

**NUTRITIONAL STATUS AND ITS ASSOCIATED  
FACTORS AMONG PREGNANT WOMEN IN  
JANAKPURDHAM SUB-METROPOLITAN**

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FACTORS AMONG PREGNANT WOMEN IN  
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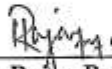
In partial fulfillment of the requirements for the  
Master's Degree of Public Health Nutrition


A thesis submitted to  
Central Department of Public Health  
Institute of Medicine  
Tribhuvan University, Nepal

February, 2023


## APPROVAL SHEET

This is to certify that Mr. Gauree Shankar Mandal has prepared the thesis entitled "Nutritional Status and its Associated Factors among Pregnant Women in Janakpurdham Sub-metropolitan" under our guidance and supervision. This thesis is prepared for the partial fulfillment of the requirement for the Master degree of Public Health Nutrition (MPHN). The thesis has been accepted and recommended for final examination.

  
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Date: 26<sup>th</sup> April 2023

## DECLARATION SHEET

To the best of my knowledge and belief, I declare that this thesis entitled “Nutritional Status and its Associated Factors among Pregnant Women in Janakpurdham Sub-metropolitan” is the research presented in this thesis is solely the product of my own efforts, and any ideas or materials sourced from other individuals have been appropriately acknowledged. Additionally, I have not previously submitted this thesis to any other academic institution as part of any other degree or diploma program.

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# APPROVAL NOTE SUPERVISOR

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I, Mr. Rajan Paudel being the Supervisor of Mr. Gauree Shankar Mandal who is a MPH student in the Central Department of Public Health, certify that I have sighted the documentation supporting the Thesis entitled "Nutritional Status and its Associated Factors among Pregnant Women in Janakpurdham Sub-metropolitan" and I am satisfied that the documentation is sufficient as the basis for examination.

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Date: .....*14th Feb 2023*.....

# APPROVAL LETTER FROM INSTITUTIONAL REVIEW BOARD

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Mr. Gauree Shankar Mandal  
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Department of Public Health  
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Ref: Approval of Research Proposal

Dear Mr. Mandal,

Thank you for the submission of your research proposal, entitled "**Association of diet quality, household food security and women empowerment with nutritional status among pregnant women in Janakpurdham sub-metropolitan**"

I am pleased to inform you that after careful evaluation, the above-mentioned research proposal has been approved by Institutional Review Committee (IRC) of Institute of Medicine (IOM), Tribhuvan University on December 15, 2022.

As per our rules and regulations, the investigator has to strictly follow the protocol stipulated in the proposal. Any change in title, objectives, problem statement, research questions or hypothesis, methodology, implementation procedures, data management and budget may be made so and implemented only after prior approval from IRC. Thus, it is compulsory to submit the details of such changes intended with justifications prior to actual change in the protocol.

Please note that you can start recruiting the research participants only after getting approval letter from the IRC. You are also requested to follow the ethical guidelines of IRC of IOM.

After completion of your study, you must submit a copy of final draft of your research to the Research Department.

If you have any further queries, please do not hesitate to contact us.

Associate Prof. Dr. Manisha Chapagai  
Member Secretary  
Institutional Review Committee

## ACKNOWLEDGEMENT

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Thank you.

Gauree Shankar Mandal

## ABSTRACT

**Introduction:** The nutritional health of pregnant women is a crucial factor that impacts the health outcomes of both the mother and child. A nutrient-rich diet during pregnancy is a must for their nutritional well-being. However, several individuals, family, and community level factors influencing the intake of a nutrient-rich diet are worse in Nepal, particularly in the Madhesh province. This study aimed to test the association of household food security, women empowerment, and other underlying factors with the nutrition status of pregnant women.

**Methods:** This was a community-based cross-sectional study carried out among 435 pregnant women of Janakpur, selected using multistage cluster sampling with probability proportionate to size method. The nutrition status was measured using MUAC tape. Pre-validated standard tools were deployed to measure diet quality, household food security, and women empowerment. The Nepalese Food Composition Table 2017 and the Indian Food Composition Table 2017 were referenced to compute the nutrient value in the recipe consumed. Data were collected using face-to-face interviews. The data were processed and analyzed in IBM SPSS. Logistic regression was carried out to evaluate the association between variables.

**Results:** Around one-third (31.7%) of pregnant were undernourished based on MUAC. Pregnant women's food insecurity in their households and gender-based food-eating preference orders in their families were significant predictors of their undernutrition. Only 12% of pregnant women were able to meet their recommended diet quality, with only 14.0%, 23.9%, and 13.8% meeting iron, calcium and folate intake of the daily recommended amount respectively.

**Conclusion:** The findings indicate that undernutrition is a significant concern among pregnant women. Both food consumption behaviour and household food security could be reasons behind poor diet quality. Hence, targeted nutrition-specific and sensitive intervention programs toward food security and a blanket approach to comprehensive nutrition education are recommended to improve diet quality.

**Keywords:** maternal nutrition, predictors, women empowerment, household food security, diet quality



# TABLE OF CONTENTS

APPROVAL SHEET .....	i
DECLARATION SHEET .....	ii
APPROVAL NOTE SUPERVISOR .....	iii
APPROVAL LETTER FROM INSTITUTIONAL REVIEW BOARD .....	iv
ACKNOWLEDGEMENT .....	v
ABSTRACT .....	vi
LIST OF FIGURES .....	x
LIST OF TABLES .....	xi
LIST OF ABBREVIATIONS .....	xii
CHAPTER I: INTRODUCTION.....	1
1.1 Background .....	1
1.2 Problem statement.....	2
1.3 Rationale and Justification.....	3
1.4 Objectives .....	4
1.4.1 General objective .....	4
1.4.2 Specific objectives .....	4
1.5 Research questions.....	5
1.6 Study variables.....	5
1.6.1 Independent variables .....	5
1.6.2 Dependent variables.....	5
1.7 Conceptual framework on factors associated with the nutritional status of pregnant women.....	6
1.8 Operational definitions.....	7
CHAPTER II: LITERATURE REVIEW .....	11
CHAPTER III: RESEARCH DESIGN AND METHODOLOGY .....	21
3.1 Study method .....	21
3.2 Study design.....	21
3.3 Study area and its justification .....	21
3.4 Study duration.....	22
3.5 Study population/sampling frame .....	22
3.6 Sampling design.....	23

3.7 Sample size .....	23
3.8 Sampling procedure .....	24
3.9 Data collection tools and techniques.....	24
3.10 Criteria for sample selection .....	25
3.11 Data collection procedure .....	25
3.12 Data processing .....	26
3.13 Data analysis .....	26
3.14 Validity and reliability .....	28
3.15 Ethical consideration.....	29
3.16 Limitations of the study .....	30
3.16 Supervision and monitoring .....	30
CHAPTER IV: RESULTS.....	31
4.1 Descriptive findings .....	31
4.1.1 Socio-demographic characteristics .....	31
4.1.3 Household food security .....	34
4.1.4 Women Empowerment .....	35
a. Women empowerment (General characteristics).....	35
b. Women empowerment (Decision-making characteristics).....	35
4.1.5 Knowledge and Behavior.....	36
4.1.5 Diet Quality.....	40
4.1.6 Nutritional status of pregnant women.....	43
4.2. Associated factors .....	43
4.2.1 Bivariate binary logistic regression .....	44
4.2.2 Multivariate binary logistic regression .....	53
CHAPTER V. DISCUSSION .....	58
CHAPTER VI. CONCLUSION .....	65
6.1 Conclusion .....	65
6.2 Recommendations:.....	66
REFERENCES .....	67
ANNEXES .....	76
ANNEX I: INFORMED CONSENT FORM .....	76
ANNEX II: INFORMED CONSENT FORM IN NEPALI.....	77
ANNEX III: INFORMED CONSENT FORM IN MAITHILI .....	78
ANNEX IV: PARTICIPANTS INFORMATION SHEET(ENGLISH).....	79

ANNEX V: PARTICIPANTS INFORMATION SHEET(NEPALI) .....	80
ANNEX VI: PARTICIPANTS INFORMATION SHEET(MAITHILI).....	81
ANNEX VII: ENGLISH QUESTIONNAIRE.....	82
ANNEX VIII: NEPALI QUESTIONNAIRE .....	88
ANNEX IX: MAITHILI QUESTIONNAIRE.....	95
ANNEX X: DQI-P SCORE SHEET.....	95
ANNEX XI: SAMPLING METHOD (PROBABLITY PROPORTIONAL TO SIZE ).....	105
ANNEX XII: ETHNICITY CLASSIFICATION .....	106
ANNEX XIII: RESEARCH PERMISSION LETTER FROM THE STUDY SITE .....	107

## LIST OF FIGURES

Figure 1. Conceptual framework study on factors associated with the nutritional status of pregnant women.....	6
Figure 2. Map of Janakapurdham sub-metropolitan (Source; topographic map, scale 1:25000/1:50000, Survey Department and Census 2011, CBS).....	22
Figure 3. Flow-diagram of sampling procedure .....	24

## LIST OF TABLES

Table 1. Ethnicity, family type and family size, (n=435) .....	31
Table 2. Age, gravida, and number of children, (n=435) .....	32
Table 3. Education level of pregnant women and their husband, (n=435) .....	33
Table 4. Occupation status of pregnant women and their husband (n=435) .....	34
Table 5. Household food security characteristics (n=435) .....	35
Table 6. Women empowerment (General characteristics) (n=435).....	35
Table 7. Women empowerment (Decision making) (n=435) .....	36
Table 8. Behavior related to food taboos (n=435) .....	37
Table 9. Behavior related to social norms (n=435).....	38
Table 10. Behavior related to food choice (n=435) .....	39
Table 11. Practice regarding regular dietary patterns (n=435) .....	40
Table 12. Diet Quality Index-Pregnancy (n=435) .....	40
Table 13. Percentages of recommended vegetables fruits and grains intake.....	41
Table 14. Percentages of recommended iron, folate and calcium intake.....	42
Table 15. Proportion of energy intake moderation and pattern of diet (n=428).....	43
Table 16. Nutritional status of pregnant women (n=435).....	43
Table 17. Association of ethnicity, family type, and family size with undernutrition (n=435)	45
Table 18. Association of Age, gravida, and number of children with undernutrition (n=435)	46
Table 19. Association of education status with undernutrition (n=435).....	47
Table 20. Association of occupation status with undernutrition (n=435).....	48
Table 21. Association of household food security with undernutrition (n=435).....	48
Table 22. Association of Women Empowerment (general characteristics) with undernutrition (n=435).....	49
Table 23. Association of women empowerment index with undernutrition (n=435).....	50
Table 24. Association of behavior related to food taboos with undernutrition (n=435).....	50
Table 25. Association of behavior related to social norms with undernutrition (n=435).....	51
Table 26. Association of behavior related to food choice with undernutrition (n=435).....	52
Table 27. Association of behavior related to food choice with undernutrition (n=435).....	52
Table 28. Multicollinearity statistics.....	54
Table 29. Multivariate binary logistic regression .....	56

## LIST OF ABBREVIATIONS

AOR	Adjusted Odds Ratio
ANC	Antenatal checkup
BPH	Bachelor in Public Health
CBS	Central Bureau of Statistics
CDPH	Central Department of Public Health
CI	Confidence Interval
DHIS-2	District Health Information Software 2
DQI-P	Diet Quality Index- Pregnancy
FCHV	Female Community Health Volunteer
HFIAS	Household Food Insecurity Access Score
IOM	Institute of Medicine
IRC	Institutional Review Committee
LBW	Low Birth Weight
MPHN	Master in Public Health Nutrition
MUAC	Mid-Upper Arm Circumference
NDHS	Nepal Demographic Health Survey
NNMSS	Nepal National Micronutrient Status Survey
PPS	Probability proportionate to size
PSU	Primary Sampling Unit
SDG	Sustainable Development Goals
SPSS	Statistical Package for Social Sciences

# CHAPTER I: INTRODUCTION

## 1.1 Background

For the well-being of both the mother and the unborn child, it is imperative that the mother receives sufficient nutrition throughout her pregnancy. Pregnancy exerts a substantial toll on a woman's nutritional health, thereby rendering pregnant women highly vulnerable to malnutrition. In low-income countries, expectant mothers face an elevated risk of malnourishment due to socioeconomic constraints, poor diet quality, physically demanding work, and frequent pregnancies (1). Malnourishment in mothers is a significant public health issue worldwide, especially in developing nations where undernourishment remains a significant challenge. In Nepal, maternal malnutrition coexists with child malnutrition, resulting in a double and triple burden (2). Research shows that inadequate maternal nutrition during pregnancy significantly raises the likelihood of negative pregnancy outcomes, such as obstructed labor, premature or low-birthweight babies, and postpartum haemorrhage. Furthermore, severe anaemia in expectant mothers is linked to a higher incidence of maternal mortality. Additionally, maternal undernourishment can have an intergenerational impact, perpetuating cycles of undernourishment over the long term (3).

Eating a diet rich in nutrients during pregnancy is linked to improved fetal health, appropriate birth weight, and higher rates of survival for both the mother and infant (4). Poor nutrition during pregnancy results in low birth weight, impaired muscle growth, and poor development of the heart, nephrons, and bones (4–6). The developing fetus determines the available nutritional environment and adapts its growth accordingly, which leads to permanent changes in the body's structure and function (7). In a low maternal diet context, the placenta limits the available nutrition to the fetus. There is increasing evidence that maternal nutrition can induce epigenetic modifications of the fetal genome.

Studies have shown that low-birth-weight babies often experience rapid weight gain after birth with proper nutrition, but they are at higher risk of developing type 2 diabetes, hypertension, and heart disease later in life (4). Thus, consuming a diverse diet in appropriate amounts with proper eating habits is essential to fulfil the nutritional requirements of both the mother and the developing fetus. However, the intake of adequate nutrition during pregnancy is influenced by several factors such as

the availability and accessibility of food, as well as individual and household practices (8, 9). Besides, there are various factors at the individual level to the macro level influencing one's food choice and intake. At the community level, food what one eats is often decided by cultural practices. What a pregnant woman will eat is not always her own choice. It's a complex social phenomenon. Poor eating behaviour is one of the major reasons behind undernutrition among pregnant women (10).

Malnutrition among mothers is largely neglected due to inequitable resource allocation on a gender basis (11). The period from conception to childbirth, commonly referred to as the "golden 1000 days," is a crucial timeframe for the future growth and development of both the mother and child. Despite the undeniable biological relationship between maternal and child health, a significant proportion of the resources dedicated to maternal and child health have been primarily directed towards child health, with minimal emphasis placed on the nutritional requirements of women before and during pregnancy (12).

## **1.2 Problem statement**

Undernutrition is a significant issue for world health. Most South Asian countries including Nepal have major public health issues such as inadequate nutritional supplementation during pregnancy (13). Most of the population, about 795 million undernourished individuals live in low- and middle-income countries. Approximately 3.5 million mothers and children under the age of five lose their lives annually due to malnutrition worldwide (14). Every year, around 112 million individuals suffer from being underweight caused by maternal malnourishment, while approximately 13 million children are estimated to be born with intrauterine growth restriction (IUGR), with a significant proportion of cases occurring in sub-Saharan Africa and south-central Asia (14).

Research has been carried out in different regions of the globe suggests that undernutrition among mothers during pregnancy is a big problem. More than 23% of pregnant women are found to be undernutrition in African regions (15). Family income (16), education status, multiple pregnancies (15), and poor diet intakes are key factors that determine the nutritional status of pregnant women. In 2017, the prevalence of low birth weight and anaemia in women between the ages of 15 and 49 were 21.4% and 54.4% respectively in India (17). Obesity and unhealthful eating



habits and micronutrient deficiency harm health, have been linked to household food insecurity (18, 19). Besides these various social factors are responsible for the nutrition status of pregnant mothers.

In Nepal, 17% of women of reproductive ages (15–49 years) were thin (undernutrition) while the proportion is worse in Madhesh province. Around 29% of women from the reproductive age group were undernourished (19) and 16 % of non-pregnant women of reproductive age (20) were undernourished, which is the highest among all provinces. Further, 58% of women from the reproductive age group were anaemic, and 14 % of newborn babies were a low birth weight in the Madhesh province which is again the highest among all provinces (19).

The minimum dietary diversity of women in Nepal is also poor. A study conducted in a Nepalese municipality revealed that merely 55% of pregnant women consume a varied range of foods (21). According to Suaahara's yearly assessment, which is recognized as a good nutrition initiative, only about 45% of women within the reproductive age bracket satisfy the recommended minimum standard for dietary diversity (22). Considering the contextual factors such as food insecurity, level of education, and socioeconomic indicators in the Madhesh province, the condition is even more dire (23).

### **1.3 Rationale and justification**

Food choice is a complicated factor and is often influenced by social factors rather than just individuals. What pregnant women will eat is often decided by family and society rather than women themselves. Besides, there are several individual, family level and community-level factors that are worse in Nepal, especially in the Terai region deteriorating the nutrition status of pregnant women. The prevalence of stunting, undernutrition among the reproductive age group and low birth weight (LBW) babies in Madhesh province is higher than the national average (19, 20). Some studies have shown that women's empowerment and other social factors are associated with dietary diversity and ultimately nutrition status of pregnant women (21).

The second Sustainable Development Goal has focus on improving maternal nutrition status (24). To combat malnutrition, the Multi-sector Nutrition Plan-II (2018-2022),

National Health Policy 2019, National Nutrition Policy 2004, National Nutrition strategy 2020 and National Nutrition Program, all provide nutrition guidance (25). In Nepal, pregnant women's nutritional condition varies, although the causes of this are not fully understood. There are few studies conducted to measure the nutrition status of pregnant women and its relationship with underlying factors. Hence, there is limited evidence in this domain, particularly in Madhesh province.

This study was carried out at a local level of Madhesh province to cover this gap. Further, just inclusion of diversity is not the solution to undernutrition. Adequate quantity and quality of foods are required to meet the requirement and that will reflect in their nutrition status during pregnancy. Hence, this study measured nutrition status during pregnancy using MUAC, a standard tool used in the nutritional screening of pregnant women. It also measured dietary diversity and the amount of food consumed.

The literature lacks good documentation of diet quality in the context of Terai and its relationship with maternal nutrition. Therefore, the purpose of this study was to gather data on the nutritional status of pregnant women and the factors that affect it also findings from this study will be relevant in designing programs to focus on diet quality through social domains as well as nutrition-specific factors.

## **1.4 Objectives**

### **1.4.1 General objective**

To measure the nutritional status of pregnant women in the Janakpurdham sub-metropolitan and determine the factors associated with it.

### **1.4.2 Specific objectives**

- To measure the nutrition status of pregnant women in the Janakpurdham sub-metropolitan.
- To measure diet quality, household food security, and women empowerment among pregnant women of the Janakpurdham sub-metropolitan.
- To identify the association of diet quality, household food security, women empowerment, socio-demographic factors, and knowledge/behavioural factors with the nutritional status of pregnant women of the Janakpurdham sub-metropolitan.

## **1.5 Research questions**

- What is the nutritional status of pregnant women of the Janakpurdham sub-metropolitan?
- What is the diet quality status among pregnant women in the Janakpurdham sub-metropolitan?
- What is the household food security status among pregnant women in the Janakpurdham sub-metropolitan?
- What is the women empowerment status among pregnant women in the Janakpurdham sub-metropolitan?
- What are the factors associated with the nutrition status of pregnant women in the Janakpurdham sub-metropolitan?

## **1.6 Study variables**

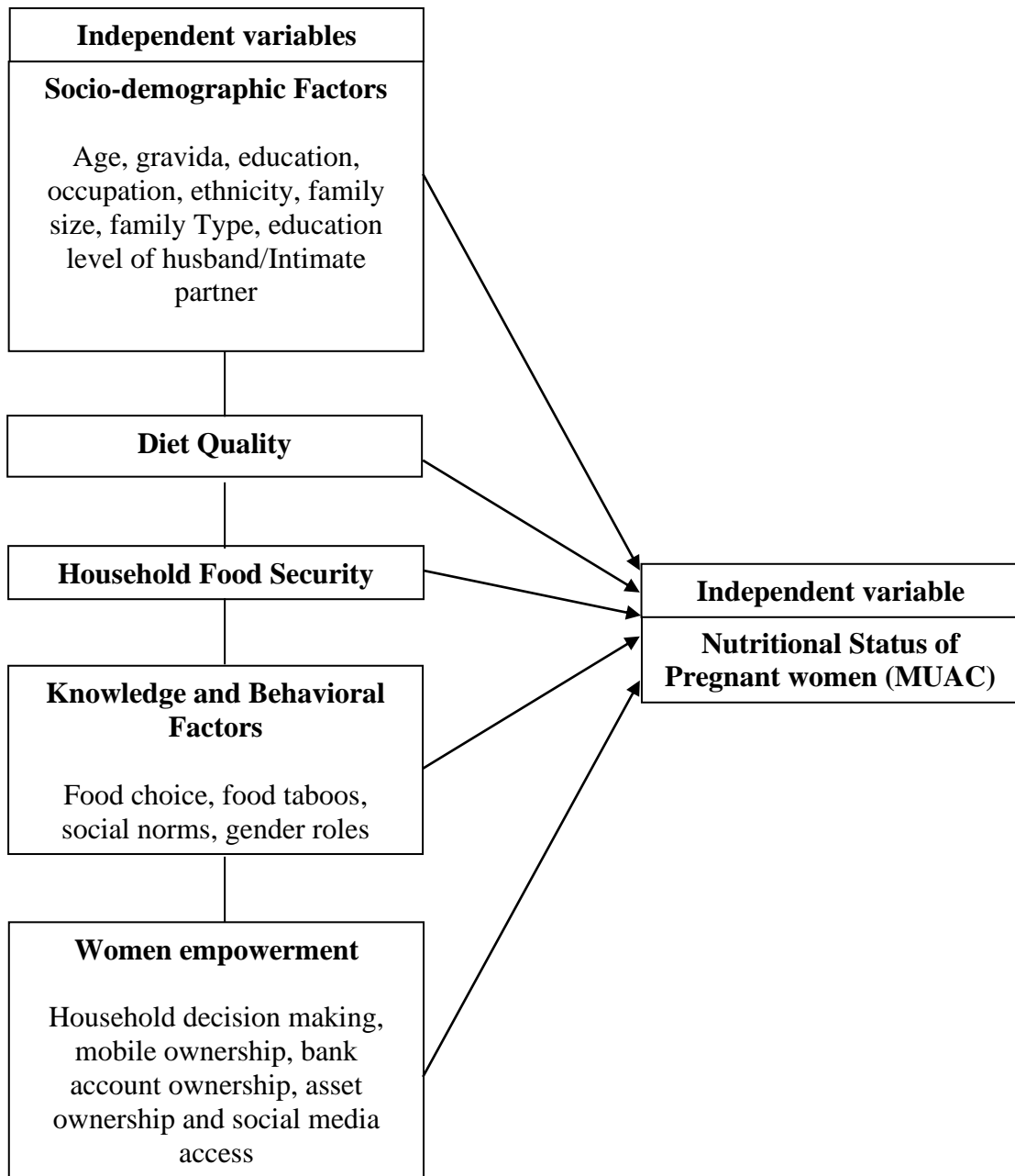
### **1.6.1 Independent variables**

- Socio-demographic factors: Age, gravida, education, occupation, family size, family type, education level of husband/intimate partner, ethnicity.
- Diet Quality
- Household Food Security
- Women empowerment: Household decision-making, mobile ownership, bank account ownership, asset ownership, and social media access.
- Knowledge and Behavioral Factors: Knowledge about food choices and restrictions, familiarity with recommended and supplementary foods, preferences for food serving, and involvement in household chores.

### **1.6.2 Dependent variables**

- Dependent variable: Nutrition status of pregnant women (MUAC) (26)

### 1.7 Conceptual framework on factors associated with the nutritional status of pregnant women



**Figure 1. Conceptual framework study on factors associated with the nutritional status of pregnant women**

## **1.8 Operational definitions**

**Nutrition status of women:** The nutrition status of women in the study was defined by the MUAC measure of the pregnant women (4-9 months). Women with MUAC measure  $\geq 23$  cm were considered as having good nutrition status while below that were considered as having poor nutrition status(26).

