : अस्पतालमा आधारित क्रस सेक्सनल अध्ययन" (PREVALENCE AND FACTORS ASSOCIATED WITH ANEMIA AMONG PREGNANT WOMEN ATTENDING AMDA HOSPITAL OF EATERN NEPAL) शिर्षकमा अनुसन्धान गर्नगइरहेको छु ।

अथवा

नमस्ते, मेरो नाम ..... हो । म हाल कलेज अफ पब्लिक हेल्थ साइन्सेस्, चुलालंकर्न विश्वविद्यालय, थाइल्याण्डमा जनस्वास्थ्य विषयको स्नातकोत्तर तहमा अध्ययनरत श्री गौरब आचार्यलाई उहाँको अनुसन्धानमा तथ्यांक संकलनमा सहयोग गरिरहेको छु। श्री गौरब आचार्यले पाठ्यक्रमको आंशिक परिपूर्तिका लागि "पूर्वी नेपालको आम्दा अस्पतालमा आएका गर्भावती महिलाहरुमा रक्तअल्पताको व्यापकता र कारक तत्वहरु : अस्पतालमा आधारित क्रस सेक्सनल अध्ययन" (PREVALENCE AND FACTORS ASSOCIATED WITH ANEMIA AMONG PREGNANT WOMEN ATTENDING AMDA HOSPITAL OF EATERN NEPAL) शिर्षकमा अनुसन्धान गर्दै हुनुहुन्छ ।

यस अनुसन्धानको तथ्यांक संकलनको क्रममा तपाईलाई तपाईको समाजिक जनसांख्यिक, प्रसुति स्वास्थ्य विगत, पोषण सम्बन्धी अभ्यास, तथा गर्भवती भए पश्चात स्वास्थ्य सेवाको उपभोग सम्बन्धी केही प्रश्नहरु सोधिने छ । यसका साथै तपाईको हिमोग्लोबिन, रक्तचाप टिपोट गर्न, उमेर तथा गर्भको अवधि रुजु गर्न तपाईको प्रयोगशालाको रिपोर्ट र प्रसुती सेवा कार्ड पनि अवलोकन गरिनेछ । यो कार्य पुरा गर्नका लागि २५ – ३० मिनेट लाग्नेछ । यस क्रममा तपाईका उत्तरहरुबाट संकलन गरिएको सूचना अनुसन्धानको निश्कर्ष निकाल्नका लागि विश्लेषण गरिनेछ । यो अनुसन्धानले तपाईलाई कुनै हानि वा कुनै प्रत्यक्ष लाभ पुऱ्याउने छैन । तथापी तपाईको मूल्यवान समय र तपाईका सही उत्तरहरुले यस अनुसन्धानको निश्कर्ष निकाल्न सहयोग गर्नेछन् र अन्तमा तपाईले यस अनुसन्धानको उद्देश्य हासिल गर्न योगदान दिनुहुनेछ। भविष्यमा यो अनुसन्धानले गर्भवती महिलाहरुमा रक्तअल्पता कम गर्नका लागि नीति निर्माता तथा कार्यक्रम तयार गर्ने व्यक्तिलाई समस्या समाधानका कार्यक्रमहरु तय गर्नमा योगदान दिनसक्ने छ ।

तपाईको नाम यो अनुसन्धानमा वा कहीँ कसैसँग खुलाइने छैन भन्ने कुरा तपाईलाई आश्वास्त पार्न चाहन्छु । यस अनुसन्धानमा तपाईको सहभागिता स्वइच्छिक हुनेछ र तपाईलाई अप्ठ्यारो लागेमा कुनैपनि समयमा यो अनुसन्धन छोड्न पाउने अधिकार हुनेछ । तपाईले प्रदान गरेका सबै सूचनाहरु गोप्य राखिनेछन् र यो अनुसन्धनको उद्देश्यका लागि मात्र प्रयोग हुनेछन् । मलाई आशा छ तपाई यस अध्ययनमा सहभागी हुनुहुनेछ र प्रश्नहरुका सही उत्तरहरु दिनुहुनेछ ।

मैले माथि उल्लेखित सूचना पढँ र यस अन्तरवार्तामा सहभागी हुन मञ्जुर छु ।

.....

