ASSOCIATION OF MATERNAL KNOWLEDGE ABOUT NUTRITION AND CHILD FEEDING PRACTICES WITH THE NUTRITIONAL STATUS OF CHILDREN UNDER 5 YEARS OF AGE RESIDING IN ARJUNDHARA MUNICIPALITY JHAPA.

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Association of Maternal Knowledge about Nutrition and Child Feeding Practices with the Nutritional Status of Children under 5 Years of Age Residing in Arjundhara Municipality, Jhapa

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

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Approval Letter

This *dissertation* entitled ***Association of Maternal Knowledge about Nutrition and Child Feeding Practices with the Nutritional Status of Children under 5 Years of Age residing in Arjundhara Municipality, Jhapa*** presented by **Anusha Poudel** has been accepted as the partial fulfillment of the requirement for the **B.Sc. degree in Nutrition and Dietetics.**

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(Anusha Poudel)

Abstract

Malnutrition is a significant global health issue, particularly in developing countries like Nepal. Malnutrition can lead to a range of adverse effects, including stunted growth, increased susceptibility to infections and impaired cognitive development. The study aimed to investigate association of maternal knowledge about nutrition and child feeding practices with the nutritional status of children under 5 years of age residing in Arjundhara Municipality, Jhapa. A community based cross-sectional study was conducted with 130 children who were selected using proportional sequential sampling. Nutritional status was assessed using anthropometric measurements including height, weight, and mid-upper arm circumference (MUAC). Data on maternal knowledge were collected via a structured questionnaire and analyzed using WHO Anthro version 3.2.2 and SPSS version 25, with Chi-square test employed to examine associations between maternal knowledge and children's nutritional status.

The prevalence rates among the children were 6.1% for wasting, 27.7% for stunting, and 8.4% for underweight. Wasting and underweight was more prevalent among children aged 24-35 months, while stunting was more prevalent in those aged 6-11 months. Stunting was observed to be higher among female children, whereas underweight was more common among male children, though the difference in wasting rates between genders was not significant. The majority of mothers (40%) had moderate level of knowledge regarding nutrition and child feeding practices, 32.3% had high level of knowledge, and 27.7% had low level of knowledge. A significant association was found between maternal knowledge with the prevalence of both stunting and underweight among children, but no significant association was observed with wasting. Therefore, community based nutrition awareness and education programs are crucial to improve the nutritional status of children.

Contents

List of tables

List of figures

List of plates

List of abbreviations

Abbreviation	Full Form
BCG	Bacillus Calmette Guerin
BMI	Body Mass Index
DPT-Hep B-Hib	Diphtheria, Pertussis, Tetanus, Hepatitis B and Haemophilus influenzae type b
FFQ	Food Frequency Questionnaire
FIPV	Fractional Inactivated Polio Vaccine
GLV	Green Leafy Vegetables
HFA	Height-for-Age
ICMR	Indian Council of Medical Research
IDA	Iron Deficiency Anemia
IDD	Iodine Deficiency Disorder
INGOs	International Non-Governmental Organizations
IYCF	Infant and Young Child Feeding
JE	Japanese Encephalitis
MR	Measles and Rubella
MUAC	Mid-Upper Arm Circumference
NDHS	Nepal Demographic and Health Survey
NGO	Non-Governmental Organizations

OPV	Oral Polio Vaccine
ORS	Oral Rehydration Solution
ORT	Oral Rehydration Therapy
PCV	Pneumococcal Conjugate Vaccine
PEM	Protein-Energy Malnutrition
RDA	Recommended Dietary Allowance
SDGs	Sustainable Development Goals
SPSS	Statistical Package for Social Sciences
UNICEF	United Nations International Children's Emergency Fund
VAD	Vitamin A Deficiency
WFA	Weight-for-Age
WFH	Weight-for-Height
WHO	World Health Organization

Part I

Introduction

1.1 Background to the study

Nutrition is a crucial, universally recognized component of the child's right to the enjoyment of the highest attainable standard of health as stated in the Convention on the Rights of the Child. Children have the right to adequate nutrition and access to safe nutritious food and both are essential for fulfilling their right to the highest attainable standard of health. Adequate nutrition forms the fundamental basis for the survival, health and growth of children (WHO and UNICEF, 2003). When children receive proper nourishment, they exhibit enhanced abilities to thrive, learn, actively engage in their communities, and demonstrate resilience against diseases, disasters, and global challenges. Sadly, many children are facing a tough reality due to lack of safe and nutritious food. For many of them, this lack of proper nutrition causes a serious problem called undernutrition (MoHP, 2016).