**Diet Quality Index- pregnancy:** To evaluate the dietary quality of pregnant women, the Diet Quality Index - Pregnancy (DQI-P) was employed, which produces a composite score ranging from 0 to 80. A score of 80 is regarded as the best, whereas 0 is the poorest. A score of 60 or higher was viewed as a satisfactory standard for the dietary quality of pregnant women(27). The DQI-P consists of eight components, with each component receiving a score of 10 if the minimum recommended serving size for that particular food group is met by the participant. If a participant fails to consume any food from a specific food group, they will receive a score of 0 (zero). Intermediate scores are calculated proportionally; for instance, if a mother consumes only 1 cup of fruit instead of the recommended 2 cups, she will be assigned a score of 5(28).

**Household food insecurity access score (HFIAS):** The Household Food Insecurity Access Score (HFIAS) is a quantitative measure that assesses the extent to which households have been able to access food over the past 12 months. The score ranges from 0 to 27 and is calculated by summing the frequency of occurrence of nine food insecurity-related conditions. The frequency-of-occurrence is obtained by asking respondents to report how often they experienced each condition over the past 12 months using a 4-point scale ranging from "never" to "often"(20,29). The sum frequency-of-occurrence question response code for the HFIAS is calculated by adding up the responses to the nine-food insecurity-related questions, denoted as Q1a, Q2a, Q3a, Q4a, Q5a, Q6a, Q7a, Q8a, and Q9a. This results in a score ranging from 0 to 27, with higher scores indicating greater food insecurity.

The criteria for interpreting the HFIAS score and determining household food insecurity status are as follows: a score of 0-1 indicates food security, 2-7 indicates mild food insecurity, 8-14 indicates moderate food insecurity and 15 or higher indicates severe food insecurity (29).

**HFIA-1 (Food secure category)** = if [(Q1a=0 or Q1a=1) and Q2=0 and Q3=0 and Q4=0 and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0]

**HFIA-2 (Mildly food insecure category)** = if [(Q1a=2 or Q1a=3 or Q2a=1 or Q2a=2 or Q2a=3 or Q3a=1 or Q4a=1) and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0]

**HFIA-3 (Mildly food insecure category)** = if [(Q3a=2 or Q3a=3 or Q4a=2 or Q4a=3 or Q5a=1 or Q5a=2 or Q6a=1 or Q6a=2) and Q7=0 and Q8=0 and Q9=0]

**HFIA-4 (Severely food insecure category)** = if [Q5a=3 or Q6a=3 or Q7a=1 or Q7a=2 or Q7a=3 or Q8a=1 or Q8a=2 or Q8a=3 or Q9a=1 or Q9a=2 or Q9a=3].

**Age:** The age of the pregnant women in years completed as recalled by the mothers. It was categorized into 3 groups: 15-19 years, 20-29 years, and 30-49 years (20).

**Ethnicity:** The study categorized ethnicity into ten groups, namely Terai Dalit, Terai Janajati, Terai Brahmin/Chhetri, Other Terai Caste, Muslim, Hill Dalit, Hill Janajati, Hill Brahmin/Chhetri, Newar, and Other (20,34). These groups were subsequently reclassified into six categories, namely Dalit, Janajati, Brahmin/Chhetri, Muslim, Other Madheshi ethnic group, and others. The Dalit category comprised both Terai Dalit and Hill Dalit, the Janajati category comprised both Terai Janajati and Hill Janajati, and the Brahmin/Chhetri category comprised both Terai Brahmin/Chhetri and Hill Brahmin/Chhetri.

**Gravida:** Pregnant women are often used with a number to indicate the number of pregnancies of any term. It was categorized into 1-2 gravida and more than 2 gravidae.

**The number of children:** This indicator gives the current number of children with the same pregnant women. It was categorized as a mother with children of two or fewer and a mother with 3 or more children.

**Education:** The education of the pregnant woman and her husband was measured on an ordinal scale under the following 4 categories (20);

- No education: Includes those who have never attended school.
- Primary education: Includes those who have completed 0 to 5 years of school.
- Some secondary education: It Includes those who have completed 6 to 9 years of school.

- SLC and above: Includes those who have completed 10 (SLC) or more years of school and university.

**Family type:** Family types were categorized into three types: single-parent family, nuclear family, and extended or joint family.

- **A single-parent family** is one where there is one parent (mother) and any number of children.
- **A nuclear family** is made up of parents and one or more children living together.
- **An extended family or joint family** means a father, mother, daughters, sons, grandparents, uncles, aunts, cousins, nieces, and nephews living together.

**Average family size:** Mean number of family members in a household. Computed as the total of family numbers divided by the total number of families.

**Occupation:** The occupations were classified into seven categories, and then subcategorized into paid and non-paid jobs for analysis.

- Housewife
- Agriculture (unpaid)
- Agriculture (paid)
- Business (self-run)
- Business (family business – only support)
- Jobs and services (public or private)
- Others

**Ownership and use of bank accountant mobile phones:** Respondents who use an account in a bank or other financial institution and own a mobile phone (19).

**Household decision-making:** women were considered to participate in household decisions if they will make decisions alone or jointly with their husbands in all three of the following areas(19);

- Their own healthcare
- Major household purchases and
- Visits to their family or relatives

**Women's empowerment indicator:** Women's participation in making household decisions shows the number of decisions in which women participate either alone or jointly with their husbands. This index ranges from 0 to 3 and reflects the degree of decision-making control that women can exercise in areas that affect their lives and the level of women's empowerment in society(19).

**Social media access:** Social media access was considered if a pregnant woman uses any of the Facebook, TikTok, and YouTube platforms regularly. It will not consider the use of only messaging or calling platforms like Messenger, Imo, and WhatsApp.

**Knowledge and behavioural factors**

- Food taboos: Common food taboos like hot and cold foods, food-restricted during pregnancy
- Social norms: pregnant women should not cross a river; pregnant women should not wander in the community, and preference to serve food.
- Gender roles: who perform domicile activities like cooking foods
- Nutritional supplement intake- It was including Iron and calcium.



## CHAPTER II: LITERATURE REVIEW

For the literature review, the researcher used different search engines and portals like PubMed, Elicit, The Lancet, Google, Google Scholar, etc. to identify the studies regarding malnutrition among pregnant mothers and associated factors. Different keywords like maternal malnutrition, maternal undernutrition, eating behaviour, healthy diet, minimum dietary diversity, women empowerment, diet quality, etc. were used while searching the articles, in different combinations. Different types of articles like journal articles, books, survey reports, WHO factsheets, policies, guidelines, etc. were found. The documents were then collected in one folder in the Zotero application. The articles were then studied in detail and the related information was extracted to prepare this research proposal. The reviewed literature is categorized into the following portion:

### **a) Policies regarding reproductive health and nutrition**

Nepal has a range of policies and strategies to address reproductive health and nutrition issues. Nepal's recent National Health Policy-2019 aims to improve nutritional status through the promotion, production, use, and access to high-quality and healthy food. Updating and implementing nutrition policies and programs should be a priority. In addition, the state is committed to improving the micronutrient status of women, children, and other age groups. Emphasize food diversification and balanced eating habits, and take measures in each of the short-term, medium-term, and long-term stages (31).

Similarly, the 2004 Nutrition Policy and Strategy emphasizes the importance of nutrition education by healthcare providers in improving pregnancy outcomes(32). Another milestone in Nepal's nutrition is the Multi-Sectoral Nutrition Plan (MSNP). The second phase of the MSNP 2018-22 is directly related to maternal nutrition. It aims to improve maternal and infant nutrition by scaling up nutritionally specific and sensitive interventions and creating an enabling environment(33). It also has various directives and programs for the agricultural sector, such as agricultural development strategies (34).

Further, Nepal Health Sector Strategy (NHSS) 2021-2025 is a comprehensive plan that has four strategic pillars: equitable access, quality health services, health systems

reform, and a multi-sectoral approach. The NHSS recognizes that maternal nutrition is essential for the health and well-being of mothers and their children. The strategy commits to improving maternal nutrition through several interventions, including strengthening the capacity of health workers to provide nutrition counselling and services; expanding access to nutritious foods, especially for pregnant and lactating women; promoting breastfeeding and complementary feeding; and addressing the social and economic factors that contribute to poor maternal nutrition(35)

**b) Associated factors with the nutritional status of a pregnant woman**

A study conducted in Ethiopia in 2013, which employed mid-upper arm circumference (MUAC) to measure malnutrition among 900 pregnant and lactating women in the community, found that 24% of the participants were malnourished. The research also discovered that housewives were less prone to malnutrition than pastoralists.

A birth cohort study carried out in Ethiopia in 2019, which was a prospective longitudinal observational study, identified nutrition-specific and nutrition-sensitive variables that were linked to mid-upper arm circumference as a gauge of nutritional status among pregnant women. The research indicated a prevalence rate of 41% for low MUAC, which is a measurement below 23 cm(36). A study conducted in Kenya in 2016 regarding the prevalence of anaemia among pregnant women revealed that those with a mid-upper arm circumference (MUAC) measurement of less than 23 cm were significantly and independently linked to anaemia during pregnancy (37).

A cohort study conducted in 2021 in the northern region of Ethiopia revealed that 36.2% of the participants had undernutrition before pregnancy, as determined by their BMI and/or MUAC measurements. The study also found that being from non-model households, having a lower age, lower female empowerment scores, experiencing food insecurity, having lower dietary diversity, engaging in regular fasting, and having lower agrobiodiversity were significantly linked to having lower BMI and/or MUAC measurements (38).

In 2018, a study was conducted in the western region of Nepal, which discovered that 24% of pregnant women suffered from acute malnutrition. This was determined by measuring their mid-upper arm circumference (MUAC) and finding it to be less than

23 cm. The study further identified that factors such as food security, ethnicity, and dietary diversity significantly influenced the nutritional status of pregnant women (26).

In 2018, a cross-sectional study was conducted in an urban municipality of Baglung district in the western hill region of Nepal involving 327 pregnant women. The study found that almost 45% of the participants had an insufficiently diverse diet. Additionally, the study revealed that household economic status, family employment type, and women's empowerment were significantly associated with dietary diversity (39).

A cross-sectional study was conducted on 376 Nepalese pregnant women from rural and urban areas, assessing their dietary intake. Results revealed a high prevalence of low birth weight (27.9%) and preterm delivery (14%), with a higher rate of low birth weight observed among rural subjects ( $p < 0.05$ ). Birth weight was associated with maternal protein and energy intake, as well as period of gestation ( $p < 0.001$ ), while low pregnancy weight gain was linked to protein and energy intake ( $p < 0.01$ ). Calcium intake was significantly associated with crown heel length ( $p < 0.001$ ), while lipid, zinc, and folate intake differed significantly between rural and urban subjects. The study emphasizes the importance of specific nutrients and dietary components on maternal nutrition and birth outcomes(40).

In 2016, a cross-sectional study was conducted on pregnant women visiting a tertiary-level hospital in Nepal to assess their nutrient intake and dietary patterns. The study found that pregnant women in Nepal were not meeting the recommended nutrient intake, except for fat. The study further revealed significant differences in carbohydrate, energy, and riboflavin intake among trimesters. Cereal intake was the most common, followed by pulses, legumes, and other vegetables. However, no significant differences were observed in the distribution of other nutrients between trimesters (41).

A study conducted in 2010 on 134 pregnant women from low-income countries found that distress had a direct impact on unhealthy eating habits, which in turn had a direct impact on the quality of their diet. Age had a significant direct effect on education and nutritional knowledge, which had an indirect effect on dietary quality. The study

concluded that psychosocial distress and poor eating habits are major contributors to inadequate dietary quality. By assessing depression, stress, poor eating habits, and overall dietary quality during the first trimester of pregnancy, healthcare professionals can identify women who need more intensive dietary monitoring and intervention throughout their pregnancy (27).

An action research project was conducted on 131 pregnant women in Central Tapanuli Regency, which revealed that 18.3% of the households were experiencing food insecurity. The study also found that 58.7% of the pregnant women had anaemia, 19.1% had SEZ, and 63.9% had low levels of iodine in their urine. Additionally, only 42% of the women had an adequate intake of energy nutrients, and 38.9% had sufficient protein intake. The study indicated a significant relationship between food security status and energy intake ( $p=0.000$ ;  $OR=53.9$ ) as well as protein intake ( $p=0.004$ ;  $OR=4.1$ ) (42).

The education status and occupation of pregnant women have a significant impact on their nutrition status. Women with higher levels of education are more likely to have a better understanding of the importance of a balanced diet and nutrition during pregnancy. They are also more likely to have access to information about proper nutrition and prenatal care, which can lead to improved nutrition status during pregnancy.

Women's occupations can also have an impact on their nutrition status during pregnancy. Women with higher-paying jobs and better working conditions are more likely to have access to healthy food choices and can afford to purchase nutritious foods. On the other hand, women in low-paying jobs or with limited job opportunities may have limited access to healthy food choices, leading to poor nutrition status during pregnancy.

In 2014, a cross-sectional survey was conducted on 350 pregnant women in Islamabad, Pakistan. The study revealed that 47% of the pregnant women had a normal pre-gestational BMI, while 22% were overweight, 17% were obese, and only 12% were underweight. Additionally, 28.1% of the pregnant women were found to be anaemic. The study observed that 89% of the pregnant women had medium dietary diversity, while only 5% had low dietary diversity, and the remaining had high dietary

diversity. The study did not find any significant association between dietary diversity and the sociodemographic or socioeconomic status of pregnant women (43).

In 2016, a study conducted in southwestern Bangladesh found that the average diet diversity score was low, measuring 4.28. Pregnant women who had a higher level of education, whose husbands were involved in business, lived in larger households, and resided in houses with more than one room had a significantly higher diet diversity score. The study also revealed a significant knowledge and consumption gap in three food groups: dairy foods, eggs, and dark green leafy vegetables. Women from low socioeconomic backgrounds had lower consumption of dairy and eggs, but no significant association was found between sociodemographic characteristics and the consumption of leafy vegetables (44).

In 2012, a cross-sectional study was conducted in the Kamrup district of Assam, India, involving 285 women from all three trimesters. The study revealed that 48% of the women had a below-normal Body Mass Index (BMI), indicating a high prevalence of undernutrition. The age of the mother and the occupation of the husband had a strong positive correlation with BMI, while the family size and income level showed a negative correlation (45).

A cross-sectional study of 282 pregnant women in their mid-trimester, who were receiving antenatal care at the Western Regional Hospital in Nepal, found that the average score for female dietary diversity was 4.96. The research also revealed that pregnant women who had an education level lower than SLC were 74.7% less likely to have a high dietary diversity score than those with a higher education level. Likewise, pregnant women whose husbands had unpaid jobs were 74.5% less likely to have high dietary diversity than those whose husbands had paid jobs (46).

A study conducted in the urban hill region of Nepal involving 327 pregnant women found that approximately 55% of them consumed at least five out of the ten recommended food groups. The study revealed that pregnant women who had greater autonomy came from wealthier households, lived with extended family, had employment, and had adequate nutritional knowledge were more likely to have a diverse diet(21). A health survey conducted in 2012 on the dietary intake patterns and nutritional status of women of reproductive age in Nepal revealed that over 25% of

women in Terai suffered from malnutrition, as evidenced by a BMI of less than 18.5 kg/m<sup>2</sup>, due to poor dietary habits (47).

A study was conducted in Nepal from September 2011 to August 2012 to assess the dietary intake patterns and nutritional status of women of reproductive age in Nepal. It found that the nutritional status of women of reproductive age was poor, especially in Terai. The dietary intake pattern of women in Nepal is also not adequate. The study suggests improving nutritional status and feeding habits, especially intake of meat, fruits and vegetables, focusing on reproductive-aged women (48).

In 2020, a study was conducted in Nepal to determine the impact of different dimensions of women's empowerment on their access to skilled delivery services. The study found that women who were empowered in terms of media and information technology, and economic and sociocultural factors had better health outcomes. Specifically, the study found that women who had education, occupation, bank account ownership, media exposure, and internet use were more likely to use the services of a qualified midwife (49). While another study found that stillbirth was significantly associated with maternal age (50).

In 2015, a case-control study conducted in eastern Nepal discovered that over 50% of infants with low birth weight were born to mothers with a height of less than 145 cm. Maternal height, the timing of the first antenatal visit, the number of antenatal visits, iron and calcium supplementation during pregnancy, and maternal education level were all found to be significantly related to low birth weight (51). A study conducted on postnatal mothers in a hospital setting found that the prevalence of LBW was 23.6%, with a 95% confidence interval of 21.88 to 25.32%. The study identified several risk factors that were statistically significant, including afternoon rest during pregnancy, dietary intake during pregnancy, and gestation period (52).

In 2011, a study conducted in Nepal showed that household food insecurity was linked to poor nutritional status in both women and children. Children from food-insecure households were more prone to stunted growth and being underweight, while women from such households were more likely to be underweight. The study revealed that households with lower incomes and those living in rural areas were more vulnerable to food insecurity (53).

A study conducted in the Sarlahi district of Nepal on seasonal dietary intakes of 15,899 women of reproductive age in 2006-2008 found that the most commonly consumed foods were rice, potatoes, lentils, and vegetable oil. However, fruits and vegetables were not consumed frequently, with a median weekly intake frequency of 0, and animal products were also rarely consumed. Food intake was analyzed based on socio-economic status (SES) and seasonal changes. It was found that higher SES and higher frequency of consumption were associated with most food types, including in-season fruits and vegetables(54). A cohort study conducted in 2008 investigated risk factors associated with maternal mortality and found that a higher mid-upper arm circumference (MUAC) measurement was associated with a reduced risk of early death(55).

The study conducted in Bhaktapur, Nepal investigated the nutritional intake and status of folate among women of reproductive age taking blood samples from 500 women, and dietary recalls from a subsample of 379 women. The results showed that folate deficiency was uncommon, and only 12% of the women had a folate intake of less than 100 µg per day (56).

A cross-sectional survey was conducted in Ghana's Northern region in 2021, which analyzed the prevalence and risk factors of anaemia in pregnant women. The survey also found that 26% of pregnant women in the region were undernourished(57). In Kenya, a cross-sectional analytical study conducted in 2016 found that the average Dietary Diversity Score (DDS) for pregnant women was 6.84, and 19.3% of pregnant women were malnourished according to their mid-upper arm circumference (MUAC) (58).

A 2010 study on low-income pregnant women found that distress led to poor eating habits, which impacted the quality of their diet. Age influenced education, nutritional knowledge, and indirectly dietary quality. Psychosocial distress and unhealthy eating habits were major contributors to inadequate dietary quality. Screening for depression, stress, poor eating habits, and overall diet during the first trimester can help identify women who need intensive dietary monitoring throughout pregnancy (27).

Household food insecurity and nutrition status of pregnant women are interlinked issues that have significant impacts on maternal and child health. When households

lack sufficient resources to access adequate and nutritious food, pregnant women are at a higher risk of malnutrition, which can lead to adverse outcomes for both the mother and the baby. Pregnant women who experience household food insecurity are more likely to have poor nutrition status and suffer from micronutrient deficiencies such as iron, folate, and zinc. These deficiencies can increase the risk of maternal anaemia, low birth weight, preterm birth, and other complications during pregnancy.

A cross-sectional study conducted in Nepal In 2014 found that in severely food-insecure households, 51% of children were stunted and 40% were underweight; 27% of married women had a BMI below 18.5 kg/m<sup>2</sup>; children were 1.50 (95% CI, 1.15 to 1.97) and 1.40 (95% CI, 1.05 to 1.85) times as likely as children in food-secure households to be stunted and underweight, respectively; and married women were 1.5 (95% CI, 1.17 to 1.92) times as likely as married women in food-secure households to have a BMI below 18.5 kg/m<sup>2</sup>. No association was found between household food insecurity and wasting among children (59).

A cross-sectional study in Kailali district, Nepal in 2009 found that More than two-thirds (69%) of households were classified as food insecure (had insufficient access to adequate food). The prevalence rates of stunting, underweight, and wasting among children were 41%, 24%, and 9%, respectively. The prevalence of anaemia was 58%. There were no significant associations between household food insecurity and stunting, underweight, or anaemia. Stunting and underweight were associated with maternal height and household wealth ( $p < .05$ ). Underweight was also associated with maternal education ( $p < 0.05$ ). Anaemia was associated with low maternal haemoglobin concentration ( $p < 0.05$ ) (60).

In 2020, a cross-sectional study was carried out in an urban municipality in Nepal, which found that 54% of households were food insecure, and over half (53%) of the mothers had a low variety of food in their diets. The study showed that higher odds of dietary monotony were associated with food insecurity (mild, moderate, and severe) with odds ratios ranging from 8.17 to 10.56. Participants with lower dietary diversity were also 8.5 times more likely to experience food insecurity than those with higher dietary diversity. Monthly income was positively related to food insecurity, while unemployment of participants or spouses was associated with higher odds of being food insecure. Additionally, owning cultivable land was negatively associated with



dietary monotony, while participant unemployment status was significantly linked to higher odds of experiencing it, with an odds ratio of 5.92 (61).

Women empowerment and the nutrition status of pregnant women are two closely related topics. Empowering women by providing them with education, resources, and opportunities can positively impact the nutrition status of pregnant women. In many parts of the world, women are not given equal access to education, healthcare, and other basic resources, which can lead to poor nutrition during pregnancy. This can have long-term negative effects on both the mother's and the child's health. Access to healthcare services, including prenatal care, can also ensure that women receive the necessary nutrients and support during pregnancy. In addition, providing women with access to economic resources and opportunities can increase their ability to purchase nutritious food and lead a healthy lifestyle. Improving women's empowerment and nutrition status during pregnancy is crucial for the well-being of both the mother and the child. It is important to promote gender equality and provide women with the necessary resources and support to ensure a healthy pregnancy and future.

In 2017, a cross-sectional study was conducted in Bhaktapur district, Nepal, which included 402 mothers. The study revealed that 18% of the mothers had low empowerment, while 27% had high empowerment. The prevalence of underweight, stunting, and wasting among children was 13%, 19%, and 7%, respectively. The study found a positive association between low empowerment of women and underweight, stunting, and wasting of their children, with odds ratios ranging from 3.031 to 10.056. This indicates that mothers with low empowerment had a higher likelihood of having underweight, stunted, and wasted children (62).

A research study conducted in 2014 in the rural Terai region found that over 60% of women had experienced pregnancy before the age of 19. The study also revealed that the rate of low birth weight babies, weighing less than 2.5 kg, was substantially higher among teenage mothers (80%) compared to mothers who were 19 years or older (63). In 2015, a case-control study conducted in a hospital found that several factors were associated with low birth weight (LBW), including mothers under 20 years old, height below 145cm, being a first-time mother, being illiterate, having less than four antenatal care (ANC) visits, and inadequate consumption of iron supplements (64).

Several studies have found a strong positive relationship (correlation coefficient  $r = 0.81$ ,  $p < 0.0001$ ) between BMI and MUAC in pregnant women. ROC curve analysis and Kappa coefficients have shown that this relationship is a good predictor of the nutritional status of pregnant women (65). The findings indicated a significant association between MUAC (mid-upper arm circumference) and BMI (body mass index) in expectant mothers, which was evident until the 30th week of their pregnancy (66). The study findings revealed a positive correlation between maternal weight and MUAC (mid-upper arm circumference) (67).

## **CHAPTER III: RESEARCH DESIGN AND METHODOLOGY**

### **3.1 Study method**

A quantitative method was used in this study as the primary research approach.