हस्ताक्षर / औंठा छाप

Appendix III: Questionnaire

This questionnaire contains six parts; Read each part carefully and write down in the dotted part or encircle appropriate number of response according to the question format.

Questionnaire ID. No.
Date of Interview: ……../……../2018

ANC card no.	
Laboratory examination report Id. No.	
Hemoglobin in g/dl:	**…….g/dl**
Blood pressure	**……mm/hg**

No.	**Question**	**Response**	**Code**	**Skip**
Part I:Socio-demographic and economic characteristics				
101	What is your Age (completed year)? (validate with ANC card) ……..years			
102	What is your weight? ……kilogram			
103	What is your height? ……. meter			
104	What is your religion?	1. Hindu	1	
		2. Buddhist	2	
		3. Muslim	3	
		4. Kirant	4	
		5. Christian	5	
		6. Others (Specify) ……	6	
105	Which Ethnicity you belong from	1.Dalit	1	

	(Verify from ANC card)	2. Brahmin/Chhetri	2	
		3. Janajati	3	
		4. Madhesi	4	
106	How many family members are living with you?.....			

107	What is your family type	1. Nuclear	1	
		2. Extended	2	
108	What is the highest education level you have completed	1. Illiterate	1	
		2. Informal education	2	
		3. Primary education (up to 5)	3	
		4. Secondary education(6 to 10/SEE)	4	
		5. Higher education 11-12 and above	5	
109	What is the highest educational level your husband/partner has completed?	1. Illiterate	1	
		2. Informal Education	2	
		3. Primary education(up to 5)	3	
		4. Secondary education(6 to 10/SEE)	4	
		5. Higher education 11-12 and above	5	

110	What is your occupation	1. Unemployed	1	
		2. Student	2	
		3. Daily laborer	3	
		4. Housemaid	4	
		5. Civil Services	5	
		6. Civil Services	6	
		7. Employed at private sector	7	
		8. Business	8	
		9. Other.(specify)……	9	
111	What is the major occupation of your Husband/ Partner?	1. Unemployed	1	
		2. Student	2	
		3. Daily laborer	3	
		4. Housemaid	4	
		5. Foreign Employment	5	
		6. Civil Services	6	
		7. Employed at private sector	7	
		8. Business	8	
		9. Others…… …….. (Specify)	9	
112	Is your family monthly income is sufficient for food and daily activities?	1. Insufficient	1	
		2. Barely sufficient	2	
		3. Sufficient	3	
		4. Enough sufficient	4	
113	Tell me about your place of residence	1. Urban	1	
		2. Rural	2	

114	Do you drink alcohol?	1. Yes	1	
		2. No	2	
115	Do you smoke?	1. Yes	1	
		2. No	2	
Part II : Agriculture related factors				
201	Does your household have your own Kitchen garden?	1. Yes	1	
		2. No	2	Q. N 204
202	What you have grown in your kitchen garden?	…… …….. …… ……..		
203	Is your Kitchen garden product sufficient for your family consumption at the point of time?	1. Yes	1	
		2. No	2	

204	In the past four weeks, how often did your household brought vegetables for consumption?	1. Never	1	
		2. Rarely	2	
		3. Sometimes	3	
		4. Often	4	
205	Does your household have any livestock, herds of other farm animals/poultry for family consumption?	1. yes	1	
		2. No	2	
206	Are you vegetarian non-vegetarian	1. Vegetarian	1	
		2. Non-vegetarian	2	