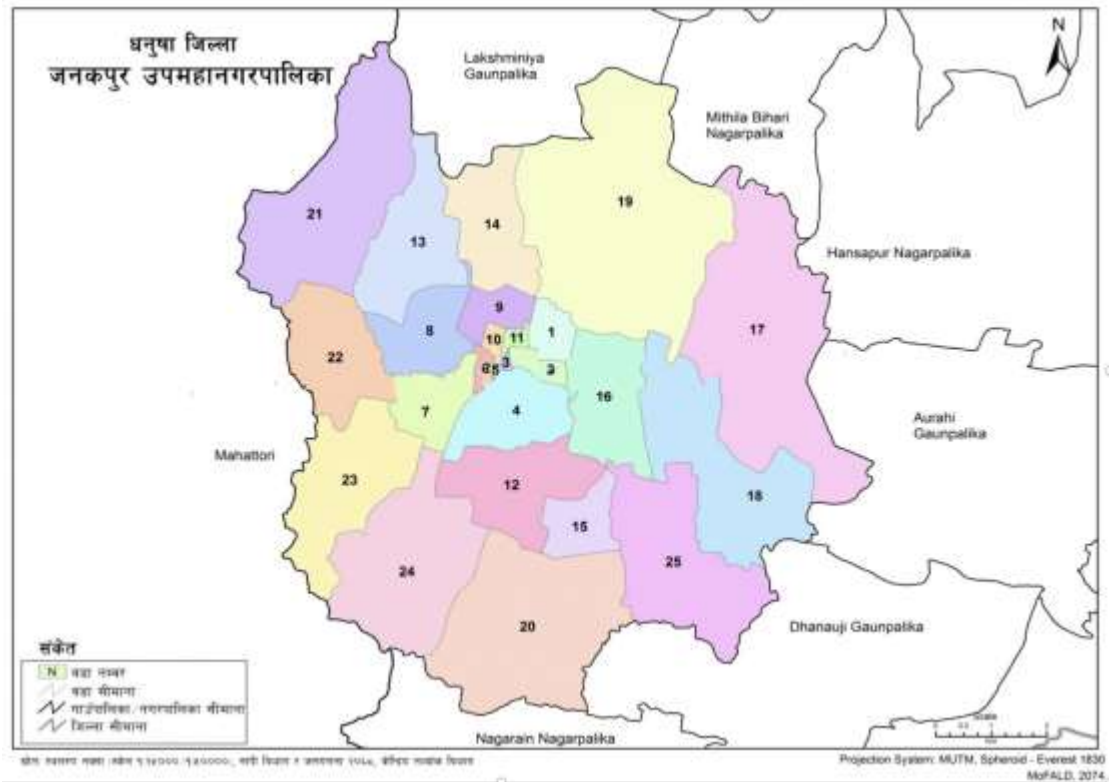
### **3.2 Study design**

The study adopted a quantitative research approach and employed a community-based cross-sectional descriptive design to investigate the research question.

### **3.3 Study area and its justification**

This was a cross-sectional survey based in a community conducted from Sep 2022 to Feb 2023 among pregnant women living in the Janakapurdham sub-metropolitan of Dhanusha district, Madhesh province, Nepal. The Janakapurdham sub-metropolitan comprises 25 wards, with a total of 41,941 households and a population of 195,434 (68) with an estimated 2987 pregnancies (69). The sub-metropolitan area is in Madhesh province, currently serving as its capital and situated at an altitude of 90 meters above sea level, approximately 450 kilometres from the federal capital, Kathmandu. The area is divided into 25 wards, covering a total area of 91.97 square kilometres, with mostly flat terrain. It shares borders with other municipalities to the east and west, Pipara Rural Municipality to the west, Laxminiya Rural Municipality to the north, and Nagarain Municipality to the south (70).

The survey site was purposively selected from the central Terai and the capital city of Madhesh province, where the occurrence of stunting being underweight and lacking essential micronutrients is higher among the reproductive age group compared to the national figure (19, 20). Janakapurdham sub-metropolitan comprises both urban and rural areas, providing a suitable representation of the entire Madhesh province (71).



**Figure 2. Map of Janakapurdham sub-metropolitan (Source; topographic map, scale 1:25000/1:50000, Survey Department and Census 2011, CBS)**

### 3.4 Study duration

The research was carried out for a duration of six months, spanning from September 2022 to February 2023. During this time, data was collected for one month. The timeframe allotted for data collection allowed for the appropriate sample size to be obtained while adhering to the study's time constraints. This study duration was determined with the aim of gathering accurate and relevant information within a feasible time frame while ensuring that the research objectives were met.

### 3.5 Study population/sampling frame

The study was conducted among pregnant women residing in the Janakapurdham sub-metropolitan area. This population served as the sampling frame from which a sample was selected to participate in the study. By targeting this specific population, the study aimed to obtain relevant and informative data pertaining to the health status of pregnant women within the area of interest.

### 3.6 Sampling design

The study utilized a sampling frame comprised of a list of 2nd and 3rd-trimester pregnant women within the Janakapurdham sub-metropolitan area. To select the sample, a multistage cluster sampling method with probability proportional to size (PPS) was employed. This sampling technique allowed for the selection of respondents in a manner that accounted for the varying sizes and importance of the elements within the population. Such a method ensures that the sample represents the population adequately, thus minimizing the potential for sampling errors and increasing the accuracy of the study's findings.

### 3.7 Sample size

The determined size of the sample for the study was 443, based on a confidence interval of 95% ( $Z=1.96$ ), a prevalence of acute undernutrition among pregnant women ( $MUAC < 23\text{cm}$ ) of 0.24 (72), an allowable error of 0.05, a design effect of 1.5, and a non-response rate of 5% and using Cochran's formula (73),

$$\text{Sample size (n)} = \frac{Z^2 p(1-p)}{e^2}$$

$$n = \frac{1.96^2 \times 0.24 (1 - 0.24)}{0.05^2}$$

$$n = 281$$

On applying a design effect of 1.5,

$$n' = 281 \times 1.5 = 422$$

Considering the non-response rate of 5%,

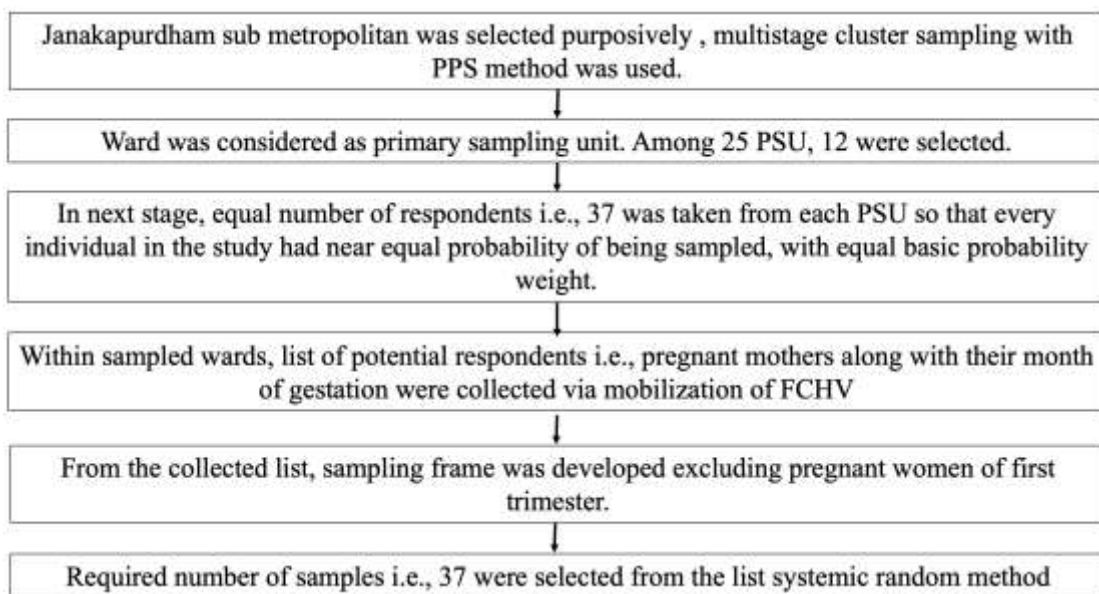
$$n'' = 422 \times 5\% \text{ of } 422$$

$$n'' = 443$$

However, the non-response and unusual diet practice leads to the loss of eight samples. Thus, the actual sample size for analysis was 435.

### 3.8 Sampling procedure

The present study employed a multistage cluster sampling approach using the probability proportionate to size (PPS) method to obtain a representative estimation of the sub-metropolitan area. The primary sampling unit was the ward, and 12 wards were selected from a pool of 25 using the PPS method. To ensure an equal probability of being sampled, an equal number of 37 respondents were chosen from each of the 12 selected wards, with an equal basic probability weight (74). A list of potential respondents comprising pregnant mothers and their month of gestation was collected within the sampled wards through the mobilization of female community health volunteers (FCHVs). Pregnant women in the first trimester were excluded from the sampling frame. Finally, the required number of samples, i.e., 37, was selected randomly from the sampling frame using a random number table. (For details of the PPS method see Annex-IX)



**Figure 3. Flow-diagram of sampling procedure**

### 3.9 Data collection tools and techniques

The primary data was collected from a household survey of pregnant women. A semi-structured questionnaire was administered via face-to-face interview. The questionnaire were incorporate standard tools to assess Household food security, Women empowerment, Diet Quality Index-Pregnancy (DQI-P), and nutrition status (MUAC) related questionnaire along with basic key demographics-related data. Adult Shakir's tape will be used to measure MUAC in the most prominent hand of the study

participants. To evaluate diet diversity and adequacy, a 24-hour recall technique was conducted. A semi-structured 24-hr dietary recall questionnaire was adopted based on Gibson and Ferguson (75). Five phases were considered during the 24-hour dietary recall interview; quick list, time, and occasion forgot foods, detail cycle, and final probe. To measure the consumption of food and drink by pregnant women, respondents were shown food photographic ATLAS, different sizes of fruits, vegetables, and food amount measuring tools such as cups, bowls, plates, and spoons. Household food security was measured by using Household Food Insecurity Access Scale (HFIAS) (76) and women empowerment will be measured by using standard tools adapted from NDHS 2016 (19). To ensure accuracy and consistency in the measurement of MUAC, a standard instrument was used in the data collection process. Specifically, a standard adult Shakier's tape was used to measure MUAC. To minimize measurement error, two measurements were taken for each variable and only the average was recorded. This approach is commonly used in research studies to improve the reliability of anthropometric measurements.

### **3.10 Criteria for sample selection**

The study utilized specific inclusion and exclusion criteria to select the participants. The inclusion criteria involved selecting pregnant women in their last two trimesters who had resided in the area for at least the last six months. In households with multiple pregnant women, the junior member was selected for the study.

On the other hand, the exclusion criteria for study participants included pregnant women (daughters) who were visiting their parents' homes. Furthermore, pregnant women who were observing special occasions such as fasting or festivals, which may impact their food consumption, were excluded from the analysis.

### **3.11 Data collection procedure**

The research team recruited two female medical graduates as enumerators and formed two groups to collect data on pregnant women. The lead researcher and two trained enumerators conducted interviews and anthropometric measurements with each participant. An information sheet was provided to each participant, which outlined the study objectives, interview techniques, and anthropometric measurement procedures. Every participant was asked for written consent before data collection, using a

questionnaire and anthropometric devices. This approach adheres to best practices for data collection in the medical field, ensuring both ethical and high-quality research.

### **3.12 Data processing**

Data was reviewed and corrected before digitalizing into the computer every day. Microsoft Excel 2016 was used for data entry. IBM SPSS (version 25) was used for analysis purposes. Additional recoding and transformation of data were done to fit the appropriate statistical method. Most of the socio-demographic and anthropometric data were categorized to ensure their comparability and unanimity to the WHO standard classification and other demographic standards.

### **3.13 Data analysis**

The collected data was carefully checked, compiled, and edited to guarantee accuracy and completeness before entering the data for analysis into Microsoft Excel 2016 and later exported to SPSS v25 for further processing. Data cleaning, recoding, and analysis were carried out in SPSS. Frequency estimates and cross-tabulations of each independent variable and outcome variable were included in exploratory data analysis. Continuous variables were presented as mean and standard deviation, whilst categorical variables were shown as percentage and frequency. In bivariate analysis, the significance of the relationship of independent variables with outcome variables was assessed using logistic regression. An unadjusted and adjusted bivariate regression test was carried out to test the potential association of the dependent variable with independent variables.

To ensure the validity of the multivariate logistic regression analysis, significant variables resulting from the bivariate regression were examined for potential multicollinearity and model fit. The assessment of multicollinearity was conducted by examining the variance inflation factor (VIF) for each variable, and it was ensured that the VIF was less than 10 for all significant variables. Furthermore, the tolerance level was greater than 0.1 for every variable, indicating no issue of multicollinearity. The Hosmer and Lemshow's test was also conducted to assess model fit, and the significance of the test was considered. These measures were implemented to ensure that the assumptions required for the multivariate analysis were met and that the results of the analysis could be interpreted with confidence.



The dependent variable, mid-upper arm circumference (MUAC), was dichotomized into "adequate" (MUAC  $\geq 23$ ) and "inadequate" (MUAC  $< 23$ ). The research evaluated the dietary quality of the subjects by utilizing 24-hour dietary recall and the Diet Quality Index for Pregnancy (DQI-P), which is a scoring system created to gauge overall dietary quality using existing standard nutrition recommendations and national dietary guidelines during pregnancy(77). The DQI-P score is composed of eight dietary elements, as presented in Annex VIII. The initial three elements involve the percentage of recommended servings of grains, fruits, and vegetables based on the Indian Dietary Guidelines as Nepal's guideline is not available (78). In the computation of nutritional values, the Nepalese Food Composition Table 2017 and Indian Food Composition Table 2017 were utilized (79, 80).

The serving size of cooked rice was found to vary based on cultural traditions, regional variations, and specific recipes, but a common serving size in the Indian context was approximately 1 cup or 200 ml in weight. Serving sizes for other food items such as cooked vegetables (curry), raw vegetables (salads), cooked cereals, raw cereals, cooked pulses, raw pulses, fruits (such as oranges, apples, pomegranates, and guavas), and grapes were measured as follows: 100 grams (or 1/2 cup) for cooked vegetables (curry), 50 grams for raw vegetables (salads), 200 grams (or 1 cup) for cooked cereals, 50 grams for raw cereals, 100 millilitres (or 1/2 cup) for cooked pulses, 20 grams for raw pulses, 100 grams for medium-sized fruits, and 30 pieces for grapes (78).

Three dietary components were identified as particularly important for pregnancy: iron, calcium, and folate. The Recommended Dietary Allowances (RDAs) of these nutrients were considered while assessing the quality of the diet. The Recommended Dietary Allowances (RDAs) of Iron, calcium and folate were taken as 27mg, 1100mg and 600 $\mu$ g respectively(80,81). Additionally, the percentage of energy from fat in the diet and the frequency and type of meals and snacks consumed per day were assessed (77).

Meals and snacks were differentiated based on their time of consumption, portion size, and frequency. Meals were typically consumed during main meal times, such as breakfast, lunch, and dinner, and were more structured, consisting of a variety of food groups (82,83).

Snacks, on the other hand, were smaller and intended to provide a quick burst of energy or satisfy a craving. They were often consumed in between meals or as a small meal replacement. Portion sizes and frequency of consumption were also taken into consideration while distinguishing between meals and snacks (84).

In addition, differentiating between meals and snacks that contain the same type of food, if a person had consumed a large portion of food during a main meal, it was considered part of a meal rather than a snack, even if the same food is consumed in a smaller portion at a different time of day. Similarly, if the food was consumed in small portions throughout the day, it is justified to consider it a snack, even if it is typically consumed as part of a larger meal.

The energy requirement for women with moderate work was found to be 2230 kcal/day (80). This was adjusted by adding energy requirements during the second and third trimesters, which were 340 kcal/d and 452 kcal/d, respectively(85). The Recommended Dietary Allowances (RDAs) of Vitamin C were taken as 60 mg per day (80). All dietary components were analyzed subjectively by participants in the eating habits survey tool and objectively using food analysis software.

In summary, the study utilized various methods to assess the quality of diet among participants, including the use of a scoring tool, dietary recommendations, and analysis of meals and snacks. The results were based on both subjective and objective measures and highlighted the importance of consuming adequate nutrients during pregnancy.

### **3.14 Validity and reliability**

To ensure the reliability and validity of the study tools, a rigorous process was followed. Content validity was achieved by developing tools that aligned with the study objectives and variables, with the consultation of experts and extensive literature review before pretesting. This process ensured that the tools accurately measured the intended constructs. Translational validity was established by conducting forward and backward translations of the questionnaire into Maithili versions language experts, ensuring that the questions were accurately translated and captured the intended meaning. Face validity was maintained by conducting pretesting with a small group of respondents (n=6) from Janakapurdham sub-

metropolitan ward no. 25, within the study site, to assess the clarity of questions and ensure they aligned with study objectives.

Reliability was ensured through the use of pretested and validated sub-questionnaires from previous surveys, such as the Nepal Demographic and Health Survey (NDHS) and the National Nutrition and Micronutrient Status Survey (NNMSS), which have been shown to have good internal consistency and reliability. Additionally, a 24-hour dietary recall was applied to collect data related to food consumption, which is a well-established method for assessing nutrient intake and has been shown to have good test-retest reliability (75). By employing these rigorous measures to ensure validity and reliability, the study results can be confidently interpreted and used to inform policy and interventions aimed at improving maternal nutrition in Nepal.

To minimize the risk of contamination of information, individual interviews were conducted with the participants separately. A written information sheet was provided to them beforehand, outlining the study's objective, process, and interview and anthropometric measurement instructions. Data collection and analysis were carried out by the researcher directly.

In this study, the 24-hour dietary recall interview was conducted using a validated multiple-pass method that involved five distinct stages. These stages included a quick list of all foods consumed, a review of the time and occasion of consumption, identification of any forgotten foods, a detailed cycle to obtain more information about the foods consumed, and a final probe to ensure all foods were accurately reported (86). To ensure accuracy, two MUAC measurements were taken for each respondent, and the average was recorded. The study was conducted as per plan, with a focus on maintaining the validity and reliability of the study instruments.

### **3.15 Ethical consideration**

The study underwent ethical review and approval by the Institutional Review Committee (IRC) of the Institute of Medicine (IOM), Tribhuvan University, in compliance with ethical guidelines. All participants who were 18 years or older provided written consent after being fully informed. For participants who were under 18, written consent was obtained from their legal guardians, namely in preferential order- their husbands, fathers-in-law, or mothers-in-law. Prior to data collection, these

guardians and participants were provided with a written information sheet that detailed the study's purpose, procedures, and instructions. This process ensured that all participants and their guardians were fully informed and consented to the study.

The subjects were informed that they had the option to refuse to participate in the interview or skip any questions if they were uncomfortable. The confidentiality of participants was maintained by coding on questionnaire sheets and limiting access to personal information to those other than the principal investigator. The study avoided raising questions that might provoke racial, gender, or ethnic discrimination, and participants were assured that their participation was voluntary. Finally, participants received counselling on the benefits of a high-quality diet for both mother and fetus after data collection.

### **3.16 Limitations of the study**

Due to the cross-sectional design of the study, it is limited in its ability to determine causal relationships or temporal associations between variables. The use of self-reported data introduces the possibility of recall bias or social desirability bias. The study's focus on a specific geographic area may limit generalizability to other regions or countries with different cultural, economic, or social contexts. The measurement of diet quality based on a single 24-hour dietary recall may not fully capture variability in dietary patterns and nutrient intake over time. The study did not assess other potential factors that may influence undernutrition among pregnant women, such as access to healthcare services or environmental factors. There may also be limitations regarding the consideration of cooking and food processing methods and the variability of individual cooking methods, potentially affecting nutrient value. Finally, the study may have only focused on certain nutrients and considered the synergistic effects of different nutrients present in the food.

### **3.16 Supervision and monitoring**

The research was supervised by faculties from the Central Department of Public Health (CDPH), IOM.

## CHAPTER IV: RESULTS

A total of 435 pregnant women of the Janakapurdham sub-metropolitan of Madhesh province were studied to measure nutritional status and identify the association of diet quality, household food security, women empowerment, and other factors with it. The following results are identified from the study.

### 4.1 Descriptive findings

#### 4.1.1 Socio-demographic characteristics

##### a. Ethnicity, Family type, and family size

The study population primarily comprised pregnant women from the Other Madheshi ethnic group (52.6%), with smaller proportions of Dalit (20.2%), Muslim (15.9%), Brahmin/Chhetri (5.7%), and Janajati (5.5%) ethnic groups. Additionally, a substantial proportion of the pregnant women (66.7%) were residing in extended or joint families, while the remaining were living in nuclear or single-parent families. The mean family size was found to be 6.79, with a standard deviation of 3.04. Most of the families (over three-fourths) consisted of more than four members.

**Table 1. Ethnicity, family type and family size, (n=435)**

Characteristics	Frequencies	Percentages
<b>Ethnicity</b>		
Dalit	88	20.2
Janajati	24	5.5
Brahmin/Chhetri	25	5.7
Muslim	69	15.9
Other Terai Caste	229	52.6
<b>Family Type</b>		
Nuclear family	125	28.7
Single parent family	16	3.7
Joint or extended family	294	67.6
<b>Family size (Mean±SD=6.79± 3.04, min=2, Max=25)</b>		
At most four-family members	103	23.7
More than four family members	332	76.3

### **b. Age, gravida, and number of children**

The table summarizes the characteristics of the pregnant women in the study. The mean age of the participants was 23 years with a standard deviation of 3.78 years. Most of the pregnant women fell between the age range of 20-29 years (80.7%), followed by those in the age range of 15-19 years (11.5%) and 30-49 years (7.8%). The average number of gravidae was found to be 2, with a standard deviation of 1.05. A considerable proportion of the pregnant women reported having more than two gravidae (29.4%). Additionally, the average number of alive children was found to be 1. Most of the women reported having at most two children (92.2%), while only a small proportion reported having more than two children (7.8%). These findings suggest that the study population consisted primarily of younger women. The proportion of pregnant women with more than two gravidae was higher compared to those with more than two children.

**Table 2. Age, gravida, and number of children, (n=435)**

<b>Characteristics</b>	<b>Frequencies</b>	<b>Percentages</b>
<b>Pregnant women's age:</b> (Mean $\pm$ SD=23 $\pm$ 3.78, Max=36, Min=16)		
15-19 years	50	11.5
20- 29 years	351	80.7
30-49 years	34	7.8
<b>No of Gravida</b> (Mean $\pm$ SD=2 $\pm$ 1.05, Max.=5, Min, =1)		
At most two gravida	307	70.6
More than two gravida	128	29.4
<b>No of Children</b> (Mean $\pm$ SD=1 $\pm$ 0.989, Max.=4, Min, =0)		
At most two children	401	92.2
More than two children	34	7.8

### **c. Education level of pregnant women and their husband**

The findings of this study indicate that a significant proportion of pregnant women (46.4%) had completed only primary education or had no education (24.8%), with 18.9% having some secondary education and only 46.4% completing secondary or higher education. In contrast, a higher proportion of pregnant women's husbands had completed secondary or higher education (54.9%), with 21.6% having some secondary education, 8% having primary education, and only 15.4% having no education.

**Table 3. Education level of pregnant women and their husbands, (n=435)**

<b>Characteristics</b>	<b>Frequencies</b>	<b>Percentages</b>
<b>Pregnant women's education level</b>		
No education	108	24.8
Primary education	43	9.9
Some secondary education	82	18.9
Secondary and above	202	46.4
<b>Husband's education level</b>		
No education	67	15.4
Primary education	35	8
Some secondary education	94	21.6
Secondary and above	239	54.9

**d. Occupation status of pregnant women and their husbands**

The present study revealed that most pregnant women (97.2%) were occupied as housewives, while a negligible proportion was involved in business (1.6%) and service (1.8%). Most of the pregnant women (93.8%) had non-paid occupations, while a small percentage (6.2%) were engaged in paid occupations. Regarding the husbands' occupations, the study revealed that a considerable proportion of them were involved in foreign employment (26%), while others were occupied in service (19.8%), business (19.5%), agriculture (paid and unpaid) (11.9%), labor (11.72%), and driving (3.9%). Most of the husbands had paid occupations (88.7%), while only a negligible proportion had non-paid occupations (3.7%).

**Table 4. Occupation status of pregnant women and their husbands (n=435)**

<b>Characteristics</b>	<b>Frequencies</b>	<b>Percentages</b>
<b>Pregnant woman's Occupation<sup>#</sup></b>		
Housewife	423	97.2
Agriculture (not paid)	5	1.1
Agriculture (paid)	9	2.1
Business (Self-run)	7	1.6
Business (family run or support)	3	0.7
Jobs-Private or government	8	1.8
Others	6	1.4
<b>Pregnant women's occupation based on paid</b>		
Paid occupation	27	6.2
Non-paid occupation	408	93.8
<b>Husband's Occupation<sup>#</sup></b>		
Agriculture (not paid)	24	5.5
Agriculture (paid)	28	6.4
Business	85	19.5
Jobs-Private or government	86	19.8
Foreign Employment	113	26.0
Labor	51	11.72
Driver	17	3.9
Others	31	7.13
<b>Husband's occupation based on paid</b>		
Paid occupation	386	88.7
Non-paid occupation	16	3.7

<sup>#</sup>Multiresponse

#### **4.1.3 Household food security**

The table displays the results of a survey conducted to evaluate the extent of food insecurity among households, using the Household Food Insecurity Scale. The findings indicate that among the households surveyed, 53.8% were classified as food secure, while 24.4% experienced mild food insecurity. Moreover, 16.3% of the households reported moderate food insecurity, which was a higher proportion compared to those who reported severe food insecurity, which was 5.5%. Notably, half of the households had sufficient access to food, as reflected in the food-secure classification.