Part III: Questions on reproductive factors and service utilization				
301	Is this your first pregnancy? (validate from ANC card)	1. Yes	1	Q.N 307
		2. No	2	
302	If no, including current pregnancy how many times have you been pregnant? ……..			
303	How many children do you gave birth? …….			
304	What is the pregnancy interval between the current and last pregnancy? ……..months			
305	Have you ever been experienced with miscarriage?	1. Yes	1	
		2. No	2	Q.N 307
306	If yes how many times?	……Times		
307	Was your menstruation regular before the pregnancy?	1. Regular	1	
		2. Irregular	2	
308	For how many days your menstruation lasts? …… Days			
309	Can you tell me the rate of flow of your menstruation during its period?	1. Very heavy	1	
		2. Heavy	2	
		3. Moderate	3	
		4. Low	4	
310	When was your last menstrual period? (Validate from the ANC card) ……..			
311	When is your expected date of delivery? (Validate from the ANC card) ……			
312	Number of ANC checkup during your current pregnancy? …….. (Validate from the ANC card)			
313	Are you currently taking Iron Tablets?	1. Yes	1	
		2. No	2	Q.N 315

314	If yes are you taking it regularly as prescribed by HW during your ANC follow up?	1. Regular	1	
		2. Irregular	2	
315	During this pregnancy did you take any drug for intestinal worm?	1. Yes	1	
		2. No	2	
316	Are you currently taking any multivitamin tonic?	1. Yes	1	
		2. No	2	
Part IV: Questions on dietary practice				
401	What is your staple food?	1. Rice	1	
		2. Wheat	2	
		3. Maize	3	
		4. Others (specify)……	4	
402	What is the frequency of eating green leafy vegetables?	1. I don't eat	1	
		2. Every day	2	
		3. Every other day	3	
		4. Once a week	4	
		5. Once a month	5	
403	What is the frequency of eating fruits?	1. I don't eat	1	
		2. Every day	2	
		3. Every other day	3	
		4. Once a week	4	
		5. Once a month	5	
404	What is the frequency of eating animal source food?	1. I don't eat	1	
		2. Every day	2	
		3. Every other day	3	

		4. Once a week	4	
		5. Once a month	5	

405	What is the frequency of eating eggs?	1. I don't eat	1	
		2. Every day	2	
		3. Every other day	3	
		4. Once a week	4	
		5. Once a month	5	
406	Did you take tea/coffee?	1. Yes	1	
		2. No	2	
Part V: Questions on Cultural factors				
501	Are there any foods that you used to have knowing good to eat during pregnancy?	1. Yes	1	
		2. No	2	Q.N 504
502	If yes then name the food that you are eating?	…….		
503	Why are these good for pregnancy?	…….		
504	Are there any foods that are avoided for you after pregnancy because of cultural beliefs and norms?	1. Yes	1	
		2. No	2	Part VI
505	If yes name the foods that are avoided for you?	…….		
506	Why the above foods are avoided at the time of pregnancy?	…….		

Part VI: Questions on Dietary Diversity				
Please describe the all foods and beverages that you ate or drank yesterday during day or night (24 hours), whether you ate/drank it at home or anywhere else. Include every foods and drinks that you have taken either at snacks, small meals or main meals. Let's start from the first food or drink that you consumed yesterday.				
Food/Drinks you consumed when you woke	**Food/Drinks you consumed when you woke**	**Food/Drinks during the afternoon**	**Food/Drinks in the evening**	**Food/Drinks before going to bed**

Food groups based on the information recorded above

No	Food groups	Types of food	Yes =1	No =0	Every other day	Every day	Once a week	Once a month
1	Grains, white roots and tubers, and plantains	maize, rice, wheat, sorghum, millet, porridge, bread or there foods made from grains, white potatoes, white yams, white cassava or other foods made from roots						
2	Pulses (beans, peas and lentils)	Mature beans or peas, lentils or bean						
3	Nuts and seeds	Tree nut, groundnut/peanut or certain seeds						
4	Dairy	Milk, cheese, yoghurt or other milk products						
5	Meat, poultry and fish	Chicken, goat, pork, buff, duck, fish						
6.	Eggs	Eggs from poultry or any other bird						
7	Dark green leafy vegetables	Dark green leafy vegetables including wild forms including locally available						

		vitamin A rich leaves such as amaranth, kale, spinach, cassava leaves						
8	Other vitamin A-rich fruits and vegetables	Pumpkin, carrots, squash or sweet potatoes that are yellow or orange inside, ripe mango, ripe papaya, dried peach						
9	Other vegetables	Other vegetables (e.g. tomato, onion) and other locally available vegetables						
10	Other fruits	Other fruits beside vitamin A-rich fruits, including wild fruits and 100 % fruit juice prepared by these fruits						

Appendix III: Questionnaire (Nepali)

प्रश्नावली

यस प्रश्नावलीमा ६ भागहरु छन् । प्रत्येक भाग ध्यान दिएर पढ्नुहोस् र प्रश्नको स्वरुप अनुसार उत्तरहरु खालि भागमा लेख्नुहोस् वा मिल्दो अंकमा गोलो चिन्ह लगाउनुहोस् ।

प्रश्नावली नं.:	
अन्तरवार्ता मिति : ...../...../२०१८	

एएनसी (ANC) कार्ड नं.:	
प्रयोगशाला परिक्षण रिपोर्ट नं. :	
हेमोग्लाबिन g/dl:	..... **g/dl**
रक्तचाप	..... **mm/hg**

सं.	**प्रश्न**	**उत्तर**	**कोड**	**प्रश्नमा जानुहोस्**
भाग १ : सामाजिक जनसाँख्यिक र आर्थिक चरित्र सम्बन्धी प्रश्नहरु				
१०१	तपाईको उमेर कति वर्ष भयो (पुरा भएका वर्ष) ? (ANC कार्डसँग रुजु गर्नुहोस्) ..... वर्ष			
१०२	तपाईको तौल कति छ ? ..... किलोग्राम			
१०३	तपाईको उचाई कति छ ? ..... मिटर			
१०४	तपाई कुन धर्म मान्नुहुन्छ ?	१. हिन्दु	१	
		२. बौद्ध	२	
		३. इस्लाम	३	
		४. किरात	४	
		५. इसाई	५	

		६. अन्य (उल्लेख गर्नुहोस्)	६	
१०५	तपाई कुन जातजातीमा पर्नुहुन्छ ? (ANC कार्डबाट रुजु गर्नुहोस्)	१. दलित	१	
		२. ब्राह्मण/क्षेत्री	२	
		३. जनजाती	३	
		४. मधेसी	४	
१०६	तपाईको परिवारमा कति जना सदस्यहरु छन् ?			
१०७	तपाईको परिवार कुन प्रकारको हो ?	१. एकल	१	
		२. विस्तृत	२	
१०८	तपाईले हासिल गरेको माथिल्लो शैक्षिक योग्यता के हो ?	१. निरक्षर	१	
		२. अनौपचारिक शिक्षा	२	
		३. प्राथमिक शिक्षा (कक्षा ५ सम्म)	३	
		४. माध्यामिक शिक्षा (कक्षा ६ देखि १०/एस्.ई.ई.सम्म)	४	
		५. उच्च शिक्षा (११–१२ र यसभन्दा माथि)	५	
१०९	तपाईको श्रीमान/जोडीले हासिल गरेको माथिल्लो शैक्षिक योग्यता के हो ?	१. निरक्षर	१	
		२. अनौपचारिक शिक्षा	२	
		३. प्राथमिक शिक्षा (कक्षा ५ सम्म)	३	
		४. माध्यामिक शिक्षा (कक्षा ६ देखि १०/एस्.ई.ई. सम्म)	४	
		५. उच्च शिक्षा (११–१२ र यसभन्दा माथि)	५	
		६. थाहा छैन	६	