**Table 5. Household food security characteristics (n=435)**

Characteristics	Frequencies	Percentages
<b>Household food insecurity scale</b>		
Food secure (HFIA Cat. 1)	234	53.8
Mildly food insecure (HFIA Cat. 2)	106	24.4
Moderately food insecure (HFIA Cat. 3)	71	16.3
Severely food insecure (HFIA Cat. 4)	24	5.5

**4.1.4 Women Empowerment****a. Women empowerment (General characteristics)**

Approximately a quarter of women who owned assets, either solely or jointly, were pregnant at the time of the study. Only a minority of pregnant women had their own bank accounts (18.6%), while a larger proportion owned cell phones (79.1%). Most pregnant women (58.6%) reported having access to social media.

**Table 6. Women empowerment (General characteristics) (n=435)**

Characteristics	Frequencies	Percentages
<b>Pregnant woman's</b>		
Ownership of Assets (Alone or jointly) (Yes)	117	26.9
Use of own bank account (Yes)	81	18.6
Use of own mobile phone (Yes)	344	79.1
Access to social media (Yes)	255	58.6

**b. Women empowerment (Decision-making characteristics)**

This study examined women's participation in decision-making in three areas: their own healthcare, major household purchases, and visits to family or relatives. The results showed that 21.4% of women participated in decisions related to their own healthcare, while 20.4% participated in decisions regarding major household purchases. Additionally, 19.4% of women participated in decisions about visiting family or relatives. Only 18.2% of women participated in all three types of decisions, while the majority (77%) did not participate in any of the three decision-making areas. To assess overall participation, a decision-making index was used, which assigned a score of 0, 1-2, or 3 to each participant based on their level of participation in the three areas. The results showed that 77% of women had no participation (score=0), 4.8% had some participation (score=1-2), and 18.2% had full participation (score=3).

**Table 7. Women empowerment (Decision making) (n=435)**

<b>Characteristics</b>	<b>Frequencies</b>	<b>Percentages</b>
<b>Participation in decision making</b>		
<b>(Alone or jointly with husband)</b>		
Woman's own health care	93	21.4
Major household purchases	89	20.4
Visit to family or relatives	84	19.4
<b>Characteristics</b>	<b>Frequencies</b>	<b>Percentages</b>
Participate in all three decisions	79	18.2
Participate in none of the three decisions	335	77
Woman's healthcare	93	21.4
<b>Participation in the decision-making index</b>		
No Participation (Score=0)	335	77
Some Participation (Score =1 to 2)	21	4.8
Fully Participation (Score=3)	79	18.2

**4.1.5 Knowledge and Behavior****c. Behavior related to food taboos**

More than half of the participants (57.2%) did not report any dietary restrictions due to cultural beliefs, while the rest did. The food items most reported as restricted were yam and banana (38.0% each), followed by curd (36.4%), papaya (26.6%), and pickles (9.8%). More than half of the respondents (56.1%) did not believe in the concept of "hot" and "cold" foods, while the rest did.

**Table 8. Behaviour related to food taboos (n=435)**

<b>Characteristics</b>	<b>Frequencies</b>	<b>Percentages</b>
<b>Behaviour regarding banned food due to cultural beliefs</b>		
Yes	185	42.5
No	250	57.5
<b>Believe in hot and cold foods</b>		
Yes	189	43.4
No	246	56.6
<b>Banned food category<sup>#</sup> n= (185)</b>		
Yam	70	38.0
Meat/fish	3	1.6
Pickles	18	9.8
Papaya	49	26.6
Curd	67	36.4
Banana	70	38.0
Others	17	9.2
<b>Reasons for banned food (n=185) <sup>#</sup></b>		
Fear of disease in baby	128	61.2
Cold food	44	21.1
Hot food	7	3.3
Fear of abortion	28	13.4

<sup>#</sup>Multiresponse

#### **d. Behavior related to social norms**

Most participants (65.3%) reported doing household chores by themselves, followed by other family members (28.7%), their husbands (3.2%), and a small percentage reported doing chores together with their spouses (2.8%). Regarding food preferences, most participants (68.7%) reported having no specific rules, while some preferred male family members (27.4%), elder family members (2.1%), or female family members (1.8%). A large percentage of respondents (81.8%) reported having no belief in the need to avoid crossing rivers or wandering in their community.

**Table 9. Behaviour related to social norms (n=435)**

<b>Characteristics</b>	<b>Frequencies</b>	<b>Percentages</b>
<b>Who does household chores?</b>		
Husband	14	3.2
Wife (Respondent)	284	65.3
Both (Husband and wife)	13	3
Other family members	124	28.5
<b>Preference to serve food</b>		
Male members	144	27.4
Female members	8	1.8
Rules-based on seniority	9	2.1
Anybody can/ no specific rules	274	63
<b>Preference to serve food</b>		
Specific rules	161	37
No specific rules	274	63
<b>Beliefs that pregnant women should not cross rivers or not wander in the community</b>		
Yes	79	18.2
No	356	81.8

**e. Behaviour related to food choice**

The study reveals that participants exhibited various eating patterns during pregnancy, with the majority reporting eating more frequently throughout the day (32.2%), followed by eating only what they craved (28.0%), and a smaller percentage eating more food each day (6.4%). In terms of nutritional knowledge, more than half of the respondents (57.2%) were aware of iron-rich foods, with green leafy vegetables being reported as a primary source of iron (83.3%). Conversely, only a quarter of the respondents (30.1%) reported knowledge about calcium-rich foods, with milk, cheese, and curd being reported as the primary sources of calcium (67.6%). These findings suggest that while participants exhibit various eating patterns during pregnancy, most respondents had adequate knowledge regarding iron-rich foods. However, the limited knowledge about calcium-rich foods highlights the need for improved nutritional education and interventions during pregnancy.

**Table 10. Behaviour related to food choice (n=435)**

<b>Characteristics</b>	<b>Frequencies</b>	<b>Percentages</b>
<b>The eating pattern of pregnant women</b>		
Eat more food each day	28	6.4
Eat more times each day	140	32.2
Eat more food and more times each day	73	16.8
Eat only what she craves	122	28.0
The same as in non-pregnant women	72	16.6
<b>Knowledge about iron-rich food</b>		
Yes	186	42.8
No	249	57.2
<b>Source of Iron<sup>#</sup> (n=186)</b>		
Green leafy vegetables	155	83.3%
Liver meat	13	7.0%
Eggs	18	9.7%
Beans/lentils/broccoli	12	6.5%
Pomegranate/beetroot	13	7.0%
Other iron sources	69	37.1%
<b>Knowledge about calcium-rich food</b>		
Yes	131	30.1
No	304	69.9
<b>Source of calcium<sup>#</sup> (n=131)</b>		
Milk/cheese/curd	123	67.6%
Green leafy vegetables	5	2.7%
Fish	14	7.7%
Others source	40	22.0%

<sup>#</sup> **Multiresponse**

#### **f. Practice regarding regular dietary pattern**

The results show that out of the 435 participants, a majority of 98.2% reported being non-vegetarian, while only 1.4% and 0.5% reported following a lacto-vegetarian and ovo-vegetarian/eggetarian diet, respectively. In terms of unusual food intake, only 1.6% of the participants reported such behaviour. Additionally, a very small proportion reported observing feast/party days (1.1%) or fasting days (0.5%). These findings suggest that most of the participants in the study follow a non-vegetarian diet and do not engage in unusual or special dietary practices.

**Table 11. Practice regarding regular dietary patterns (n=435)**

Characteristics	Frequencies	Percentages
<b>Practice regarding regular dietary pattern</b>		
Lacto-vegetarian	6	1.4
Ovo-vegetarian/ Eggetarian	2	0.5
Non-vegetarian	427	98.2

#### 4.1.5 Diet Quality

The thesis analyzed the dietary characteristics of 435 pregnant women using various indices such as Diet Quality Index-Pregnancy (DQI-P), fruit serving intake, grain serving intake, vegetable serving intake, RDAs of iron, vitamin C, calcium, folate, and energy, food moderation from fat, and pattern of meal and snack. The results showed that most pregnant women had poor diet quality, consumed less than the recommended amount of fruit and vegetable servings, and did not meet the RDAs for various nutrients such as iron, vitamin C, calcium, and folate. Additionally, a large proportion of women did not meet the recommended energy intake and had a poor pattern of meal and snack consumption.

##### a. Diet Quality Index-Pregnancy (DQI-P)

The results show that a large majority of the pregnant women had poor diet quality (88.0%), with only 12% having good diet quality.

**Table 12. Diet Quality Index-Pregnancy (n=435)**

Characteristics	Frequencies	Percentages
<b>Diet Quality Index-Pregnancy (DQI-P)</b>		
Good diet quality	52	12
Poor diet quality	383	88

##### b. Recommended vegetables fruits and grains intake

The results reveal that a large proportion of the pregnant women did not meet the recommended daily intake of fruits and vegetables, while a significant portion did not consume any vegetables at all. Specifically, only 12.4% of the population consumed the recommended daily servings of fruits (2-4 servings per day), while 78.9% did not consume any fruits. In contrast, most of the population (57.9%) met the recommended daily intake of grains (6-11 servings per day). Moreover, for vegetable intake, less

than half of the population (42.2%) met the recommended daily intake (3-5 servings per day), while more than half were either half satisfied (52.0%) or did not consume any vegetables at all (4.4%).

Overall, the data suggests that there is a significant gap between the recommended daily intake of fruits and vegetables and the actual consumption of the population. However, most of the population met the recommended daily intake of grains.

**Table 13. Percentages of recommended vegetables fruits and grains intake**

<b>Characteristics</b>	<b>Frequencies</b>	<b>Percentages</b>
<b>Fruit serving intake</b>		
Fully fruit serve met(2-4 servings/day)	54	12.4
Half satisfied (1 serving/day)	38	8.7
Fruit serves not met (0 serving/day)	343	78.9
<b>Grain serving intake</b>		
Fully grain serve met (6-11 servings/day)	252	57.9
Half satisfied (1-5 servings/day)	183	42.2
<b>Vegetable serving intake</b>		
Fullyvegetable serve met (3-5 servings/day)	190	43.7
Half satisfied (1-2 servings/day)	226	52.0
Vegetable serves not met (0 serving /day)	19	4.4

**c. Recommended iron, folate, and calcium intake**

The results highlight the inadequacy in meeting the recommended dietary allowances (RDAs) of iron, calcium, and folate, particularly among women. The results indicate that a large proportion of the population did not meet the RDAs for these essential nutrients. Regarding iron intake, most of the population did not meet the RDA, with only 14.0% fully meeting the recommendation. Over half of the population were partially meeting the RDA for iron, while 35.2 % did not meet it at all. Similarly, for calcium, only 23.9 % of the population fully met the RDA, while 38.9% were partially meeting it, and 37.2 % did not meet the RDA. For folate, a meagre 13.8% of the population fully met the RDA, with 35.6 % partially meeting it, and a majority (50.6%) not meeting it.

**Table 14. Percentages of recommended iron, folate and calcium intake**

<b>Characteristics</b>	<b>Frequencies</b>	<b>Percentages</b>
<b>RDAs of Iron from food</b>		
RDA fully Met (met 100%)	61	14.0
Half satisfied (50%-99.9%)	221	50.8
RDA Not met (<50%)	153	35.2
<b>RDAs of Calcium</b>		
RDA fully Met (met 100%)	104	23.9
Half satisfied (50%-99.9%)	169	38.9
RDA Not met (<50%)	162	37.2
<b>RDAs of Folate</b>		
RDA fully Met (met 100%)	60	13.8
Half satisfied (50%-99.9%)	155	35.6
RDA Not met (<50%)	220	50.6

**d. Energy intake moderation and pattern of diet**

A significant proportion of pregnant women (89.5%) adhere to the recommended daily intake of fat, consuming less than or equal to 30% of their daily energy from this macronutrient. However, a small percentage of pregnant women (6.2%) consumed between 35-40% of their daily energy from fat, and an even smaller percentage (4.3%) consumed more than 40% of their daily energy from fat.

In terms of meal and snack patterns, a minority of the population (3.7%) had a good pattern of consuming three meals and two snacks per day. More than half of the population (50.8 %) were only half satisfied, consuming either three meals or two meals and two snacks per day. A significant portion of the population (45.5 %) had a poor pattern of consuming only two meals and one snack per day or only one meal per day.



Table 15. Proportion of energy intake moderation and pattern of diet (n=428)

Characteristics	Frequencies	Percentages
<b>Food moderation from fat</b>		
<=30% energy from fat/day	389	89.5
35%-40% energy from fat/day	27	6.2
>=40% energy from fat /day	19	4.3
<b>Pattern of meal and snack</b>		
Good pattern (3 meals and 2 snacks)	16	3.7
Half satisfied ((3 meals) or (2 meals and 2 snacks))	221	50.8
poor pattern ((2 meal and 1 snacks) or (1 meal)	198	45.5

#### 4.1.6 Nutritional status of pregnant women

Approximately one-third of pregnant women were found to be undernourished, as indicated by a mid-upper arm circumference (MUAC) of less than 23 cm, while 68% of pregnant women had adequate nutrition. The average MUAC measure was 24.37 cm with a standard deviation of 2.67 cm.

Table 16. Nutritional status of pregnant women (n=435)

Characteristics	Frequencies	Percentages
<b>Nutritional status of pregnant women: Mean±SD=24.37±2.67</b>		
Undernutrition (MUAC<23 cm)	138	31.7
Good nutrition (MUAC≥23 cm)	297	68.3

#### 4.2. Associated factors

In order to investigate the association between various characteristics and MUAC status, bivariate binary logistic regression was performed for each characteristic. This analysis aimed to identify significant determinants that would be further deployed in a multivariate binary logistic regression to establish a more robust association. The results of the bivariate binary logistic regression for each characteristic were evaluated to determine their significance in relation to MUAC status. The characteristics that were found to be significant were then used in the multivariate binary logistic regression analysis to determine their combined effect on MUAC status.

Overall, this approach aimed to identify the most significant predictors of MUAC status and to establish a more concrete association between these predictors and the outcome variable. This approach can provide valuable insights into the factors that contribute to poor MUAC status and can inform targeted interventions to improve nutritional outcomes in the population.

#### **4.2.1 Bivariate binary logistic regression**

The bivariate binary logistic regression test was employed to analyze the data to investigate the potential association between each independent variable and the dependent variable (MUAC status).

This statistical method allowed for the examination of each independent variable in isolation to assess its individual impact on the outcome of interest. The significance of each independent variable was assessed by examining its respective odds ratio and p-value, which indicated the strength and direction of the relationship between the independent variable and the dependent variable.

The equation for bivariate binary logistic regression can be expressed as follows:

$$\text{logit}(p) = \beta_0 + \beta_1 * X$$

where:

logit(p) is the natural logarithm of the odds ratio of the probability of the dependent variable (undernutrition being present (or equal to 1) to the probability of it being absent (or equal to 0)).

$\beta_0$  is the intercept, representing the log odds of the dependent variable when all independent variables are zero.

$\beta_1$  is the regression coefficient, representing the change in log odds of the dependent variable for a one-unit increase in the independent variable.

X is the value of the independent variable.

The logit transformation is used to convert the probability of the dependent variable into a linear relationship with the independent variables. The logistic regression model estimates the coefficients  $\beta_0$  and  $\beta_1$  that maximize the likelihood of the observed data and tests the statistical significance of these coefficients to determine if they are significantly different from zero.

**a. Association of ethnicity, family type, and family size with undernutrition**

The results indicate a statistically significant association between ethnicity and undernutrition, with individuals belonging to the Dalit ethnicity demonstrating higher odds of undernutrition compared to individuals belonging to Brahmin/Chhetri (OR=3.333, 95% CI=1.148-9.679, p=0.016). However, no significant associations were observed between undernutrition and Janjati, Muslim, or Other Terai Caste ethnicity. Furthermore, family type and family size did not demonstrate any significant associations with good nutrition.

**Table17. Association of ethnicity, family type, and family size with undernutrition (n=435)**

Characteristics	Under-nutrition	Good-Nutrition	p-value	OR	95%CI
<b>Ethnicity</b>			<b>0.016</b>		
Dalit	40 (45.5)	48 (54.5)		<b>3.333</b>	<b>1.148-9.679</b>
Janjati	10 (41.7)	14 (58.3)		2.857	0.800-10.198
Muslim	18 (26.1)	51 (73.9)		1.412	0.462-4.317
Other Terai Caste	65 (28.4)	164 (71.6)		1.585	0.571-4.402
Brahmin/Chhetri	5 (20.0)	20 (80.0)		Ref	
<b>Family type</b>			0.242		
Nuclear	43 (34.4)	82 (65.6)		Ref	
Single parent	2 (12.5)	14 (87.5)		3.671	0.797-16.899
Joint	93 (31.6)	201 (68.4)		3.239	0.721-14.542
<b>Family Size</b>					
At most four-family member	31 (30.1)	72 (69.9)	0.685	1.105	0.684-1.785
More than four family members	109(32.8)	223(67.2)		Ref	

**b. Association of age, gravida and number of children with undernutrition**

There are no statistically significant associations between under-nutrition and good nutrition with respect to the age of pregnant women, gravida, and the number of children.

The reference category for both age and gravida were "30-49 years" and "at most two", respectively. The odds ratios (OR) for the other age categories (15-19 years and 20-29 years) and gravida category (More than two) are 1.350 (95% confidence interval [CI]: 0.529-3.445) and 1.248 (95% CI: 0.806-1.931), respectively. However, the p-values for both are greater than 0.05 (p=0.529 and p=0.321, respectively),

indicating that there is no statistically significant association between these variables and under-nutrition versus good nutrition.

Similarly, there is no significant association between the number of children and under-nutrition versus good nutrition. The OR for having more than two children is 1.190 (95% CI: 0.571-2.481) and the p-value is 0.642, which is not statistically significant.

**Table 18. Association of Age, gravida, and number of children with undernutrition (n=435)**

<b>Characteristics</b>	<b>Under-nutrition</b>	<b>Good-Nutrition</b>	<b>p-value</b>	<b>OR</b>	<b>95%CI</b>
<b>Age of the pregnant women</b>			0.768		
15-19 years	18 (36.0)	32 (64.0)		1.350	0.529-3.445
20-29 years	110 (31.3)	241 (68.7)		1.095	0.506-2.369
30-49 years	10 (29.4)	24 (70.6)		Ref	
<b>Gravida</b>			0.321		
At most two	93 (30.3)	214 (69.7)		Ref	
More than two	45 (35.2)	83 (64.8)		1.248	0.806-1.931
<b>Number of Children</b>			0.642		
At most two	126 (31.4)	275 (68.6)		Ref	
More than two	12 (35.3)	22 (64.7)		1.190	0.571-2.481

### **c. Association of education status with undernutrition**

The analysis revealed a statistically significant association between the grade completed by pregnant women and their nutritional status during pregnancy ( $p < 0.001$ ). Specifically, pregnant women with no education were more likely to experience under-nutrition during pregnancy compared to those with secondary and above education (OR=5.173, 95% CI: 3.076-8.699). Similarly, pregnant women with primary education (OR=2.389, 95% CI: 1.161-4.126) or some secondary education (OR=2.312, 95% CI: 1.296-4.126) were also more likely to experience under-nutrition compared to those with secondary and above education.

On the other hand, there was no statistically significant association between the grade completed by pregnant women's husbands and their nutritional status during pregnancy ( $p=0.059$ ). However, husbands with some secondary education (OR=1.896, 95% CI: 1.147-3.133) were more likely to have pregnant wives

experiencing under-nutrition compared to those with secondary and above education. No significant associations were found for husbands with no education (OR=1.663, 95% CI: 0.938-2.948) or primary education (OR=1.458, 95% CI: 0.685-3.101) compared to those with secondary and above education.

**Table 19. Association of education status with undernutrition (n=435)**

<b>Characteristics</b>	<b>Under-nutrition</b>	<b>Good-Nutrition</b>	<b>p-value</b>	<b>OR</b>	<b>95%CI</b>
<b>Grade completed by pregnant women</b>			<b>&lt;0.001</b>		
No education	58 (53.7)	50 (46.3)		<b>5.173</b>	<b>3.076-8.699</b>
Primary education	15 (34.9)	28 (65.1)		<b>2.389</b>	<b>1.161-4.126</b>
Some secondary education	28 (34.1)	54 (65.9)		<b>2.312</b>	<b>1.296-4.126</b>
Secondary and above education	37 (18.3)	165 (81.7)		Ref	
<b>Grade completed by pregnant women's husband</b>			<b>0.059</b>		
No education	25 (37.3)	42 (62.7)		1.663	0.938-2.948
Primary education	12 (34.3)	23 (65.7)		1.458	0.685-3.101
Some secondary education	38 (40.4)	56 (59.6)		1.896	1.147-3.133
Secondary and above education	63 (26.4)	176 (73.6)		Ref	

**d. Association of occupation with undernutrition of pregnant women**

There is no significant association between under-nutrition and good nutrition among pregnant women with respect to their occupation or their husband's occupation. The reference category for both variables is "Paid occupation," and the odds ratio (OR) for having a non-paid occupation is 0.470 (95% CI: 0.174-1.268), with a p-value of 0.136. This indicates that there is no statistically significant association between occupation and under-nutrition versus good nutrition among pregnant women.

Similarly, the OR for the occupation of the husband (non-paid occupation versus paid occupation) is 0.995 (95% CI: 0.338-2.928), with a p-value of 0.993. This suggests that there is no significant association between the husband's occupation and the nutritional status of the pregnant woman.

**Table 20. Association of occupation status with undernutrition (n=435)**

<b>Characteristics</b>	<b>Under-nutrition</b>	<b>Good-Nutrition</b>	<b>p-value</b>	<b>OR</b>	<b>95%CI</b>
<b>Occupation of pregnant women (n=435)</b>			0.136		
Paid occupation	5 (18.5)	22 (81.5)		Ref	
Non-paid occupation	133 (32.6)	275 (67.4)		2.128	0.788-5.743
<b>Occupation of husband (n=402)</b>					
Paid occupation	121 (31.3)	265 (68.7)	0.993	Ref	
Non-paid occupation	5 (31.3)	11 (68.8)		0.995	0.338-2.928

**e. Association of household food security with undernutrition**

The results of the chi-square test showed a statistically significant association between household food insecurity access scale and under-nutrition/good nutrition ( $p < 0.001$ ). Pregnant women who reported mild household food insecurity (HFIA-2) were almost 4 times more likely to have under-nutrition compared to those who reported being food secure (OR=3.881, 95% CI: 2.288-6.584). Those who reported moderate household food insecurity (HFIA-3) were more than 8 times more likely to have under-nutrition compared to food-secure pregnant women (OR=8.732, 95% CI: 4.810-15.852). Pregnant women who reported severe household food insecurity (HFIA-4) were more than 13 times more likely to have undernutrition compared to food-secure women (OR=13.808, 95% CI: 5.337-35.728).

**Table 21. Association of household food security with undernutrition (n=435)**

<b>Characteristics</b>	<b>Under-nutrition</b>	<b>Good-Nutrition</b>	<b>p-value</b>	<b>OR</b>	<b>95%CI</b>
Household food insecurity access scale			<b>&lt;0.001</b>		
HFIA – 1 (food secure)	35 (15.0)	199 (85.0)		Ref	
HFIA – 2 (Mild insecure)	43 (60.6)	63 (59.4)		<b>3.881</b>	<b>2.288-6.584</b>
HFIA -3 (Moderate insecure)	43 (60.6)	28 (39.4)		<b>8.732</b>	<b>4.810-15.852</b>
HFIA – 4 (Severe insecure)	17 (70.8)	7 (29.2)		<b>13.808</b>	<b>5.337-35.728</b>

#### f. Association of women empowerment with undernutrition of pregnant women

For the variable "Asset ownership", there was no significant association between undernutrition and asset ownership (p-value=0.136). However, for "Own bank account", there was a significant association between undernutrition and not owning a bank account (p-value=0.006, OR=2.343, 95% CI=1.283-4.277). Similarly, for "having own mobile phone" and "social media access", there was a significant association between undernutrition and not owning a mobile phone (p-value <0.001, OR=3.150, 95% CI=1.956-5.074) or not having access to social media (p-value <0.001, OR=4.312, 95% CI=2.808-6.622), respectively.