११०	तपाईको प्रमुख पेशा के हो ?	१. बेरोजगार	१	
		२. विद्यार्थी	२	
		३. दैनिक ज्यालादारी कामदार	३	
		४. घरेलु कामदार	४	
		५. गृहणी	५	
		६. सरकारी कर्मचारी	६	
		७. निजि क्षेत्रमा कर्मचारी	७	
		८. व्यापार	८	
		९. अन्य (उल्लेख गर्नुहोस्)	९	
१११	तपाईको श्रीमान/जोडीको प्रमुख पेशा के हो ?	१. बेरोजगार	१	
		२. विद्यार्थी	२	
		३. दैनिक ज्यालादारी कामदार	३	
		४. घरेलु कामदार	४	
		५. बैदेशिक रोजगारी	५	
		६. सरकारी कर्मचारी	६	
		७. निजि क्षेत्रमा कर्मचारी	७	
		८. व्यापार	८	
		९. अन्य (उल्लेख गर्नुहोस्)	९	
११२	के तपाईको परिवारको मासिक आम्दानी खाना तथा दैनिक क्रियाकलापका लागि पर्याप्त छ ?	१. अपर्याप्त २. मुश्किलले पर्याप्त ३. पर्याप्त ४. प्रशस्त	१ २ ३ ४	
११३	तपाई सहर या गाउँ कहाँ बस्नुहुन्छ, भन्नुहोस् ।	१. सहर	१	
		२. गाउँ	२	
११४	तपाईले रक्सी/मदिरा पिउनुहुन्छ कि हुँदैन ?	१. पिउँछु	१	
		२. पिउँदिन	२	

११५	तपाई धुम्रपान गर्नुहुन्छ की हुँदैन ?	१. गर्छु	१	
		२. गर्दिन	२	
भाग २ : कृषि सम्बन्धी प्रश्नहरु				
२०१	तपाईको आफ्नो करेसा बारी छ की छैन ?	१. छ	१	
		२. छैन	२	२०४
२०२	तपाईले आफ्नो करेसा बारीमा के उमार्नु भएको छ ?	....		
२०३	तपाईको करेसा बारीको उत्पादन तपाईको परिवारको उपभोगकालागि पर्याप्त छ छैन ?	१. छ	१	
		२. छैन	२	
२०४	गएको चार हप्तामा तपाईले परिवारको उपभोगका लागि तरकारी कति पटक किन्नुभयो ?	१. एक पटक पनि किनँन	१	
		२. बिरलै	२	
		३. कहिलेकाँही	३	
		४. प्रायजसो	४	
२०५	तपाईले परिवारको उपभोगको लागि कुनै पशुपंक्षी पाल्नुभएको छ कि छैन ?	१. छ	१	
		२. छैन	२	
२०६	तपाई शाकाहारी वा मांशाहारी के हो ? (प्रश्नकर्ताले शाकाहारी मांशाहारी बारे बुझाउने)	१. शाकाहारी	१	
		२. मांशाहारी	२	

भाग ३ : प्रजनन् तथा सेवा उपभोग सम्बन्धी प्रश्नहरु				
३०१	तपाईको यो पहिलो गर्भ हो की होइन ? (एएनसी कार्डसँग रुजु गर्नुहोस्)	१. हो	१	प्रश्न ३०७
		२. होइन	२	
३०२	यदि होइन भने, यो गर्भ समेत तपाई कति पटक गर्भवती हुनुभयो ?			
३०३	तपाईले कतिजना बच्चाबच्चीको जन्म दिनुभयो ?			
३०४	तपाईको अघिल्लो गर्भ र यो गर्भबिचको अन्तर कति छ ? ..... महिना			
३०५	तपाईको कहिल्यै गर्भ खेर गएको वा तुहिएको छ की छैन ?	१. छ	१	
		२. छैन	२	प्रश्न ३०७
३०६	यदि छ भने कति पटक ?	..... पटक		
३०७	यो गर्भभन्दा पहिले तपाईको महिनावारी नियमित थियो की थिएन ?	१. नियमिति थियो	१	
		२. अनियमित थियो	२	
३०८	तपाईको महिनावारी कति दिनसम्म रहन्थ्यो ? ..... दिन			
३०९	तपाईको महिनावारीको बेला कति रगत बग्दथ्यो ?	१. एकदमै धेरै	१	
		२. धेरै	२	
		३. ठिकै	३	
		४. थोरै	४	
३१०	तपाईको पछिल्लो महिनावारी कहिले भएको थियो ? (प्रसुती सेवा कार्डबाट रुजु गर्नुहोस्)			
३११	तपाईको अनुमानित सुत्केरी हुने मिति कहिले छ ? (प्रसुती सेवा कार्डबाट रुजु गर्नुहोस्)			
३१२	यो गर्भको दौरान तपाईले स्वास्थ्य जाँच (ANC) कति पटक गराउनुभयो ? (प्रसुती सेवा कार्डबाट रुजु गर्नुहोस्)			

३१३	तपाईले आइरन चक्की खाइरहनु भएको छ की छैन ?	१. छ	१	
		२. छैन	२	प्रश्न ३१५
३१४	के तपाईले यस गर्भ जाँचको समयमा स्वास्थ्यकर्मीले भने अनुसार आइरन चक्की खाइरहनुभएको छ की छैन ?	१. नियमित	१	
		२. अनियमित	२	
३१५	यो गर्भको दौरान के तपाईले जुकाको कुनै औषधी खानुभएको छ की छैन ?	१. छ	१	
		२. छैन	२	
३१६	के तपाईले अहिले कुनै बहूभिटामिन औषधी खाइरहनु भएको छ की छैन ? (प्रश्नकर्ताले बहूभिटामिन औषधीबारे प्रष्ट पार्ने)	१. छ	१	
		२. छैन	२	
भाग ४ : पोषण सम्बन्धी प्रश्न				
४०१	तपाईले दैनिक खाने खानाहरु मध्येको प्रमुख खाना के हो ?	१. चामल	१	
		२. गहुँ	२	
		३. मकै	३	
		४. अन्य (कृपया उल्लेख गर्नुहोस्)	४	
४०२	तपाई हरियो सागपात कत्तिको खानुहुन्छ ?	१. खाँदिन	१	
		२. सधै	२	
		३. एक दिन विराएर	३	
		४. हप्तामा एक पटक	४	
		५. महिनामा एक पटक	५	

४०३	तपाई फलफूल कत्तिको खानुहुन्छ ?	१. खाँदिन	१	
		२. सधै	२	
		३. एक दिन विराएर	३	
		४. हप्तामा एक पटक	४	
		५. महिनामा एक पटक	५	
४०४	तपाई माछा मासु कत्तिको खानुहुन्छ ?	१. खाँदिन	१	
		२. सधै	२	
		३. एक दिन विराएर	३	
		४. हप्तामा एक पटक	४	
		५. महिनामा एक पटक	५	
४०५	तपाई अण्डा कत्तिको खानुहुन्छ ?	१. खाँदिन	१	
		२. सधै	२	
		३. एक दिन विराएर	३	
		४. हप्तामा एक पटक	४	
		५. महिनामा एक पटक	५	
४०५	तपाई चिया/कफी खानुहुन्छ ?	१. खान्छु	१	
		२. खाँदिन	२	

भाग ५ : परम्परा सम्बन्धी प्रश्नहरु				
५०१	तपाईहरुको समुदायको चलनचल्ती, परम्परामा गर्भावस्थाको बेला फाइदा गर्छ भनी तपाईले खाने थप अन्य खाने कुराहरु छन् कि छैनन् ?	१. छन्	१	
		२. छैनन्	२	प्रश्न ५०४
५०२	यदि छन् भने तपाईले खाइरहेका त्यस्ता खाने कुराहरु के के हुन् ?	....		
५०३	यी खाने कुराहरु गर्भावस्थाका लागि किन राम्रो मानिन्छ ?	....		
५०४	तपाईहरुको समुदायको चलनचल्ती, परम्पराका कारण तपाईले गर्भावस्थामा नखाएका खाने कुराहरु छन् ?	१. छन्	१	
		२. छैनन्	२	**भाग ६**
५०५	यदि छन् भने माथि भनेका खाने कुराका नाम भन्नुहोस् ?	....		
५०६	माथि भनेका खाने कुराहरु गर्भावस्थामा खानबाट किन बन्चित गरिएको हो ?	....		