**Table 22. Association of Women Empowerment (general characteristics) with undernutrition (n=435)**

<b>Characteristics</b>	<b>Under-nutrition</b>	<b>Good-Nutrition</b>	<b>p-value</b>	<b>OR</b>	<b>95%CI</b>
<b>Asset ownership</b>			0.136		
Alone or Jointly Ownership	29 (24.8)	88 (75.2)		Ref	
Doesn't ownership	109 (34.3)	209 (65.7)		2.128	0.788-5.743
<b>Own bank account</b>			<b>0.006</b>		
Yes	15 (18.5)	66 (81.5)		Ref	
No	123 (34.7)	231 (65.3)		<b>2.343</b>	<b>1.283-4.277</b>
<b>Own mobile phone</b>			<b>&lt;0.001</b>		
Yes	90 (26.2)	254 (73.8)		Ref	
No	48 (52.7)	43 (47.3)		<b>3.150</b>	<b>1.956-5.074</b>
<b>Social Media Access</b>			<b>&lt;0.001</b>		
Yes	48 (18.8)	207 (81.2)		Ref	
No	90 (50.0)	90 (50.0)		<b>4.312</b>	<b>2.808-6.622</b>

#### g. Association of women empowerment index with undernutrition

The result showed a significant association between under-nutrition and women's participation in decision-making (Chi-square= 19.173, p-value= 0.000). The odds of undernutrition were 5.283 times higher among women who had no participation in decision-making compared to those who had full participation (OR= 5.283, 95%CI= 2.461-11.338, p-value < 0.05). Women who had some participation in decision-making had 2.773 times higher odds of under-nutrition than women who had full participation in decision-making, but the difference was not statistically significant (OR= 2.773, 95%CI= 0.801-9.604, p-value > 0.05).

**Table 23. Association of women empowerment index with undernutrition (n=435)**

<b>Characteristics</b>	<b>Under-nutrition</b>	<b>Good-Nutrition</b>	<b>p-value</b>	<b>OR</b>	<b>95%CI</b>
<b>Participation in decision making</b>			<b>&lt;0.001</b>		
No participation (Score-0)	125 (37.3)	210 (62.7)		<b>5.283</b>	<b>2.461-11.338</b>
Some participation (Score-1-2)	5 (23.8)	16 (76.2)		2.773	0.801-9.604
Fully participation (Score-3)	8 (10.1)	71 (89.9)		Ref	

**h. Association of behaviour related to food taboos with undernutrition of pregnant women**

The results show that there is no significant association between cultural taboos on foods (banned eating) and under-nutrition (p-value=0.725, OR=1.076, 95% CI=0.715-1.621). Similarly, there is no significant association between cultural taboos on food (belief in hot and cold food) and undernutrition (p-value=0.684, OR=1.088, 95% CI=0.724-1.637).

**Table 24. Association of behaviour related to food taboos with undernutrition (n=435)**

<b>Characteristics</b>	<b>Under-nutrition</b>	<b>Good-Nutrition</b>	<b>p-value</b>	<b>OR</b>	<b>95%CI</b>
<b>Foods banned to eat</b>			0.725		
Yes	57 (30.8)	128 (69.2)		Ref	
No	81 (32.4)	169 (67.6)		1.076	0.715-1.621
<b>Believe in hot and cold foods</b>			0.684		
Yes	58 (30.7)	131 (69.3)		Ref	
No	80 (32.5)	166 (67.5)		1.088	0.724-1.637

**i. Association of behaviour related to social norms with undernutrition**

There is a significant association between eating preference rules in the family and undernutrition. Women who had specific rules had a higher risk of undernutrition than those who had no specific rules (OR = 3.855, 95% CI = 2.520-5.895, p < 0.001). For the variable "Household chores performed," none of the categories showed a significant association with undernutrition. For the variable "Beliefs that pregnant



women should not cross a river or not wander in community," there was no significant association with under-nutrition.

**Table 25. Association of behaviour related to social norms with undernutrition (n=435)**

Characteristics	Under-nutrition	Good-Nutrition	p-value	OR	95%CI
<b>Eating preference rule in the family</b>			<b>&lt;0.001</b>		
Specific rules	81 (50.3)	80 (49.7)		<b>3.855</b>	<b>2.520-5.895</b>
No specific rules	57 (20.8)	217 (79.2)		Ref	
<b>Household chores performed</b>			0.268		
Husband	3 (21.4)	11 (78.6)		0.784	0.206-2.990
Wife (pregnant woman)	98 (34.5)	186 (65.5)		1.515	0.946-2.426
Both (husband and wife)	5 (38.5)	8 (61.5)		1.797	0.548-5.892
Other family member	32 (25.8)	92 (74.2)		Ref	
<b>Beliefs that pregnant women should not cross rivers or not wander in the community</b>			0.605		
Yes	27 (34.2)	52 (65.8)		1.146	0.684-1.920
No	111 (31.2)	245 (68.8)		Ref	

#### **j. Association of behaviour related to food choice with undernutrition**

There is a significant association between knowledge about iron-rich food and undernutrition. Women who had no knowledge about Iron rich food had a higher risk of under-nutrition than those who had knowledge (OR = 1.868, 95% CI = 1.224-2.850, p = 0.004). Similarly, there is a significant association between knowledge about calcium-rich food and undernutrition. Women who had no knowledge about calcium-rich food had a higher risk of undernutrition than those who had knowledge (OR = 2.215, 95% CI = 1.366-3.592, p = 0.001). No, other variables showed a significant association with undernutrition or good nutrition.

**Table 26. Association of behaviour related to food choice with undernutrition (n=435)**

<b>Characteristics</b>	<b>Under-nutrition</b>	<b>Good-Nutrition</b>	<b>p-value</b>	<b>OR</b>	<b>95%CI</b>
<b>Eating pattern of pregnant women</b>			0.346		
Eat more food each day	10 (35.7)	18 (64.3)		1.044	0.419-2.602
Eat more times each day	40 (28.4)	101 (71.6)		0.745	0.405-1.367
Eat more food more times each day	25 (34.7)	47 (65.3)		Ref	
Eat only what she craves	34 (27.9)	88 (72.1)		0.726	0.388-1.359
The same as in non-pregnant women	29 (40.3)	43 (59.7)		0.491	0.645-2.493
<b>Knowledge about Iron rich food</b>			<b>0.004</b>		
Yes	45 (24.2)	141 (75.8)		Ref	
No	93 (37.3)	156 (62.7)		<b>1.868</b>	<b>1.224-2.850</b>
<b>Knowledge about calcium-rich food</b>			<b>0.001</b>		
Yes	27 (20.6)	104 (79.4)		Ref	
No	111 (36.5)	193 (63.5)		<b>2.215</b>	<b>1.366-3.592</b>

**k. Association of behaviour related to food choice with undernutrition**

There is a significant association between Diet Quality Index-Pregnancy (DQI-P) and under-nutrition. Women with poor diet quality had a higher risk of under-nutrition than those with good diet quality (OR = 5.001, 95% CI = 1.942-12.875, p = 0.001).

**Table 27. Association of behaviour related to food choice with undernutrition (n=435)**

<b>Characteristics</b>	<b>Under-nutrition</b>	<b>Good-Nutrition</b>	<b>p-value</b>	<b>OR</b>	<b>95%CI</b>
<b>Diet Quality Index-Pregnancy (DQI-P)</b>			<b>0.001</b>		
Good Diet Quality	133 (34.7)	250 (65.3)		Ref	
Poor Diet Quality	5 (9.6)	47 (90.4)		<b>5.001</b>	<b>1.942-12.875</b>

#### **4.2.2 Multivariate binary logistic regression**

This section deals with the multivariate analysis from the binary logistic regression model to find out the association between the independent variables and dependent variables. The goal of the regression analysis is to find an equation that best predicts the probability of a value of the dependent variable as a function of independent variables. Regression analysis is carried out to examine the independent effect of each of the measured variables and to identify the most significantly associated factors of nutritional status.

In this model, independent variables are entered into the model at the same time, and their combined effect on the dependent variable is estimated. Those variables were significant at 95 percent confidence during the bivariate binary logistic regression test and were further analyzed using multivariate binary logistic regression analysis.

The equation for the multivariate binary logistic regression model is:

$$\text{logit}(p) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k$$

where:

$\text{logit}(p)$  is the natural logarithm of the odds of the dependent variable being equal to 1 (i.e., the probability of the event happening divided by the probability of it not happening).

$\beta_0$  is the intercept or constant term.

$\beta_1$  to  $\beta_k$  are the coefficients of the independent variables  $X_1$  to  $X_k$ , respectively.

$X_1$  to  $X_k$  are the independent variables.

The logistic regression model estimates the values of the coefficients  $\beta_1$  to  $\beta_k$  using a method called maximum likelihood estimation. The coefficients represent the change in the log odds of the dependent variable for a one-unit change in the corresponding independent variable while holding all other variables constant.

##### **a. Test for model fit and multicollinearity**

Before applying multivariate binary logistic regression to analyze the relationship between independent variables and the nutritional status of pregnant women, the

goodness of fit of the model and the presence of multicollinearity were assessed. Hosmer and Lemshow tests were conducted for all significant independent variables and the results indicated a non-significant relationship, as the test value was 0.604 which is greater than the alpha value of 0.05. Additionally, multicollinearity statistics were analyzed for all independent variables concerning the linear dependent variable, and the variance inflation factor (VIF) was found to be less than 10 and tolerance was greater than 0.1 for every variable. These findings suggest that the variable of diet quality was the cause of concern for the model fit as per Hosmer and Lemshow's tests. Hence, it was excluded from the analysis. Besides this, the model was a good fit and multicollinearity is not a concern in the analysis.

**Table 28. Multicollinearity statistics**

Independent variables	Multicollinearity statistics	
	Variance inflation factor (VIF)	Tolerance
Ethnicity	1.118	0.895
Decision-making index	1.171	0.654
Household food insecurity access scale	1.551	0.645
Grade completed by pregnant women	2.939	0.340
Social media access	3.080	0.325
Knowledge about iron-rich food	1.508	0.663
Knowledge about calcium-rich food	1.639	0.610
Preference to serve food	1.145	0.874
Use own mobile phone	1.247	0.802
Use own bank account	1.097	0.912

**b. The results from multivariate logistic regression**

The table shows the results of a multivariate logistic regression analysis examining the factors associated with under-nutrition among pregnant women in a certain region. The adjusted odds ratio (AOR) and the corresponding 95% confidence interval (CI) for each factor are presented, along with the p-value. Among the socio-demographic factors examined, ethnicity, grade completed by pregnant women, ownership of a bank account, ownership of a mobile phone, and social media access were not significantly associated with undernutrition. However, Janjati ethnicity showed a

higher odd of undernutrition (AOR=3.141, 95% CI=0.728-13.557) compared to Brahmin/Chhetri ethnicity, although this was not statistically significant (p=0.295).

Regarding women's empowerment, those with no participation or only some participation had higher odds of under-nutrition than those with strong participation (AOR=2.016, 95% CI=0.857-4.740 and AOR=1.967, 95% CI=0.496-7.799, respectively), although these associations were not statistically significant (p=0.273).

Household food security was strongly associated with under-nutrition, with increasing odds of under-nutrition as food security decreased (p<0.001). Pregnant women in households with mild (AOR=2.515, 95% CI=1.372-4.610), moderate (AOR=5.569, 95% CI=2.721-11.397), and severe (AOR=6.795, 95% CI=2.254-20.483) food insecurity had significantly higher odds of under-nutrition compared to those in food-secure households.

Preference to serve food with specific rules in the family was also strongly associated with under-nutrition (p<0.001). Pregnant women in families with specific rules had higher odds of under-nutrition compared to those without specific rules (AOR=2.595, 95% CI=1.588-4.231). Finally, knowledge about iron-rich food was not significantly associated with under-nutrition (p=0.309 and p=0.557 for two different measures of knowledge).

In conclusion, this study suggests that household food insecurity and preference to serve food with specific rules are strongly associated with under-nutrition among pregnant women in this region. Ethnicity and women's empowerment may also be important factors, but further research is needed to confirm these findings.

**Table29. Multivariate binary logistic regression**

<b>Characteristics</b>	<b>Under-nutrition</b>	<b>Good nutrition</b>	<b>AOR</b>	<b>95%CI</b>	<b>P-value</b>
<b>Ethnicity</b>					0.295
Dalit	40 (45.5)	48 (54.5)	1.363	0.392-4.731	
Janjati	10 (41.7)	14 (58.3)	3.141	0.728-13.557	
Other Terai Caste	18 (26.1)	51 (73.9)	0.995	0.274-3.608	
Muslim	65 (28.4)	164 (71.6)	1.684	0.522-5.433	
Brahmin/Chhetri	5 (20.0)	20 (80.0)	Ref		
<b>Grade completed by pregnant women</b>					0.992
No education	58 (53.7)	50 (46.3)	1.157	0.444-3.016	
Primary education	15 (34.9)	28 (65.1)	1.070	0.411-2.786	
Some secondary education	28 (34.1)	54 (65.9)	1.098	0.505-2.386	
Secondary and above education	37 (18.3)	165 (81.7)	Ref		
<b>Own bank account</b>					
Yes	15 (18.5)	66 (81.5)	Ref		0.146
No	123 (34.7)	231 (65.3)	1.697	0.832-3.461	
<b>Characteristics</b>	<b>Under-nutrition</b>	<b>Good nutrition</b>	<b>AOR</b>	<b>95%CI</b>	<b>P-value</b>
					0.379
<b>Own mobile phone</b>					
Yes	90 (26.2)	254 (73.8)	Ref		
No	48 (52.7)	43 (47.3)	1.300	0.724-2.335	
<b>Social Media Access</b>					0.435
Yes	209 (76.0)	66 (24.0)	Ref		
No	110 (76.4)	34 (23.6)	1.377	0.617-3.073	
<b>Women Empowerment Index</b>					0.273
No Participation (Score-0)	125 (37.3)	210 (62.7)	2.016	0.857-4.740	
Some Participation (Score-1-2)	5 (23.8)	16 (76.2)	1.967	0.496-7.799	
Strong Participation (Score-3)	8 (10.1)	71 (89.9)	Ref		
<b>Household Food Security Category</b>					<0.001
HFIA – 1 (Food secure)	35 (15.0)	199 (85.0)			
HFIA – 2 (Mild insecure)	43 (60.6)	63 (59.4)	<b>2.515</b>	<b>1.372-4.610</b>	
HFIA -3 (Moderate insecure)	43 (60.6)	28 (39.4)	<b>5.569</b>	<b>2.721-11.397</b>	
HFIA – 4 (Severe insecure)	17 (70.8)	7 (29.2)	<b>6.795</b>	<b>2.254-20.483</b>	
<b>Preference to serve food rule in the family</b>					<0.001
Specific rules	81 (50.3)	80 (49.7)	<b>2.595</b>	<b>1.588-4.231</b>	
No specific rules	57 (20.8)	217 (79.2)	Ref		

Characteristics	Under-nutrition	Good nutrition	AOR	95%CI	P-value
<b>Knowledge about iron-rich food</b>					0.309
Yes	45 (24.2)	141 (75.8)	Ref		
No	93 (37.3)	156 (62.7)	1.358	0.753-2.448	
<b>Knowledge about calcium-rich food</b>					0.557
Yes	27 (20.6)	104 (79.4)	Ref		
No	111 (36.5)	193 (63.5)	0.814	0.410-1.618	

### c. The final multivariate logistic regression model

The multivariate logistic regression model estimates the log odds of undernutrition among pregnant women as a function of several predictor variables. The equation for this model is presented as follows:

$$\text{logit (undernutrition among pregnant women)} = -3.666 + 0.922*(\text{mild food insecurity}) + 1.717*(\text{moderate food insecurity}) + 1.916*(\text{severe food insecurity}) + 0.952*(\text{specific rule for food serving})$$

The intercept term, -3.666, represents the log odds of undernutrition among pregnant women when all predictor variables are equal to zero. The coefficients for each of the predictor variables, including mild food insecurity, moderate food insecurity, severe food insecurity, and specific rules for food serving, indicate the change in log odds of undernutrition associated with a one-unit increase in each predictor variable, holding all other variables constant. These results suggest that moderate and severe food insecurity, as well as specific rules for food serving, are associated with increased log odds of undernutrition among pregnant women, while mild food insecurity is associated with a smaller increase in log odds. These findings may have important implications for the development of interventions aimed at reducing undernutrition among pregnant women, particularly in settings where food insecurity is prevalent.

## CHAPTER V: DISCUSSION

The nutritional status of pregnant women plays a crucial role in determining maternal and child health outcomes. Understanding factors such as sociodemographic and socioeconomic status, household food security, women's empowerment, diet quality, and knowledge and behaviour regarding dietary intake is vital for comprehending their nutritional well-being. To evaluate the nutritional status of pregnant women in the Janakpur sub-metropolitan and investigate its associated factors, a community-based cross-sectional approach was utilized.

Firstly, the finding that approximately one-third of pregnant women in the Janakpur sub-metropolitan, Nepal was undernourished is consistent with some previous studies and varies from some previous studies in Nepal. For example, a 2016 study conducted in Bhaktapur found that 11% of pregnant women had a low BMI (56), while another study in 2012 reported 27.9% of pregnant women malnourished in the Terai region (87). Similarly, another hospital-based study in western Nepal reported that 24% of pregnant women were undernourished (26). Further, the finding was also in line with 29.1% of the Madhesh province average (88). However, it is higher than the national average of 17% among women of reproductive age (88). The results indicate that malnutrition among expectant mothers is still a major public health concern in Nepal, particularly in the Madhesh province, indicating that the increased nutritional requirements of pregnant women are not being adequately fulfilled.

The disaggregation of the finding showed that Dalit and Janajati ethnic groups had higher rates of undernutrition is also consistent with previous research from Nepal. For example, a 2018 study from the western region of Nepal found that Dalit and Janajati women had higher rates of malnutrition compared to other ethnic groups (26). However, our study didn't have a significant association unlike reported by Lama et al.

We found just over half of the households were food secure while 24.4% were mildly food insecure, 16.3% were moderately food insecure, and 5.5% were severely food insecure. This figure is higher compared to the average of the Terai region as reported



by NDHS 2016. As reported by NDHS, 14%, 19.2%, and 7.6% of households experience mild, moderate, and severe food insecurity, respectively in the Terai region. However, severe food insecure households were 5.5% which is slightly lower than the region's average. The National Population and Housing Census 2021 indicates that Janakpurdham sub-metropolitan has a significant portion of the population who are economically inactive; unemployed; and poor considering their access to basic amenities (74). Further, merging outskirts villages like Kanakpatti, AndupattiKatrait, Mansinghpatti and Gopalpur during federalization, and decreasing agriculture in urban areas are found in the Janakpur. This may have played a role in part to such figures.

It is important to highlight that undernutrition among pregnant women and household food insecurity are closely related issues. The absence of access to food and proper nutrition not only negatively affects the health of pregnant women but also the overall health and well-being of the household. The association between household food security and undernutrition among pregnant women in this study is also consistent with existing evidence from various studies in Nepal.

Upon conducting further analysis of NDHS 2011, it was found that women residing in households with food insecurity were 1.5 times more prone to undernourishment compared to those in food-secured households, with a 95% confidence interval ranging from 1.17 to 1.92 (53). A study conducted at the local level in Bajhang also found that more than half (53%) of the mothers had low dietary diversity, which was associated with food insecurity prevalent in 54% of households (61). Other evidence from Indonesia suggests food insecurity is directly linked with energy consumption among pregnant women ( $p = 0.000$ ; OR = 53.9) (42). Poor calorie intake is ultimately found to impact the nutrition status of pregnant women.

Household food insecurity can affect the nutrition status of women in several ways. Firstly, food insecurity can lead to a reduction in the quantity and quality of food consumed by women, which can result in undernutrition and micronutrient deficiencies. Secondly, food insecurity can limit the variety of foods available to women, which can result in a less diverse diet and an increased risk of micronutrient deficiencies. Finally, food insecurity can lead to stress and anxiety, which can affect appetite and nutrient absorption.

These findings suggest that improving household food security is crucial in efforts to improve maternal and child health outcomes. Consequently, addressing these issues requires a multifaceted approach that involves improving access to food and nutrition, enhancing the economic status of households, and promoting behavioural changes related to eating habits and food choices.

The study presents several indicators related to women's empowerment, including ownership of assets, use of a personal bank account, ownership of a mobile phone, decision-making power, attitudes towards wife beating, access to social media, skill to use social media and sources of information regarding government activities within the household.

The findings show that women's ownership of major assets like land, homes, and automobiles alone or jointly is 26.9%, which is higher than the provincial average and in line with the recently conducted Nepal Population and Housing Census 2021 (89). However, women's use of personal bank accounts is very lower (18.6%) compared to the national average of 40.5% and the provincial average of 28.7%. This indicates that financial independence and autonomy remain significant challenges for women in Madhesh province. Nonetheless, it was determined that this was not significantly linked to the nutritional status of expectant mothers.

Though finding from previous studies shows its association with one study in Bangladesh. The study was conducted in Bogra, Faridpur and Moulavibazar districts in Bangladesh and found that land ownership, relative wealth, access to media, and women's freedom to access the market all significantly reduced the risk of food insecurity and improve dietary diversity and nutrition status of pregnant women (90).

In 2019, research conducted in Nepal revealed that women who owned land had a favourable correlation with dietary diversity, which is a significant measure of overall nutritional status. The study also found that women who owned land had a higher chance to have higher education levels, be employed, and have greater decision-making power within their households, all of which are factors that contribute to improved nutrition outcomes (91–93). Similarly, a study conducted in Bangladesh found that women's asset ownership, including land, was positively associated with improved maternal nutrition outcomes, including higher levels of dietary diversity and

increased consumption of iron-rich foods (94). Globally, a study conducted in 25 low- and middle-income countries found that women's asset ownership was positively associated with improved nutrition outcomes, including higher dietary diversity and greater consumption of animal-source foods (95). These studies suggest that women's asset ownership, particularly land ownership, is an important factor in improving the nutrition status of women.

On a positive note, the ownership of mobile phones is 79.1%, which is also higher than the national (72.6%) and provincial (72.6%) average (88). This increase in mobile phone ownership is a promising development that can contribute to women's empowerment, access to information, and communication. Many of the pregnant women (58.6%) reported having access to social media.

However, ownership of mobile phones and social media access was not a significant contributor to the nutrition status of women in this study. Although some previous studies elsewhere show demonstrate this relationship. For instance, a study conducted in rural India and China found that women who owned a mobile phone were more likely to consume a diverse diet and meet their nutrient requirements compared to those who did not own a mobile phone (96, 97). Another study conducted in Bangladesh found that mobile phone ownership was associated with better nutritional status among pregnant women, as well as increased access to healthcare services (98). This evidence suggests that owning a mobile phone may increase women's access to nutrition information and enable them to make better dietary choices. It is important to note, however, that the relationship between mobile phone ownership and nutrition outcomes is likely to be complex and influenced by a range of factors. For example, women who own mobile phones may also have other socioeconomic advantages, such as higher levels of education or income, which could contribute to better nutrition outcomes.

Due to the increase in foreign employment and the decreasing gap in access to phones and social media, these resources are becoming more widely available in Madhesh province, especially for women after marriage. This may have contributed to the lack of association found in the study. In general, research indicates that owning a mobile phone may play a significant role in improving women's nutrition status, especially in low-income countries. Interventions aimed at increasing mobile phone ownership

among women could therefore have the potential to improve maternal and child health outcomes in these settings.

Regarding decision-making power within the household, the study reveals that women have limited influence in major decisions. Only 18.2% of women make decisions jointly or alone with their husbands on all three decisions related to health care, major household purchases, and visits to family or relatives. On the other hand, a larger proportion of women (77%) do not take part in any of these decision-making processes, which is greater than the national average of 62.3% (88). This indicates that women's decision-making power within the household remains a challenge, despite efforts to promote gender equality in Nepal. A study conducted in Nepal found that women's participation in household decision-making was positively associated with their dietary diversity and nutrient intake (99). Another study conducted in rural Bangladesh found that women who had greater autonomy in decision-making related to healthcare had better nutritional status than those who had limited autonomy (100). The results of this study indicate that interventions focused on improving women's empowerment may have beneficial effects on the health outcomes of both mothers and children.

Further, this study found that only 12 percent of pregnant women consumed a quality diet. This finding is very consistent with previous evidence in Nepal and globally. A study among lower- to middle-income women from North Carolina found that only 8.9 percent met diet quality (101). Another study in a developing country found only 18 percent had met recommended diet quality (27). A study conducted in Nepal in 2021 found that overall diet quality was poor among pregnant women, with only 45% of women meeting the recommended dietary diversity with a lack of information regarding the quantity of consumed food (102). Similarly, another study in Baglung, Nepal also found that 45% (95% CI: 39.6–50.4) of the participants did not consume a diverse diet (102). However, the findings in our study are in contrast with a systematic review showing high-income countries have below recommendation consumption of grains and dairy while higher consumption of animal-source foods like meat and eggs (103).

Similarly, the finding that a low proportion of pregnant women in the Janakpurdham sub-metropolitan, Nepal met the recommended nutrient intake for iron from food

(14%) is consistent with previous studies. A survey by USAID found that two in five Nepali people consume less than adequate calories (104). This is quite worsening with the fact that energy and nutrients demand during pregnancy increase. Similarly, a hospital-based study in Kathmandu found that 21.7 percent of women met RDA for iron (41). The different contexts of the study and the demography of study participants may have played a role in these differences. However, it is better than what is found in a study in West Delhi, India reporting no pregnant women met the recommended daily intake of iron (105). The 2022 NDHS showed that more than half of the women (52%) in the Madhesh Province suffer from anaemia. These results emphasize the necessary for programs and policies and interventions that aim to improve maternal nutrition should prioritize efforts to improve diet quality among all women, regardless of their social determinants.

This study found that only 13.8% of pregnant women met RDA for folate while 50.6% met less than half of the daily requirement. This was lower than a previous study from Bhaktapur, Nepal where 69% of pregnant women consumed less than 320 mcg of folate per day (56). However, another study in southeastern rural Nepal found only 12 percent of pregnant women to be folate deficient (106). This variation may be due to the seasonal availability of rich sources of folates, cooking practices and food consumption patterns.

Further, this study found that gender-based eating practice rule in the family leads to undernutrition. Such evidence is not found in previous studies in Nepal. However, traditional norms are impacting food behaviours. For instance, women in a study reported being pressured by family members to eat certain foods or limit their food intake based on cultural beliefs, which led to inadequate nutrient intake and low birth weight infants (107). This is also supported by another multi-year study in northern KwaZulu-Natal (108), where food taboos like not consuming mango, orange, and papaya were in effect. Though our study didn't find any association with such food taboos, certain food taboos like not eating yam, papaya, banana, and curd. Interventions aimed at improving maternal nutrition should take into account these gender-related factors, and address harmful cultural practices that may contribute to poor nutrition outcomes. Though, logically food taboos, family size, and women

empowerment would have a significant impact on nutrition status as other studies suggested, food consumption pattern is not much different as found in this study.

Overall, the outcomes of this research align with and somewhat differ from prior studies conducted in Nepal and other low-income nations. These results demonstrate that undernutrition among pregnant women continues to be a significant public health issue, and it is essential to address social determinants of health, including poverty, gender inequality, and food insecurity, to improve maternal and child health outcomes. The study's findings highlight the necessity for interventions targeted at enhancing the quality of diet and nutrient intake among pregnant women in the Madhesh province. Educating and increasing awareness among individuals regarding the significance of a balanced diet and how far they are from the ideal level of food diversity and quantity could be a potential intervention. Organizing a weekly community feast program for pregnant women in collaboration with nutritional education and cooking skills at the local level in the community could be beneficial to some degree.

However, the results presented in this study should be interpreted with some caution. First, because the focus of the study was on assessing nutrition status based on their recall this may have some recall bias in addition to self-reported biases. The study also didn't consider the bioavailability of the consumed recipe, metabolic disorders (109), and other biological factors in addition to behavioural factors like cooking practices - cooking temperature and duration (110), eating practices - chewing duration, and food interactions that directly affect the bioavailability of many nutrients (111).

A follow-up study to measure weight gain during pregnancy would have been given. More insights regarding nutrition consumption during pregnancy over time. The 24-hour recall may not reflect their food consumption pattern throughout their pregnancy. Also, this study was conducted in the urban of Madhesh province, which has different lifestyles compared to other locations within the country, so the findings may not be generalizable nationwide.

## CHAPTER VI: CONCLUSION

### 6.1 Conclusion

The findings of this study indicate that undernutrition is a significant concern among pregnant women in the Janakpurdham sub-metropolitan area of Nepal. The study found that one-third of pregnant women increased demand for nutrition was not being fulfilled. This is particularly concerning as undernutrition during pregnancy can lead to adverse outcomes for both the mother and child, including low birth weight, preterm delivery, and increased risk of infections.

The study also revealed that only around 12% of pregnant women had good diet quality, with only 14% meeting the recommended daily allowance for iron, 13.8% meeting the recommended daily allowance for folate, and 23.9% meeting the recommended daily allowance for calcium. These findings indicate a significant gap between the nutrient needs of pregnant women and the actual nutrient intake. The study found that over half of the households were food secure, while 24.4% were mildly food insecure, 16.3% were moderately food insecure, and 5.5% were severely food insecure. This means that a considerable proportion of households in the study area are experiencing food insecurity, which can have a significant impact on maternal and child health outcomes. Furthermore, the study found that 37% of households had a specific rule regarding food preferences, with a preference for males to eat first. This social norm was associated with undernutrition among pregnant women, emphasizing the importance of addressing cultural factors in improving maternal nutrition.

In summary, the results underscore the necessity for programs that tackle the economic, social, and cultural determinants of maternal malnutrition. These programs should prioritize enhancing women's agency, securing households' food supply, and providing pregnant women with nutritious foods.

## 6.2 Recommendations

- i. Develop and implement a comprehensive maternal nutrition program that targets the underlying social determinants of undernutrition among pregnant women in the Janakapurdham sub-metropolitan. This program should focus on improving women's empowerment, household food security, and access to nutrient-dense foods.
- ii. Implement interventions to improve dietary diversity and nutrient intake among pregnant women in the study area. Such interventions could include nutrition education, counselling, and behaviour change communication.
- iii. Promote gender equality and women's empowerment by encouraging women's participation in decision-making and addressing harmful gender norms and practices.
- iv. Identify food-insecure households or marginalized families and enable them to produce their food or buy the required food through nutrition-sensitive interventions.
- v. Conduct further research to understand the underlying factors contributing to poor food consumption among pregnant women, especially in the Terai region of Nepal, as well as the effectiveness of interventions aimed at improving maternal nutrition status.
- vi. Strengthen the health system's capacity to provide high-quality maternal and child health services, including nutrition counselling and screening.
- vii. Ensure that health professionals receive appropriate training on maternal nutrition, including the importance of dietary diversity, micronutrient supplementation, and weight gain during pregnancy.
- viii. Foster collaboration among relevant stakeholders, including government agencies, civil society organizations, and international organizations, to improve maternal and child health outcomes in the Terai region.



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## ANNEXES

### ANNEX I: INFORMED CONSENT FORM

**Central Department of Public Health (CDPH)**  
Institute of Medicine (IOM)  
Maharajgunj, Kathmandu, Nepal

“Nutritional Status and its Associated Factors among Pregnant Women in  
Janakpurdham Sub-metropolitan”

I,....., male/female of ..... years of age,  
hereby confirm that I have read and understood the information sheet and consent  
form for this research being conducted by Mr. Gauree Shankar Mandal, and have had  
the opportunity to ask questions about it.

I hereby declare that,

1. I understand that my/my wife/daughter in law participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, and without my medical care or legal rights being affected.
2. I understand that the researchers, the IRC and other regulatory authorities will not need my permission to look at my/my wife/my daughter in law health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my/my wife/my daughter in law identity will not be revealed in any information that will be published or released to third parties.
3. I agree not to restrict the use of any data or results that arise from this study provided that such use is only for scientific purpose(s).
4. I agree to take part in this study.

**Signature (or Thumb impression) of  
the research  
participant/LegalGuardian**

Signature: .....  
Name: .....  
Date: .....

**Signature (or Thumb impression) of  
Witness**

Signature: .....  
Name: .....  
Date: .....

**Investigator's**

Signature:.....  
Name:.....  
Date : .....

## ANNEX II: INFORMED CONSENT FORM IN NEPALI

### सुसूचितमन्जुरीनामा

जनस्वास्थ्यकेन्द्रियविभाग  
चिकित्साशास्त्र अध्ययन संस्थान  
महाराजगंज, काठमाडौं, नेपाल

“जनकपुरधाम उप-महानगरपालिका अन्तरगतका गर्भवती महिलाहरूको पोषण स्थिति र त्यससंग सम्बन्धित कारकतत्वहरूको अध्ययन”

म.....उमेर.....वर्षको पुरुष/ महिलाले, श्री गौरी शंकर मण्डलले गर्न लाग्नु भएको यस अनुसन्धान सम्बन्धि संलग्न 'जानकारीपत्र/ पुस्तिका' पढेर, सुनेर प्रश्नोत्तर समेत गरेर यो अध्ययन-अनुसन्धान सम्बन्धमा जानकारी प्राप्त भयो।

- यो अनुसन्धान कार्यमा मेरो/ मेरो श्रीमती/ मेरो छोरी बुहारीको सहभागिता मेरो व्यक्तिगत इच्छामा भर पर्ने र मैले चाहेको खण्डमा कुनै पनि बेला यो अनुसन्धान प्रक्रियाबाट बाहिरिन पाउने भन्ने कुरा मैले बुझेको छु। यसको लागि मैले कुनै कारण दिनु नपर्ने र त्यसबाट मैले पाउने सेवा र मेरो कानुनी अधिकारमा असर नपर्ने समेत मलाई बुझाईएकोछ।
- यस अनुसन्धानको प्रतिवेदन वासम्बन्धित प्रकाशित कृतिहरूमा मेरो/ मेरो श्रीमती/ मेरो छोरी-बुहारीको कुनै व्यक्तिगत परिचय खुल्ने जानकारी प्रकाशित हुनेछैन भन्ने कुरा मैले बुझेको छु।
- यी सबै कुराहरू जानी-बुझी, म यस अध्ययन-अनुसन्धानमा सहभागी हुन स्वेच्छाले राजी भई यो सुसूचितमन्जुरीनामामा सहिछाप गरेकोछु।

#### सहभागी/सहभागीकोअभिभावकको

सही : .....  
नाम-थर : .....  
मिति : २०७...../...../.....

#### साक्षीको

सही : .....  
नाम-थर : .....  
मिति : २०७...../...../.....

#### अनुसन्धानकर्ताको

सही : .....  
नाम-थर : .....  
मिति : २०७...../...../.....

#### सहभागीकोबुढीऔंलाको ल्याप्छाप

दाँया	बाँया

## ANNEX III: INFORMED CONSENT FORM IN MAITHILI

### ससूचित सहमति जनस्वास्थ्य केन्द्रिय बिभाग चिकित्साशास्त्रअध्ययन संस्थान महाराजगन्ज, काठमाडौं, नेपाल

"जनकपुरधाम उप-महानगरपालिका अन्तर्गतके गर्भवती महिला सभक पोषणके स्थिति आ वोसं संबंधित कारकतत्व सभक अध्ययन "

हम.....उम्र.....वर्ष पुरुष/महिला, श्री गौरी शंकर मंडल द्वारा कयल जा रहल एहि शोधक विषय मे संलग्न 'सूचना पत्र/पुस्तिका' पढ़ि, सुनि आ प्रश्नक उत्तर द' क' समेत एहि अध्ययन-शोधक सम्बन्धमे जानकारी भेटलनि |

- हम बुझैत छी जे एहि शोध कार्य मे हमर/हमर घरवाली/ हमर पुतौहके सहभागिता हमर व्यक्तिगत इच्छा पर आधारित अछि आ हम चाहब त एहि शोध प्रक्रिया स कोनो समय हटि सकैत छी। हमरा बुझाओल गेल अछि जे हमरा एकर कोनो कारण नहि देबय पड़त आ एहि सं हमरा भेटय वाला सेवा आओर हमर कानूनी अधिकार पर कोनो असर नहि पड़त।
- हम बुझैत छी जे एहि शोध रिपोर्ट वा संबंधित प्रकाशित रचना मे हमरा बारे मे कोनो व्यक्तिगत पहचान योग्य जानकारी प्रकाशित नहि होयत।
- ई सब बात जनैत हम स्वेच्छा स एहि अध्ययन मे भाग लेबय लेल सहमत भ गेल छी आ एहि सूचित सहमति पत्र पर हस्ताक्षर केलहुं अछि।

#### प्रतिभागी के/प्रतिभागी के अभिभावक के

सही : .....  
नाम: .....  
तिथि : २०७ ...../...../.....

#### गवाह के

सही : .....  
नाम-थर : .....  
तिथि : २०७...../...../.....

#### शोधकर्ता के

सही : .....  
नाम-थर : .....  
तिथि : २०७...../...../.....

#### प्रतिभागीकेअंगूठे के लपचेसील

दाहिना	बामा

## **ANNEX IV: PARTICIPANTS INFORMATION SHEET(ENGLISH)**

### **Participants Information Sheet**

**Tribhuvan University**

**Institute of Medicine**

**Central Department of Public Health**

#### **Greetings,**

I, Gauri Shankar Mandal, a second-year Master's degree student in Public Health Nutrition at the Central Department of Public Health under the Institute of Medicine, am conducting a research study titled "Association of diet quality, household food security, women empowerment with nutritional status of pregnant women in Janakpur sub-metropolitan". The research is being conducted as a partial requirement for my master's degree, and I would like to request your participation in this study.

**The Objective of this research;** is to assess the nutritional status of pregnant women in the Janakpur sub-metropolitan of the Dhanusha district and explore the relationship between quality diet, household food security, and women's empowerment.

**Study process of the study;** The data collection will involve the use of a structured questionnaire and MUAC tape to measure the nutritional status of pregnant women. The interview and nutritional status check will take approximately 30 to 45 minutes. The nutritional status of the participants will be measured with a tape measure on the arm.

**Benefits and risks;** There are no risks associated with this research study, and if you face any inconvenience, you can inform the researcher. While there are no direct benefits for the participants, the study will provide health education related to nutrition, and the information gathered will aid relevant stakeholders in formulating necessary policies. Participation in this study is entirely voluntary, and you have the right to refuse participation or withdraw from the study at any point.

**Privacy;** It is assured that all information collected from this study will remain confidential, and your name will not be included in the questionnaires or research reports. If you have any questions or require further information, please feel free to contact me at the address below:

Name of Researcher: Gauri Shankar Mandal

Contact No.: 9851151521

Email: [gaureeshankar2041@gmail.com](mailto:gaureeshankar2041@gmail.com)

## ANNEX V: PARTICIPANTS INFORMATION SHEET(NEPALI)

सहभागी जानकारीपत्र (नेपालीमा)  
त्रिभुवन विश्वविद्यालय  
चिकित्साशास्त्र अध्ययन संस्थान  
जनस्वास्थ्य केन्द्रीय विभाग

### नमस्कार!

मेरो नाम गौरी शंकर मण्डल हो। म हाल चिकित्सा शास्त्र अध्ययन संस्थान अन्तर्गत केन्द्रीय जनस्वास्थ्य विभागमा जनस्वास्थ्य पोषण विषयमा स्नातकोत्तर दोस्रो वर्षमा अध्ययनरतछु। म “जनकपुरधाम उप-महानगरपालिका अन्तरगतका गर्भवती महिलाहरूको पोषण स्थिति र त्यससंग सम्बन्धित कारकतत्वहरूको अध्ययन” विषयमा अनुसन्धान गर्दैछु। यो अध्ययन मेरो स्नातकोत्तर तहको डिग्रीको आंशिक पूर्तिका लागि आवश्यक छ। यसका लागि तपाईंलाई यो अनुसन्धानमा भाग लिइदिनुहुन अनुरोध गर्दछु ।

### अध्ययनको उद्देश्य:

यस अध्ययनको मुख्य उद्देश्य धनुषा जिल्लाको जनकपुरधाम उपमहानगरपालिका अन्तरगतका गर्भवती महिलाहरूको पोषण स्थिति र त्यससंग सम्बन्धित कारकतत्वहरूको लेखाजोखा गर्नु हो।

### अध्ययनको प्रक्रिया:

यस अध्ययनमा तथ्याङ्क सङ्कलनका लागि संरचित प्रश्नावली तथा गर्भवती महिलाको पोषण स्थिति मापनको लागि मुवाक टेप प्रयोग गरिनेछ। अन्तर्वार्ता र पोषण स्थिति जाँचको लागि ३० देखि ४५ मिनेटको समय लाग्नेछ। पोषण स्थिति मापनको लागि पाखुरामा मुवाक टेपले नापिनेछ।

### लाभ र जोखिम:

यस अध्ययनबाट सहभागीहरू लाई कुनै पनि किसिमको जोखिम हुनेछैन। यदि तपाईंलाई कुनै किसिमको अप्ठ्यारो परेको खण्डमा अनुसन्धानकर्तालाई सूचित गर्न सक्नुहुन्छ। तपाईंलाई कुनै पनि किसिमको प्रत्यक्ष लाभ हुनेछैन तथापि पोषण सम्बन्धि स्वास्थ्य शिक्षा प्रदान गरिनेछ। यस अध्ययनबाट सङ्कलन गरिएको जानकारीबाट सम्बन्धित सरोकारवालाहरू लाई आवश्यक नीति तर्जुमा गर्न सहयोग पुऱ्याउनेछ।

### स्वेच्छिक सहभागिता:

तपाईंको सहभागिता नितान्त स्वेच्छिक हो। तपाईंसँग सहभागिता अस्वीकार गर्ने र कुनै पनि समयमा अध्ययनमा भागलिने अस्वीकार गर्ने अधिकार छ।

### गोपनीयता:

यस अध्ययन बाट सङ्कलन गरिएका सबै जानकारीहरू गोप्य राखिनेछ। म तपाईंलाई विश्वस्त पार्न चाहन्छु कि तपाईंको नाम कुनै पनि समयमा प्रश्नावली वा अनुसन्धान प्रतिवेदनहरूमा राखिनेछैन। यदि तपाईंसँग केही प्रश्नहरू छन वा थप जानकारी आवश्यक छ भने तलको ठेगानामा सम्पर्क गर्न सक्नुहुनेछ।

सोधकर्ताको नाम : गौरी शंकर मण्डल

सम्पर्क नं.: ९८५११५१५२१

इमेल: gaureeshankar2041@gmail.com

## ANNEX VI: PARTICIPANTS INFORMATION SHEET(MAITHILI)

प्रतिभागी जानकारीपत्र (मैथिली)  
त्रिभुवन विश्वविद्यालय  
चिकित्साशास्त्र अध्ययन संस्थान  
जनस्वास्थ्य केन्द्रीय विभाग

### नमस्कार!

हमर नाम गौरी शंकर मंडल अछि। हम एखन चिकित्साविज्ञान संस्थानके अंतर्गत केंद्रीय जनस्वास्थ्य विभागमें जनस्वास्थ्य पोषणमें स्नातकोत्तरके दोसर वर्षमें पढ़ाई करहलछी। हम "जनकपुरधाम उप-महानगरपालिकामे गर्भवती महिलाके पोषणके स्थिति आ ओईस सम्बन्धित कारकतत्वसभक अध्ययन " पर शोध करहल छी। हमर मास्टर डिग्रीके आंशिक पूर्तिके लेल ई अध्ययन आवश्यक अछि। एकरा लेल हम आग्रह करैतछी जे एहि शोधमे भागली।

### अध्ययनके उद्देश्य:

एहि अध्ययनक मुख्य उद्देश्य धनुषा जिलाक जनकपुरधाम उप-महानगरपालिकामे गर्भवती महिलाक पोषणक स्थिति आ ओईस संबंधित कारकतत्वसभक जायजा लेबक अछि।

### अध्ययन प्रक्रिया:

अइ अध्ययनमे आंकड़ासं ग्रहणके लेल संरचित प्रश्नावलीके उपयोग कैल जेतय आ गर्भवती महिलाके पोषणके स्थितिके मापके लेल मुवाक टेपके उपयोग कैल जेतय | साक्षात्कार आ पोषणके स्थितिके जांचमे ३० सं ४५ मिनटके समय लागत | पोषणके स्थितिके मापके लेल बांह पर मुवाक टेपसं माप कैल जेतय |

### लाभ आजोखिम:

एहि अध्ययनस प्रतिभागीके कोनो जोखिम नहि होएत। अगर अहांके कोनो तर हक असुविधाके सामना करय पड़य त अहां शोधकर्ताके सूचित कसकयछी | अहांके कोनो प्रत्यक्ष लाभ नहि भेटतय, तथापि पोषणसं संबंधित स्वास्थ्य शिक्षाके व्यवस्था कैलजेतय | अइ अध्ययनसं एकत्रित जानकारी संबंधित हितधारकके आवश्यक नीति बनावामे मदद करतय |

### स्वैच्छिक सहभागिता:

अहाँक सहभागिता सख्त स्वैच्छिक अछि। अहांके कोनो समय भागीदारीसं मनाकरयके आ अध्ययनमे भागलेवासं मनाकरयके अधिकार अछि।

### गोपनीयता:

एहि अध्ययनसं एकत्रित सभ जानकारी गोपनीय राखल जाएत | हम अहांसभके विश्वास दिलाबय चाहयछी जे अहांसभ केना कोनो समय प्रश्नावली आ शोधरिपोर्टमे शामिल नहि होएत | अगर अहांके कोनो सवाल अछि आ बेसि जानकारीके जरूरत अछि त अहां नीचा देलगेल पताप संपर्क कसकयछी |

सोधकर्ताकेनाम :गौरी शंकर मण्डल

सम्पर्क न.: ९८५११५१५२१

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## ANNEX VII: ENGLISH QUESTIONNAIRE

Code No: \_\_\_\_\_

Interview date (YYYY-MM-DD): \_\_\_\_\_, Time (current): \_\_\_\_\_:

1.	Municipality	3. FCHV Name	
2.	Ward no.		
<b>A. SOCIODEMOGRAPHIC/ SOCIOECONOMIC INFORMATION</b>			
<b>Q. No.</b>	<b>QUESTIONS AND FILTERS</b>	<b>CATEGORIES AND CODE</b>	<b>SKIP TO</b>
SD1	What is your Caste/Ethnicity?	Terai dalit.....1 Terai janajati.....2 Terai brahmin/chhetri.....3 Muslim.....4 Other Terai Caste.....5 Hill dalit.....6 Hill janjati.....7 Hill brahmin/chhetri.....8 Newar.....9 Other( <b>Specify</b> ).....10	
SD2	In what month and year were you born?	Month..... <input type="text"/> <input type="text"/> Don't know month.....9 Year..... <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Don't know the year.....99	
SD3	How old were you on your last birthday? <b>(COMPLETE AND CORRECT SD2 AND/OR SD3 IS INCONSISTENT)</b>	Completed Year..... <input type="text"/> <input type="text"/>	
SD4	What is your current marital status?	Currently married.....1 Single.....2 Divorced/Separated.....3 Widowed.....4	
SD5	What is the type of family in which you live? <b>(CLASSIFY ACCORDING TO THEIR LIVING FAMILY MEMBERS)</b> <b>(PROBE WITH, WITH WHOM YOU LIVE?)</b>	Nuclear family.....1 Single-parent family.....2 Joint or Extended family.....3	
SD6	How many members in your family?	<input type="text"/> <input type="text"/>	
SD7	Can you read and write?	Yes.....1 No.....2	
SD8	Have you ever attended school?	Yes.....1 No.....2 → SD10	