भाग ६ : खानामा विविधता सम्बन्धी प्रश्नहरु

तपाईले दिनमा होस् वा रातमा घरमा वा अन्य ठाउँमा खाएका वा पिएका खानाहरु बारे व्याख्या गर्नुहोस् । तपाईले विहानको नास्तामा, साँझ विहानको खानामा वा दिउसोको खाजा खाएका वा पिएका खानाहरु समावेश गर्नुहोस् । तपाईले हिजो खाएको वा पिएको पहिलो खानाबाट सुरु गरौं ।

विहान उठ्ना साथ खाएका वा पिएका खाना	**विहान खाएका वा पिएका खाना**	**दिउसो खाएका वा पिएका खाना**	**बेलुका खाएका वा पिएका खाना**	**सुत्नुभन्दा पहिले खाएका वा पिएका खाना**

माथि बताइए अनुसार खाना समूह

उत्तरदाताले माथि भने अनुसार पछिल्लो २४ घण्टामा खाइएका खाना तथा पेय पदार्थ निम्न खाना समूहमा पर्ने खानाहरु मध्येबाट कम्तिमा एउटा खाना परको छ भने १ र छैन भने २ लेख्नुहोस् ।					**विगत चार हप्तामा तपाईले निम्न खाना समूहमा पर्ने खानाहरु मध्येबाट कम्तिमा एउटा खाना कत्तिको खानुहुन्छ**			
सं.	**खाना समूह**	**खानाको प्रकार**	छ = १	छैन = २	सधै = ३.	एक दिन विराए र = ४	हप्तामा एक पटक = ५	महिनामा एक पटक = ६
१	अन्न, जरा तथा कन्दमुल	मकै, चामल, गहुँ, जुनेलो, कोदो, दलिया, रोटी वा अन्नबाट बनेका अन्य खानाहरु, सखरखण्ड, तरुल, पिडालु, वा जराबाट बनेका अन्य खानाहरु						
२	दाल (सिमि, केराउ, मसुर)	छिप्पेका सिमी, केराउ, मुसुर तथा गेडागुडी						
३	बदाम तथा गेडा	ओखर, बदाम, वा खास गेडागुडी						
४	दुग्धजन्य खाना	दुध, चिज, दहि, वा अन्य दुग्धजन्य पदार्थ						
५	माछा, मासु	कुखुरा, खसी, सुँगुर, राँगा, हाँस, माछा						

६	अण्डा	कुखुरा तथा अन्य चराका अण्डा						
७	हरियो सागपात	जंगली सागपातका साथै स्थानिय रुपमा पाइने अमरनाथ, बन्दागोभी, पालुंगो, पिडालुको पात जस्ता भिटामिन ए धेरै पाइने हरियो सागपात						
८	भिटामिन ए प्रशस्त पाइने अन्य फलफूल तथा तरकारीहरु	भित्र पहेँलो वा सुन्तला रङ भएका फर्सी, गाँजर, स्कुस, सखरखण्ड, पाकेको आँप, पाकेको मेवा, सुकाइएको आडु						
९	अन्य तरकारीहरु	अन्य तरकारीहरु (जस्तै टमाटर, प्याज) र स्थानिय रुपमा उपलब्ध अन्य तरकारीहरु						
१०	अन्य फलफूल हरु	जंगली फलफूल सहित भिटामिन ए पाइने फलफूल बाहेका अन्य फलफूल र यी फलफूलको सतप्रतिसत रस						

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