SD9	What is the highest grade you have completed? <b>(1-12, Bachelor, Masters and above)</b>	.....	
SD10	Can your husband read and write?	Yes.....1 No.....2	
SD11	Have your husband ever attended school?	Yes.....1 No.....2 →	SD17
SD12	What is the highest grade your husband completed? <b>(1-12, Bachelor, Masters and above)</b>	.....	
SD13	What is your occupation? <b>(MULTI ANSWER)</b>	Housewife.....1 Agriculture (unpaid).....2 Agriculture (paid).....3 Business (self-run).....4 Business (family business – only support).....5 Jobs and services (public or private).....6 Others <b>(Specify)</b> .....7	
SD14	What is your husband's occupation? <b>(MULTI ANSWER)</b>	Agriculture (unpaid).....1 Agriculture (paid).....2 Business.....3 Foreign Employment.....4 Jobs and services (public or private).....5 Others <b>(Specify)</b> .....6	
SD15	How many times have you been pregnant? (Gravida)	First.....1 Second.....2 Third.....3 Fourth.....4 Five and above.....5	
SD16	The number of existing children from you? <b>(Don't include adopted children)</b>	<input type="text"/> <input type="text"/>	

**B. WOMEN EMPOWERMENT**

<b>Q. No.</b>	<b>QUESTIONS AND FILTERS</b>	<b>CATEGORIES AND CODE</b>	<b>SKIP TO</b>
WE1	Do you own land or other significant assets?	Alone only.....1 Jointly only.....2 Both jointly and alone.....3 Does not own.....4	
WE2	Do you own a bank account?	Yes.....1 No.....2	
WE3	Do you own a mobile phone?	Yes.....1 No.....2	

WE4	Do you have access to social media like Facebook, TikTok, YouTube, etc. <b>(Don't include imo, WhatsApp or other messenger)</b>	Yes.....1 No.....2	
WE5	Who usually makes decisions about healthcare for yourself in your household?	Wife.....1 Husband.....2 Both (husband and wife).....3 Father in law .....4 Mother in law .....5 Others (Specify).....6	
WE6	Who usually makes decisions about major household purchases in your household?	Wife.....1 Husband.....2 Both (husband and wife).....3 Father in law .....4 Mother in law .....5 Others (Specify).....6	
WE7	Who usually makes decisions about Visits to their family or relatives in your household?	Wife.....1 Husband.....2 Both (husband and wife).....3 Father in law .....4 Mother in law .....5 Others (Specify).....6	

**C. HOUSEHOLD FOOD SECURITY**

<b>Q. No.</b>	<b>QUESTIONS AND FILTERS</b>	<b>CATEGORIES AND CODE</b>	<b>SKIP TO</b>
FS1	In the past 12 months, how frequently did you worry that your household would not have enough food?	Never.....1 Rarely.....2 Sometimes.....3 Often.....4	
FS2	In the past 12 months, how often were you or Is any household member not able to eat the kinds of foods you preferred because of a lack of resources?	Never.....1 Rarely.....2 Sometimes.....3 Often.....4	
FS3	In the past 12 months, how often did you or any household member have to eat a limited variety of foods due to a lack of resources?	Never.....1 Rarely.....2 Sometimes.....3 Often.....4	
FS4	In the past 12 months, how often did you or any household member have to eat some food that you really did not want to eat because of a lack of resources to obtain other types of food?	Never.....1 Rarely.....2 Sometimes.....3 Often.....4	
FS5	In the past 12 months, how often did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	Never.....1 Rarely.....2 Sometimes.....3 Often.....4	
FS6	In the past 12 months, how often did you or any household member eat fewer meals in a day because of lack of resources to get food?	Never.....1 Rarely.....2 Sometimes.....3 Often.....4	

FS7	In the past 12 months, how often was there no food to eat of any kind in your household because of lack of resources to get food?	Never.....1 Rarely.....2 Sometimes.....3 Often.....4	
FS8	In the past 12 months, how often did you or any household member go to sleep at night hungry because there was not enough food?	Never.....1 Rarely.....2 Sometimes.....3 Often.....4	
FS9	In the past 12 months, how often did you or any household member go a whole day and night without eating anything because there was not enough food?	Never.....1 Rarely.....2 Sometimes.....3 Often.....4	
<b>D. KNOWLEDGE AND BEHAVIOUR</b>			
<b>Q. No.</b>	<b>QUESTIONS AND FILTERS</b>	<b>CATEGORIES AND CODE</b>	<b>SKIP TO</b>
KB1	How many months pregnant are you? <b>(RECORD NUMBER OF COMPLETED MONTHS)</b>	Months..... <input type="text"/> <input type="text"/>	
KB2	Are there any foods in your home that cultural beliefs and norms prevent you from eating while pregnant?	Yes .....1 No.....2	→ KB5
KB3	Which foods have been banned to eat since pregnancy?	1..... 2..... 3..... 4.....	
KB4	Why are these foods forbidden to eat during pregnancy? <b>(PROBE THE REASON)</b>	1..... 2..... 3..... 4.....	
KB5	Do you believe in hot and cold foods?	Yes.....1 No.....2	
KB6	Who does household chores like cooking in your house?	Husband.....1 Wife (Respondent).....2 Both (Husband and wife).....3 Other family members.....4	
KB7	When your family takes breakfast, lunch and dinner, who eats first?	Male members.....1 Female members.....2 Rules based on seniority .....3 Anybody can/ no specific rules.....4	
KB8	Do you believe that pregnant women should not cross river or they should not wander in community?	Yes.....1 No.....2	
KB9	How should a pregnant woman eat in comparison to a non-pregnant woman?	Eat more food each day.....1 Eat more times each day.....2 Eat more foods and more times each day .....3 Eat only what she craves.....4 The same as in non-pregnant women.....5	
KB10	Have you heard about iron rich food?	Yes.....1 No.....2	
KB11	If yes, can you tell me the source of iron rich food? <b>(Major sources only)</b>	1.....2..... 3.....4.....	

KB12	Have you heard about calcium rich food?	Yes .....1 No.....2	
KB13	Can you tell me the source of calcium rich food? (MAJOR SOURCES ONLY)	1.....2..... 3.....4.....	

**E. 24h Recall and Anthropometric measurement**

**ID:** \_\_\_\_\_

The following questions refer to the past 24 hours, starting from the previous day.

Date: \_\_\_\_\_, day of week: \_\_\_\_\_, time: \_\_\_\_\_: \_\_\_\_\_

**DQ1. 24hr Recall**

Quick list	Time	Place eaten	Description of food or drink	Brand	Total amount (Unit)	Amount of leftovers (unit)	Amount consumed (unit)	Weight equivalent (g)
Morning Tea and Snacks								
Breakfast								
Lunch								
Dinner								
Q. No.	QUESTIONS AND FILTERS		CATEGORIES AND CODE	Q. No.	QUESTIONS AND FILTERS		CATEGORIES AND CODE	
DQ2.	Do you drink alcohol?		Yes.....1 No.....2	DQ3.	Are you a vegetarian?  (If the response is vegetarian,		Vegan.....1 Lacto-vegetarian.....2 Ovo-vegetarian.....3 Non-vegetarian.....4	

				also check the types of vegeterian)	
DQ4.	Was your food intake unusual? If yes, how was it unusual? (If no skip to ques. No. AM1)	Yes.....1 No.....2	DQ5.	Are you sick?	Yes.....1 No.....2
DQ6.	If yes, did sickness affect appetite?	Yes.....1 No.....2	DQ7.	If sickness affects hunger, then how?	Increase appetite.....1 Decrease appetite.....2
DQ8.	Was it a feast/party day?	Yes.....1 No.....2	DQ9.	Was it a fasting day?	Yes.....1 No.....2
DQ10.	Was it a market day?	Yes.....1 No.....2			
Anthropometric measurementof pregnant women					
AM1.	MUAC of Pregnant women	.....cm			

## ANNEX VIII: NEPALI QUESTIONNAIRE

अन्तरवार्ता मिति:.....(बर्ष -महिना -दिन), बर्तमान समय..... सङ्केत संख्या:.....

१.	उप-महानगरपालिका: जनकपुरधाम	३. महिला स्व. सेविकाको नाम:	
२.	वडा नं.:		
<b>समूह क: सामाजिक- जनसंख्याकिय र सामाजिक आर्थिक बिबरण</b>			
प्र. सं.	प्रश्नहरू र कैफियत	समूह तथा श्रेणी र सङ्केत	अर्को प्रश्नमा जानुहोस
स.१	तपाईं कुन जात/जातिमा पर्नुहुन्छ?	तराई दलित.....१ तराई जनजाति.....२ तराई ब्राह्मीन/ क्षेत्री.....३ मुस्लिम.....४ अन्य तराई जाति.....५ पहाड दलित .....६ पहाड जनजाति .....७ पहाड ब्राह्मीन/ क्षेत्री .....८ नेवार.....९ अन्य (उल्लेख गर्नुहोस).....१०	
स.२	तपाईं कुन महिना र सालमा जन्मनु भएको थियो?	महिना..... <input type="text"/> <input type="text"/> महिना थाह छैन .....९ <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> बर्ष..... बर्ष थाह छैन.....९९	
स.३	तपाईंको अन्तिम जन्मदिनमा, तपाईं कति वर्षको हुनुहुन्थ्यो? (प्रश्न स.२ र/वा स.३ गलत भएमा पूर्ण र सही गर्नुहोस)	पुरा भएको बर्ष..... <input type="text"/> <input type="text"/>	
स.४	तपाईंको हालको वैवाहिक स्थिति के हो ?	हाल विवाहित.....१ एकल.....२ सम्बन्धविच्छेद भएको/विछोडिएको.....३ विधवा.....४	
स.५	तपाईं परिवारमा को-को संग बस्नुहुन्छ? (तिनीहरू बस्ने परिवारका सदस्यहरूको आधारमा वर्गीकरण गर्नुहोस)	एकल परिवार.....१ एउटा आमा वा बुवा र छोरा छोरी भएको परिवार.....२ संयुक्त वा बृहत परिवार.....३	

स.६	तपाईको परिवारमा कति सदस्यहरु छन्?		
स.७	के तपाई पढ्न र लेख्न सक्नुहुन्छ ?	हो.....१ होइन.....२	
स.८	के तपाई कहिल्यै बिद्घालय जानुभएको छ?	हो.....१ होइन.....२	→ स.१०
स.९	तपाईले उच्चतम कति कक्षा/ग्रेड पुरा गर्नुभएको छ? (१-१२, स्नातक, स्नातकोत्तर वा सो भन्दा माथि)	.....	
स.१०	के तपाईको श्रीमान पढ्न र लेख्न सक्नुहुन्छ ?	हो.....१ होइन.....२	
स.११	के तपाईको श्रीमान कहिल्यै बिद्घालय जानुभएको छ?	हो.....१ होइन.....२	→ स.१३
स.१२	तपाईको श्रीमानले उच्चतम कति कक्षा/ग्रेड पुरा गर्नुभएको छ? (१-१२, स्नातक, स्नातकोत्तर वा सो भन्दा माथि)	.....	
स.१३	तपाई कुन काम गर्नुहुन्छ? (बहुउत्तर)	गृहिणी.....१ कृषि (ज्वाला नपाउने).....२ कृषि (ज्वाला पाउने) .....३ ब्यबसाय/व्यापार (आफै संचालन गरेको)..४ व्यवसाय/व्यापार (पारिवारिक व्यवसाय सहयोग मात्रै गरेको).....५ नोकरीवा सेवा)सार्वजनिक वा निजी(.....६ अन्य (उल्लेख गर्नुहोस).....७	
स.१४	तपाईको श्रीमानले कुन काम गर्नुहुन्छ ? (बहुउत्तर)	कृषि (ज्वाला नपाउने).....१ कृषि (ज्वाला पाउने).....२ ब्यबसाय/व्यापार.....३ नोकरीवा सेवा)सार्वजनिक वा निज.....४ बैदेशिक रोजगारी.....५ अन्य(उल्लेख गर्नुहोस).....६	
स.१५	तपाई यो गर्भवती भएको कतिऔं पटकको हो ?	पहिलो.....१ दोस्रो.....२ तेस्रो.....३ चौथो.....४ पाँचौ र सो भन्दा माथि.....५	

स.१६	तपाईंको कति जना छोराछोरीहरू छन् ? (धर्मपुत्र बच्चाहरू समावेश नगर्नुहोस)		
<b>समुह ख. महिला सशक्तिकरण</b>			
प्र. संख्या	प्रश्नहरू र कैफियत	समुह तथा श्रेणी र सङ्केत	अर्को प्रश्नमा जानुहोस
म.१	के तपाईंसँग जग्गा वा अन्य महत्वपूर्ण सम्पत्ति छ ?	एकल मात्र.....१ संयुक्त रूपमा मात्र.....२ संयुक्त र एकल दुवै.....३ स्वामित्व छैन.....४	
म.२	के तपाईंको आफ्नो बैंक खाता छ ?	छ .....१ छैन.....२	
म.३	के तपाईंको आफ्नो मोबाइल फोन छ?	छ .....१ छैन.....२	
म.४	के तपाईंको फेसबुक, टिकटक, यूट्यूब, आदि जस्ता सामाजिक सञ्जालहरूमा पहुँच छ ? (वाट्स एप, इमो अथवा अन्य मेसेन्जर समावेश नगर्नुहोस)	छ .....१ छैन.....२	
म.५	तपाईंको परिवारमा तपाईंको स्वास्थ्य सेवाको बारेमा सामान्यतया कसले निर्णय गर्छ ?	तपाईं आफै.....१ श्रीमान्.....२ दुवैजना (श्रीमान, श्रीमती).....३ अन्य (उल्लेख गर्नुहोस).....४	
म.६	तपाईंको घरमा हुने प्रमुख घरायसी खरिदहरूको बारेमा सामान्यतया कसले निर्णय गर्छ?	तपाईं आफै.....१ श्रीमान्.....२ दुवैजना (श्रीमान, श्रीमती).....३ अन्य (उल्लेख गर्नुहोस) .....४	
म.७	तपाईंको परिवार वा आफन्तहरूलाई भेट्ने बारे सामान्यतया कसले निर्णय गर्छ?	तपाईं तपाईं आफै.....१ श्रीमान्.....२ दुवैजना (श्रीमान, श्रीमती).....३ अन्य (उल्लेख गर्नुहोस) .....४	



समुहग.घरेलु खाद्य सुरक्षा			
प्र . संख्या	प्रश्नहरू र कैफियत	समुहतथाश्रेणी र सङ्केत	अर्कोप्रश्न माजानुहोस
खा.१	विगत १२ महिनामा, तपाईंको घरमा पर्याप्त खाना नपाउने भनेर तपाईंले कति पटकचिन्ता गर्नुभयो?	कहिल्यै .....१ विरलै.....२ कहिले.....३ धेरैज.....४	
खा.२	विगत १२ महिनामा, तपाईं वा घरका कुनै सदस्यले स्रोतको अभावमा कति पटक आफूले मनपर्ने खानेकुरा खान पाएनन् ?	कहिल्यै .....१ विरलै.....२ कहिले.....३ धेरैज.....४	
खा.३	विगत १२महिनामा, तपाईं वा घरको कुनै सदस्यले स्रोतको अभावका कारण कति पटक सीमित किसिमका खानेकुरा खानुपन्थो ?	कहिल्यै .....१ विरलै.....२ कहिले.....३ धेरैज.....४	
खा.४	विगत १२ महिनामा, तपाईं वा घरका कुनै सदस्यले अन्य प्रकारका खानेकुराहरू प्राप्तगर्नका लागि स्रोतको अभावका कारण तपाईंले वास्तवमै खान नचाहेको खानेकुरा कति पटक खानुपन्थो?	कहिल्यै .....१ विरलै.....२ कहिले.....३ धेरैज.....४	
खा.५	विगत १२महिनामा, तपाईं वा घरका कुनै सदस्यले पर्याप्त खाना नभएको कारण आफूलाई महसुस भएको आवश्यक खाना भन्दा कति पटक थोरै खाना खानुपरेको थियो ?	कहिल्यै .....१ विरलै.....२ कहिले.....३ धेरैज.....४	
खा.६	विगत १२महिनामा, तपाईं वा घरको कुनै सदस्यले खाना पाउनको लागि स्रोतको अभावमा दिनमा कति थोरै पटक खाना खानुभयो?	कहिल्यै .....१ विरलै.....२ कहिले.....३ धेरैज.....४	
खा.७	विगत १२ महिनामा, कति पटक तपाईंको घरमा खाना पाउन स्रोतको अभावमा खाना खानको लागि कुनै पनि प्रकारको खानाथिएन ?	कहिल्यै .....१ विरलै.....२ कहिले.....३ धेरैज.....४	

खा.८	विगत 12महिनामा, पर्याप्त खाना नभएको कारण तपाईं वा घरको कुनै सदस्य राती भोके सुत्नुभयो?	कहिल्यै .....१ विरलै.....२ कहिले.....३ धेरैज.....४	
खा.९	विगत १२ महिनामा, पर्याप्त खानेकुरा नभएको कारण तपाईं वा घरका कुनै सदस्यले केहि नखाइकन दिन रात कति पटक बिताउनु भयो ?	कहिल्यै .....१ विरलै.....२ कहिले.....३ धेरैज.....४	
<b>समूह घ. ज्ञान र ब्यबहार</b>			
प्र . संख्या	प्रश्नहरु र कैफियत	समुहतथाश्रेणी र सङ्केत	अर्कोप्रश्न माजानुहोस
जा.१	तपाईं कति महिनाको गर्भवती हुनुभयो?	महिना ..... <input type="text"/> <input type="text"/>	
जा.२	के तपाईंको घरमा कुनै खाद्य पदार्थहरु सांस्कृतिक विश्वास र मापदण्डहरुको कारणले तपाईं गर्भवती भएदेखि खान रोक लगाएको छ ?	छ.....१ छैन .....२	→ जा. ५
जा.३	गर्भवती भएदेखि कुनकुन खानेकुरा खानमा रोक लगाइएको छ ?	१..... २..... ३..... ४.....	
जा.४	गर्भावस्थामा यी खानेकुराहरु किन खान रोकलगाइएको हो ? <b>(कारण छानबिन गर्नुहोस)</b>	१..... २..... ३..... ४.....	
जा.५	के तपाईं तातो र चिसो खानामा विश्वास गर्नुहुन्छ ?	गर्छु .....१ गर्दिन.....२	
जा.६	तपाईंको घरमा खाना पकाउने जस्ता घराइसी कामहरु कसले गर्छन् ?	श्रीमान.....१ श्रीमति(उत्तरदाता).....२ दुबैजना(श्रीमान श्रीमति).....३ परिवारका अन्य सदस्यहरु.....४	
जा.७	तपाईंको परिवारमा बिहानको खाजा, दिउँसो र बेलुकाको खाना खाँदा पहिले क-कसले खान्छ ?	पुरुष सदस्यहरु.....१ महिला सदस्यहरु.....२ जो कोहिले खान सक्छ.....३	
जा.८	के तपाईं गर्भवती महिलाहरुले खोला तर्नुहुँदैन वा समुदायमा घुम्नहुँदैन भन्नेकुरामा विश्वास गर्नुहुन्छ ?	गर्छु .....१ गर्दिन .....२	

जा.९	अन्य महिलाको तुलनामा गर्भवती महिलाले खाना कसरी खानुपर्दछ ?	हरेक दिन धेरै खाना खाने.....१ हरेक दिन धेरै पटक खाने.....२ आफूले चाहेको मात्रै खाने .....३ गैर गर्भवती जस्तै खाने.....४ अन्य (उल्लेख गर्ने).....५	
जा.१०	के तपाईंले आइरन युक्त खानाको बारेमा सुन्नुभएको छ ?	छ.....१ छैन .....२	
जा.११	के तपाईं मलाई आइरनयुक्त खानाको स्रोत बताउन सक्नुहुन्छ ? (प्रमुख स्रोतहरू मात्र)	१.....२..... ३.....४.....	
जा.१२	के तपाईंले क्याल्सियमयुक्त खानाको बारेमा सुन्नुभएको छ ?	छ .....१ छैन .....२	
जा.१३	के तपाईं मलाई क्याल्सियमयुक्त खानाको स्रोत बताउन सक्नुहुन्छ ?	१.....२..... ३.....४.....	

निम्नप्रश्नहरूलेअघिल्लोदिनबाटसुरुभएकोगत २४ घण्टालाई जनाउँछ। मिति: \_\_\_\_\_, दिन: \_\_\_\_\_, समय: \_\_\_\_\_:

गु. आ.१ २४ घण्टे सम्झना ।

द्रुत सूची	समय	खाए को ठाउँ	खाना वा पेय पदार्थको बिबरण	ब्रा न्ड	जम्मा परिमाण (इकाई)	शेष परिमाण (इकाई)	खाएको परिमाण (इकाई)	तौल बराबर (ग्राम)
बिहानको चिया र खाजा								
बिहानको खाना								

दिउँसोको चिया र खाजा								
रातिको खाना								
प्र. संख्या	प्रश्नहरू र कैफियत	समुह तथा श्रेणी र सङ्केत	प्र. सं ख्या	प्रश्नहरू र कैफियत	समुह तथा श्रेणी र सङ्केत			
गुआ२.	के तपाईं जाँड रक्सि खानुहुन्छ ?	खान्छु .....१ खाँदिन.....२	गुआ ३.	के तपाईं शाकाहारी हुनुहुन्छ ? (यदि प्रक्रिया शाकाहारी हो भने शाकाहारीको जाँच गर्नुहोस)	पूर्ण शाकाहारी(दुध पनि नखाने)...१ ल्याकटो-शाकाहारी(दुध दहि खाने).२ ओवो- शाकाहारी(अन्डा खाने).....३ मांसाहारी.....४			
गुआ४.	के तपाईंको खाना सेवन असामान्य थियो? (होइन भने प्र. संख्या पो.१ मा जानुहोस)	थियो .....१ थिएन.....२	गुआ ५.	के तपाईं बिरामी हुनुहुन्छ ?	हो.....१ होइन.....२			
गुआ६.	यदि हो भने, के रोगले भोकलाई असर गर्छ ?	गर्छ .....१ गरेन.....२	गुआ ६.	यदि रोगले भोकले असर गर्छ, भने कसरी ?	भोकमा बृद्धि.....१ भोकमा कमि.....२			
गुआ८.	के यो एक भोज/पार्टीको दिन थियो ?	थियो .....१ थिएन.....२	गुआ ९.	के यो उपवास/बर्तको दिन थियो ?	थियो .....१ थिएन.....२			
गुआ१०.	के यो बजारको दिन थियो ?	थियो .....१ थिए.....२						
<b>गर्भवती महिलाको पोषण स्थिति</b>								
पो.१	गर्भवती महिलाको MUAC जाँच		.....से.मि.					

## ANNEX IX: MAITHILI QUESTIONNAIRE

साक्षात्कारक तिथि..... (बर्ष -महिना -दिन), समय:.....

सङ्केत संख्या:

१.	उप-महानगरपालिका: जनकपुरधाम	३. महिला स्व. सेविकाके नाम:	
२.	वाड न.:		
<b>अनुभाग क: सामाजिक-जनसांख्यिकीय/ सामाजिक आर्थिक सूचना</b>			
प्र. संख्या	प्रश्न आ गुणवत्ता	समूह अथवा श्रेणी आ संकेत	अगिला प्रश्न पर जाउ
स.१	अंहा कोन जातिमे परैछी ?	तराई दलित.....१ तराई जनजाति.....२ तराई ब्राह्मण/ क्षेत्री.....३ मुसलमान.....४ अन्य तराई जाति.....५ पहाड़ी दलित .....६ पहाड़ी जनजाति .....७ पहाड़ी ब्राह्मण/ क्षेत्री .....८ नेवार.....९ अन्य (निर्दिष्ट करु).....१०	
स.२	अहाँ के जन्म कोन मास आ साल मे भेल छल ?	मास ..... <input type="text"/> <input type="text"/> मास नहि बुझल अछि.....९ साल..... <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> साल नहि बुझल अछि.....९९	
स.३	अहाँक अंतिम जन्मदिन पर अहाँक उम्र कतेक छल ?  (प्रश्न स. २ आ / अथवा प्रश्न स. ३ अगर गलत अछि त पूर्ण आ सहि करु)	पुरा भेल उम्र..... <input type="text"/> <input type="text"/>	
स.४	अहाँक वर्तमान वैवाहिक स्थिति की अछि ?	बर्तमानमे विवाहित.....१ एकल.....२ तालकशुदा/ अलग भेल .....३ विधवा.....४	

स.५	अंहा परिवार मे केकरा सभसंगे रहैत छी ? (परिवारक सदस्यक आधार पर वर्गीकरण करु जकरा संग ओ रहैत छथि)	एकल परिवार.....१ एकटा माय वा बाप आ बच्चा रहवाला परिवार.....२ संयुक्त वा बिस्तारित परिवार.....३	
स.६	अहाँक परिवार मे कतेक सदस्य अई ?	<input type="text"/>	
स.७	की अहाँ पढ़ि-लिखि सकैत छी ?	हँ.....१ नहि.....२	
स.८	की अहाँ कहियो स्कूल गेल छी ?	हँ.....१ नहि.....२	स.१० →
स.९	अहाँसबसँ बेसी कतेक क्लास/ग्रेड पूरा केने छि? (१-१२, स्नातक, स्नातकोत्तर वा ओहिसँ बेसी)	.....	
स.१०	की अहाँक पति पढ़ि-लिखि सकैत छथि ?	हँ.....१ नहि.....२	
स.११	की अहाँक पति कहियो स्कूल गेल छथि ?	हँ.....१ नहि.....२	स.१३ →
स.१२	अहाँक पति सबसँ बेसी कतेक क्लास/ग्रेड पूरा केने छथि ? (१-१२, स्नातक, स्नातकोत्तर वा ओहिसँ बेसी)	.....	
स.१३	अहाँ कोन काज करैत छी ? (बहुउत्तर)	गृहिणी.....१ कृषि (बोइन नहि मिलवाला).....२ कृषि (बोइन मिलवाला).....३ व्यवसाय/व्यापार (स्वयं संचालित).....४ ब्यवसाय/व्यापार (परिवारक व्यवसाय- सहायता मात्र).....५ नौकरी या सेवा (सरकारी या निजी).....६ अन्य (निर्दिष्ट करु).....७	

स.१४	अहाँक पति कोन काज करैत छथि ? <b>(बहुउत्तर)</b>	कृषि (बोइन नहि मिलवाला).....१ कृषि (बोइन मिलवाला).....२ व्यवसाय/व्यापार.....३ नौकरी या सेवा (सरकारी या निजी).....४ बिदेशी रोजगार.....५ अन्य (निर्दिष्ट करु).....६	
स.१५	अहाँक यी गर्भवती भेल कई बेरके अछि ?	पहिल.....१ द्वितीय.....२ तेसर.....३ चारिम.....४ पाँचम आ ओहिसँ ऊपर .....५	
स.१६	अहाँक कतेक बच्चा अछि ?	<input type="text"/>	
<b>ख. महिला सशक्तिकरण</b>			
<b>प्र. संख्या</b>	<b>प्रश्न आ गुणवत्ता</b>	<b>समूह अथवा श्रेणी आ संकेत</b>	<b>अगिला प्रश्न पर जाउ</b>
म.१	की अहाँक पास जमीन वा अन्य महत्वपूर्ण संपत्ति अछि ?	असगर मात्र.....१ संयुक्त रूप सँ मात्र.....२ असगर आसंयुक्त दुनू.....३ कोनो स्वामित्व नहि.....४	
म.२	की अहाँक अपन बैंक खाता अछि ?	हँ.....१ नहि.....२	
म.३	की अहाँक अपन मोबाइल फोन अछि ?	हँ.....१ नहि.....२	
म.४	की अहाँक फेसबुक, टिकटोक, यूट्यूब, आदि सोशल नेटवर्क तक पहुंच अछि ? (व्हाट्सएप, ईमो या अन्य मैसेंजर के शामिल नै करु)	हँ.....१ नहि.....२	
म.५	अहाँक परिवार मे आमतौर पर अहां केँ स्वास्थ्य देखभाल केँ बारे मे निर्णय के करएयत अछि ?	अपने सँ.....१ पति.....२ दुनु कोइ (पति, पत्नी).....३ अन्य (निर्दिष्ट करु).....४	
म.६	अहाँक परिवार मे आमतौर पर घरक केँ पैघ खरीदारी केँ बारे मे निर्णय केँ लेत अछि ?	अपने सँ.....१ पति.....२ दुनु कोइ (पति, पत्नी).....३ अन्य (निर्दिष्ट करु).....४	

म.७	अहाँक परिवार मे आमतौर पर परिवार या रिश्तेदारक सं भेंट करय के बारे मे निर्णय के लेत अछि ?	अपने सँ.....१ पति.....२ दुनु कोइ (पति, पत्नी).....३ अन्य (निर्दिष्ट करु).....४	
<b>ग. घरेलू खाद्य सुरक्षा</b>			
प्र . संख्या	प्रश्न आ गुणवत्ता	समूह अथवा श्रेणी आ संकेत	अगिला प्रश्न पर जाउ
खा.१	पिछला १२ महीनामे अहाँके कतेक बेर चिंता भेल जे घरमे पर्याप्त भोजन नहि अछि ?	कहियो .....१ शयादे कहियो .....२ कहियो कहियो.....३ बेसीकाल.....४	
खा.२	पिछला १२ महीना मे कतेक बेर संसाधनक कमी के कारण अहां या घर के कोनो सदस्य अपना पसंद के खाद्यपदार्थ नहि खा सकलहुं ?	कहियो .....१ शयादे कहियो .....२ कहियो कहियो.....३ बेसीकाल.....४	
खा.३	पिछला १२ महीना मे कतेक बेर संसाधनक कमी के कारण अहां या घरके के कोनो सदस्य के सीमित किस्म के खाद्य पदार्थ खाएय पड़ल ?	कहियो .....१ शयादे कहियो .....२ कहियो कहियो.....३ बेसीकाल.....४	
खा.४	पिछला १२ महीना मे कतेक बेर अन्य प्रकार के भोजन प्राप्त करय के लेल संसाधनक कमीके कारण अहां या अहां के घर के कोनो सदस्य के एहन भोजन करय पड़ल जे अहां के वास्तव मे खाएय के इच्छा नहि छल ?	कहियो .....१ शयादे कहियो .....२ कहियो कहियो.....३ बेसीकाल.....४	
खा.५	पिछला १२ महीना मे अहां या घर के कोनो सदस्य पर्याप्त भोजन नहि भेलाक कारण कतेक बेर अहां के जरूरत के हिसाब सं कम खाएल गेलय ?	कहियो .....१ शयादे कहियो .....२ कहियो कहियो.....३ बेसीकाल.....४	
खा.६	पिछला १२ महीना मे संसाधनक कमी के कारण दिन मे कतेक कम बेर अहां या घर के सदस्य भोजन केलहुं ?	कहियो .....१ शयादे कहियो .....२ कहियो कहियो.....३ बेसीकाल.....४	



खा.७	पिछला १२ महीना मे कतेक बेर खाद्य संसाधन के कमी के कारण अहां के घर मे खाय लेल कोनो तरहक भोजन नहि छल ?	कहियो .....१ शयादे कहियो .....२ कहियो कहियो.....३ बेसीकाल.....४	
खा.८	पिछला १२ महीना मे पर्याप्त भोजन नहि भेलाक कारण अहां या घर के कोनो सदस्य राति मे भूखल सुतय गेल छलहुं ?	कहियो .....१ शयादे कहियो .....२ कहियो कहियो.....३ बेसीकाल.....४	
खा.९	पिछला १२ महीना मे पर्याप्त भोजन नहि भेलाक कारण कतेक बेर अहां या अहां के घर के कोनो सदस्य बिना किछु खयने दिन-राती बितेने छै ?	कहियो .....१ शयादे कहियो .....२ कहियो कहियो.....३ बेसीकाल.....४	

**घ. ज्ञान र ब्यबहार**

प्र . संख्या	प्रश्न आ गुणवत्ता	समूह अथवा श्रेणी आ संकेत	अगिला प्रश्न पर जाउ
जा.१	अँहा कतेक मासक गर्भवती छी ?	..... <input type="text"/> <input type="text"/>	
जा.२	की अहाँकेँ घरमे कोनों एहन खाद्य पदार्थ छै जेकरा सांस्कृतिक मान्यता आ मानदंड के कारण गर्भवती भेलाक बाद सं अहाँकेँ खाएय केँ अनुमति नहि देल गेल छै ?	हँ .....१ नहि .....२	जा.५ →
जा.३	गर्भावस्था सं कोन-कोन खाद्यपदार्थ पर रोक लगादेल गेल अछि ?	१.....२..... ३.....४.....	
जा.४	गर्भावस्था मे इ खाद्यपदार्थ सभकेँ सेवन सं मनाही कियाक कयने छै ?	१.....२..... ३.....४.....	
जा.५	की अंहा गरम ठण्डा भोजनमे बिश्वास करैत छि ?	हँ.....१ नहि.....२	

जा.६	अहाँ के घर मे खाना बनाबय सन घरक काज के करैत अछि ?	पति .....१ पत्नी (उतरदाता).....२ दुनु कोइ (पति पत्नी).....३ परिवारके दोसर सदस्य .....४	
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जा.७	जखन अहाँक परिवार जलखै, दुपहरक आ रातुक भोजन करैत अछि तखन पहिने के खाइत अछि ?	पुरुष सदस्यसभ.....१ स्त्री सदस्यस.....२ कियो खासकैत अछि (कोनो नियम नई).....३	
जा.८	की अहां केँ माननाय छै की गर्भवती महिलाक केँ नदी पार नहि करबाक चाही आ नहि समाज मे घुमबाक चाही ?	हँ.....१ नह.....२	
जा.९	अन्य महिलाक केँ तुलना मे गर्भवती महिला केँ कोना खाना चाही ?	रोज खूब भोजन करके चा.....१ दिनमे बहुत बेर भोजन करके चाही.....२ जे चाहीसे मात्र खाइक.....३ गैर गर्भवती व्यक्तिजकाँ भोजन करके चाही.....४ अन्य (निर्दिष्ट करु).....५	
जा.१०	की अहाँ आयरन सं भरपूर खाद्य पदार्थक नाम सुनने छी ?	हँ.....१ नह.....२	
जा.११	की अंहा आइरन सं भरपूर भोजनक स्रोत बता सकैत छी ? (प्रमुख स्रोत सभमात्र)	१.....२..... ३.....४.....	
जा.१२	की अंहा कैल्शियम सं भरपूर खाद्य पदार्थक केँ बारे मे सुनने छी ?	१.....२..... ३.....४.....	
जा.१३	की अंहा कैल्शियम सं भरपूर भोजनक स्रोत बता सकैत छी ?	१.....२..... ३.....४.....	

निम्न लिखित प्रश्न पिछला दिन स शुरू भ क अंतिम २४ घंटा क संदर्भित करैत अछि।

तिथि : \_\_\_\_\_, दिन : \_\_\_\_\_, समय : \_\_\_\_\_:

गु आ १.२४ घंटा क स्मृति

द्रुत सूची	समय	भोजनक स्थान	खाद्य या पेय चिजक विवरण	ब्रांड	कुल मात्रा (इकाई)	शेष मात्रा (इकाई)	भोजन कायल गेल मात्रा (इकाई)	वजन बराबर (ग्राम)
भोरका चाह आ जलखई								
भोरका भोजन								
दुपहरकचाह आ दुपहरकभोजन								
रातिक भोजन								

प्र. संख्या	प्रश्नहरू र कैफियत	समुह तथा श्रेणी र सङ्केत	प्र. संख्या	प्रश्नहरू र कैफियत	समुह तथा श्रेणी र सङ्केत
गुआ २.	की अंहा शराब के प्रयोग करैछी ?	हँ.....१ नहि.....२	गुआ ३.	की अहाँ शाकाहारी छि ? (जँ शाकाहारी प्रतिउतर अई तँ शाकाहारी के प्रकारसभ के सेहो जाँच करु)	पूर्ण शाकाहारी (दुधभी नई खायवाला).....१ लैक्टो-शाकाहारी(दुध दहिखायवा).....२ ओवो-शाकाहारी(अन्डा खायवाला).....३ मांसाहारी.....४
गुआ ४.	की अंहाक भोजनक सेवन असामान्य छल ? (जँ नहि तँ प्र .सं . पो. १ पर जाउ)	हँ.....१ नहि.....२	गुआ ५.	की अंहा बीमार छी ?	हँ.....१ नहि.....२
गुआ ६ .	जँ बिमार छि तँ,की एहि रोगक भूख पर असर पड़ल ?	हँ.....१ नहि.....२	गुआ ७.	जँ भूख पर असर पड़ल, तँ केना पड़ल ?	बेसी भूख लागल .....१ कम भूख लागल.....२
गुआ ८ .	की यि कोनो भोज/पार्टी के दिन छल ?	हँ.....१ नहि.....२	गुआ ९.	की यि कोनो ब्रत आ पावन के दिन छल ?	हँ.....१ नहि.....२
गुआ १०.	की यि कोनो बाजारक दिन छल ?	हँ.....१ नहि.....२			
<b>गर्भवती महिला के पोषण के स्थिति</b>					
पो.१	गर्भवती महिला के एमयूएसी (MUAC) जांच	.....से.मि.			

## ANNEX X: DQI-P SCORE SHEET

A score of 0 to 10 has been allocated to each of the components, constituting a totalscore between 0 and 80. A total score of  $\geq 70$  reflects the most desirable general dietary quality (Bodnar & Siega-Riz, 2002). Meeting the minimum number of cups or ounces based on the recommendation for that food group results in allotting a score of 10 to that component. It is scored 0 if any of that food group is not consumed by the participant. Intermediate scores are calculated proportionately; for instance, a score of 5 is given if a woman consumes 1 cup of fruit instead of the recommended 2 cups (Fowles et al. 2011)

Diet quality component	Grouping of diet quality component	Scoring criteria	Score
Adequacy	Percentage of suggested vegetables, fruits, and grains intake	Between 0 and 10 points awarded for each of the 3 adequacy groups, depending on percentage met	0-30
	Vegetables	3-5 servings/day- 10 points 1-2 servings/day- 5 points 0 servings/day- 0 points	
	Fruit	2-4 servings/day- 10 points 1 servings/day- 5 points 0 servings/day- 0 points	
	Grain	6-11 servings/day- 10 points 1-5 servings/day- 5 points 0 servings/day- 0 points	
Adequacy	Percentage of suggested iron, folate, and calcium intake	Between 0 and 10 points awarded for each of the 3 adequacy groups, depending on RDA(AI) met	0-30
	Iron	$\geq 100\%$ of RDA (AI)/day-10 points 50% to 99 % of RDA (AI)/day- 5 points <50 % of RDA (AI)/day- 0 points	
	Folate	$\geq 100\%$ of RDA (AI)/day-10 points 50% to 99 % of RDA (AI)/day- 5 points <50 % of RDA (AI)/day- 0 points	
	Calcium	$\geq 100\%$ of RDA (AI)/day-10 points	

		50% to 99 % of RDA (AI)/day- 5 points <50 % of RDA (AI)/day- 0 points	
Moderation	Percentage of energy from patterns of snack and meal as well as total fat	Between 0 and 10 points awarded for each of the 2 moderation groups, depending on percentage of RDA met	0-20
	Total fat	<or= 30 % energy/day- 10 points >30 or< or =35 % of energy/day- 5 points >35 or < or = 40 % of energy/day- 3 points >or =40 % of energy – 0 points	
	patterns of snack and meal	3 meals/2 snacks- 10 points 3 meals/0–1 snack(s) or 2 meals/2 snacks- 5 points 2 meals/0–1 snack(s) or 1 meal/snacks-0 points	

## ANNEX XI: SAMPLING METHOD (PROBABLITY PROPORTIONAL TO SIZE )

Ward/ PSU Name	Total pregnancy		2nd and 3rd trimester pregnancy		Participants number to be sampled		Basic Probability	
	(expected)	CF		Probability 1	Probability 2	weight	Sampled	
20315 Janakpur 15	56	56	37	0.225	37	0.661	6.73	
20315 Janakpur 03	60	116	40	0.241	37	0.617	6.73	1
20315 Janakpur 22	62	178	41	0.249	37	0.597	6.73	
20315 Janakpur 10	62	240	41	0.249	37	0.597	6.73	
20315 Janakpur 05	64	304	43	0.257	37	0.578	6.73	
20315 Janakpur 06	68	372	45	0.273	37	0.544	6.73	1
20315 Janakpur 02	81	453	54	0.325	37	0.457	6.73	
20315 Janakpur 11	83	536	55	0.333	37	0.446	6.73	
20315 Janakpur 13	102	638	68	0.410	37	0.363	6.73	1
20315 Janakpur 18	104	742	69	0.418	37	0.356	6.73	
20315 Janakpur 12	106	848	71	0.426	37	0.349	6.73	1
20315 Janakpur 16	116	964	77	0.466	37	0.319	6.73	
20315 Janakpur 23	125	1089	83	0.502	37	0.296	6.73	1
20315 Janakpur 25	125	1214	83	0.502	37	0.296	6.73	
20315 Janakpur 09	129	1343	86	0.518	37	0.287	6.73	1
20315 Janakpur 07	133	1476	89	0.534	37	0.278	6.73	
20315 Janakpur 24	136	1612	91	0.546	37	0.272	6.73	1
20315 Janakpur 21	141	1753	94	0.566	37	0.262	6.73	
20315 Janakpur 20	143	1896	95	0.574	37	0.259	6.73	1
20315 Janakpur 14	146	2042	97	0.587	37	0.253	6.73	
20315 Janakpur 19	152	2194	101	0.611	37	0.243	6.73	1
20315 Janakpur 01	161	2355	107	0.647	37	0.230	6.73	1
20315 Janakpur 08	178	2533	119	0.715	37	0.208	6.73	
20315 Janakpur 17	181	2714	121	0.727	37	0.204	6.73	1
20315 Janakpur 04	273	2987	182	1.097	37	0.136	6.73	
	<b>2987</b>	<b>2987</b>	<b>1991</b>					

Sampling interval	249	
Random start	62	
Sampling series	62.00	RS
	311.00	Rs+(1*SI)
	560.00	Rs+(2*SI)
	809.00	Rs+(3*SI)
	1058.00	Rs+(4*SI)
	1307.00	Rs+(5*SI)
	1556.00	Rs+(6*SI)
	1805.00	Rs+(7*SI)
	2054.00	Rs+(8*SI)
	2303.00	Rs+(9*SI)
	2552.00	Rs+(10*SI)
	2801.00	Rs+(11*SI)

## ANNEX XII: ETHNICITY CLASSIFICATION

Code	Group	Caste/Ethnicity
1.	Dalit	Hill 1. Biswokarma (Kami, Sunar, Od, Chunara, Parki, Tamata), 2. Pariyar (Damai, Darjee, Suchikar, Nagarchi, Hudrake), 3. Sarki (Mijar, Charmakar, Bhul), 4. Gandharwa (Gaine), 5. Badi
		Terai 6. Kalar, 7. Kakaihiya, 8. Kori, 9. Khatik, 10. Khatwe (Mandal, Khadga), 11. Chamar (Ram, Mochi, Harijan, Rabidas), 12. Chidimar, 13. Dom (Marik), 14. Tatma (Tati, Das), 15. Dushad (Paswan, Hajara), 16. Dhobi (Rajak) Hindu, 17. Pattharkatta, 18. Pasi, 19. Batar, 20. Mushahar, 21. Mestar (Halkhor), 22. Sarbhanga (Sarbariya) 23. Sonar, 24. Lohar, 25. Natuwa
2.	Janajati	Hill 1. Sherpa, 2. Bhote (Bhutia), 3. Thakali, 4. Byansi, 5. Wallung, 6. Chhairrotan, 7. Dolpo, 8. Tangbe, 9. Tin GauleThakali, 10. Topkegola (Dhokpya) 11. Bara GaunleThakali, 12. MarphaliThakali, 13. Mugali, 14. Lhopa, 15. Lhomi (Shingsawa), 16. Siyar (Chumba), 17. Thudam, 18. Magar, 19. Tamang, 20. Newar 21. Rai, 22. Gurung, 23. Limbu 24. Bhujel, 25. Sunuwar, 26. Chepang, 27. Thami, 28. Yakkha, 29. Pahari, 30. Chhantyal, 31. Jirel, 32. Dura, 33. Lepcha, 34. Hayu, 35. Yehlmo, 36. Kushbadia, 37. Kusunda, 38. Phree (Free), 39. Bankaria, 40. Baramo/ Baramu, 41. Larke, 42. Surel, 43. Kumal, 44. Majhi, 45. Danuwar, 46. Darai, 47. Bote, 48. Raji, 49. Raute
		Terai 50. Tharu, 51. Dhanuk (Rajbanshi), 52. Rajbansi (Koch), 53. Satar/Santhal, 54. Jhagar/Jhangar, 55. Gangai, 56. Dhimal, 57. Tajpuriya, 58. Meche (Bodo), 59. Kisan
3.	Madhesi	1. Yadav, 2. Teli, 3. Kalwar, 4. Sudhi, 5. Koiri, 6. Kurmi, 7. Kanu, 8. Haluwai, 9. Hajam/Thakur, 10. Badhae, 11. Rajbhar, 12. Kewat, 13. Mallah, 14. Nuniya, 15. Kumhar, 16. Kahar, 17. Lodha, 18. Binna (Bing/Binda), 19. Gaderi/Bhediyar, 20. Mali, 21. Kamar, 22. Dhunia, 23. Barae, 24. Munda, 25. Badai, 26. Panjabi, 27. Bangali, 28. Marwadi, 29. Nurang, 30. Kayastha, 31. Rajput, 32. Jaine, 33. Brahman (Terai) 34. Baniya, 35. Amat, 36. Kathawaniya, 37. Rajdhob, 38. Kushbaha
4.	Muslim	1. Muslim, 2. Churaute
5.	Brahman/Chhetri	1. Brahman (Hill), 2. Chhetri (Hill)
6.	Others	1. Thakuri, 2. Sanyasi/Dasnami, etc.,



ANNEX XIII: RESEARCH PERMISSION LETTER FROM THE STUDY SITE

जनकपुरधाम उप-महानगरपालिका  
नगर कार्यपालिकाको कार्यालय  
जनकपुरधाम धनुषा

पत्र संख्या - २०७९/८०  
कानुनी नं. २०७९

Website : janakpurnam.gov.np  
Email : info@janakpurnam.gov.np  
फोन नं. : ०५१-४३०११६, ४३०४१७  
फ्याक्स नं. : ०५१-४३०४१८, ४३०४१९

मिति : २०७८/०८/०७

विषय : अनुसन्धान अनुमति र आवश्यक सहयोग सम्बन्धमा ।

श्री

जो जम संग सम्बन्धित छ ।

उपरोक्त सम्बन्धमा त्रिभुवन विश्वविद्यालय, चिकित्सा अध्ययन संस्थान अन्तर्गतको जनस्वास्थ्य केन्द्रिय विभागको मिति २०७९/०७/२९ गतेको च. नं. १८७/०८९/०८० को आवश्यक सहयोग गरिदिने सम्बन्धमा पत्र प्राप्त भयो । उक्त पत्रानुसार तहो विभाग अन्तर्गत अध्ययनरत विद्यार्थी श्री गौरी शंकर मण्डलले यस उप-महानगरपालिका अन्तर्गतका केहि वडाहरुमा गर्भवती महिलाहरुलाई सहभागी गराई " Association of Diet Quality, Household Food Security and Women Empowerment with Nutritional Status among Pregnant Women in Janakapurdham Sub- Metropolitan City" शिर्षकमा अनुसन्धान गर्न गइरहेकोले उक्त अनुसन्धान कार्यको लागि अनुसन्धान अनुमति दिइएको व्यहोरा जानकारी गराइन्छ । साथै, यस उप- महानगरपालिका अन्तर्गतका सम्बन्धित सरोकारवालाहरुले तथ्यांक संकलनमा आवश्यक सहयोग गरिदिन हुनु अनुरोध छ ।

(महेीलाल यादव)  
वरिष्ठ उप-सचिव  
महेीलाल यादव  
वरिष्ठ उपसचिव

"धार्मिक, सांस्कृतिक, पर्यटकीय नगर जनकपुरधाम"