According to global Nutrition Report 2022, the Southern Asia sub-region experiences a malnutrition burden among children aged under 5 years. The average prevalence of overweight is 2.5%, the lowest compared to other sub regions in Asia with sufficient data. The prevalence of stunting is 30.7%, which is higher than the global average of 22.0%. The Southern Asia sub region's prevalence of wasting is 14.1%, which is also higher than the global average of 6.7%. Nepal is making progress towards meeting the target for reducing stunting, yet 31.5% of children under five are still affected, exceeding the Asia region's average of 21.8%. Conversely, Nepal has not improved its situation regarding wasting, with 12.0% of children under five affected which is significantly higher than the Asia region's average of 8.9% and among the highest globally (Report, 2022). According to the World Health Organization, around 45 percent of death among children under the age of 5 are linked to undernutrition (WHO, 2023).

The mother holds a central role as the primary caregiver for her child in the initial five years of life. Mother's understanding of child feeding practices and nutrition is a crucial factor in the child's growth, development and overall well-being of children. Without

adequate knowledge, malnutrition and poor nutritional status can occur even in households with sufficient income, food and health services (Jemide *et al.*, 2016). Inadequate information regarding complementary feeding practices among mothers is the one among underlying causes of undernutrition among children (Binamungu *et al.*, 2023). Mothers' misconception of a healthy diet is one of the major causes of nutritional problems in preschool-aged children in Nepal and these beliefs and attitudes can result in the inappropriate feeding of young children (Acharya, 2018).

Poor infant feeding practices coupled with high rates of infectious diseases are the major causes of malnutrition. Inadequate knowledge of appropriate foods and feeding practices is often a greater determinant of malnutrition than lack of foods (Akeredolu *et al.*, 2014). The complex issue of malnutrition is influenced by various factors such as individual differences, household dynamics, community disparities, insufficient health and nutrition knowledge, economic limitations, unhealthy practices, social and cultural elements, household food insecurity, frequent illnesses, suboptimal environmental practices, inadequate dietary intake, poor hygiene, reliance on fast foods, child vaccination status, breastfeeding practices, and maternal factors (Dhungana, 2017). Thus, nutritional awareness and education of mother plays the significant role in improving nutritional status of children (Ahumah, 2017).

1.2 Problem statement and justification

Child malnutrition remains a pressing global concern, affecting millions of children under the age of five years. In 2022, worldwide estimates revealed that 149 million children were stunted (short for their age), 45 million were wasted (thin for their height), and 462 million were underweight (thin for their age). Tragically, nearly half of deaths in this age group were attributed to undernutrition, predominantly in low- and middle-income countries (WHO, 2023). In the context of developing countries like Nepal, child undernutrition persists as a significant challenge (Dhungana, 2017). According to the latest report, still 25% of children under age 5 were stunted, 8% were wasted, and 19% were underweight (MoHP *et al.*, 2022). According to Global nutrition report 2022, Nepal has made no any progress towards achieving the target for wasting, with 12.0% of children under 5 years of age affected, which is higher than the average for the Asia region (8.9%) and among the highest in the world (Report, 2022).

Maternal knowledge about child feeding practices plays a pivotal role in the nutritional well-being of children during their formative years. Inadequate and improper feeding practices contribute to high prevalence of undernutrition. Recommended Infant and Young Child Feeding (IYCF) practices, including early initiation of breastfeeding, exclusive breastfeeding for the first 6 months and providing a diverse diet, play a crucial role in combating undernutrition (WHO and UNICEF, 2021). However, recent data highlights gap in adherence to these practices, with only 55% of children aged 0–23 months experiencing early initiation of breastfeeding, 56% of children under 6 months being exclusively breastfed and 78% meeting the minimum dietary diversity requirement among those aged 6–23 months (MoHP *et al.*, 2022). The prevalence of stunting (36%), wasting (10%), and underweight (30%) was greater among children whose mothers had no formal education compared to those whose mothers had received basic education or higher (MoHP *et al.*, 2022).

Mother's health, her education, her beliefs & attitude regarding child rearing are important milestones on the road of child's health and nutritional well-being. Inadequate knowledge about appropriate foods and feeding practices is often a greater determinant of malnutrition than the lack of food (Farghaly *et al.*, 2021). Early introduction of cereals and particularly vegetables can interfere with the absorption of breast-milk iron, thus potentially resulting in iron deficiency. In addition, weaning foods prepared under unhygienic conditions are frequently contaminated with pathogens and thus are a major factor causing diarrhea and associated malnutrition in infants. In rural areas, under-educated mothers, practices and taboos seem to be significant causative factors for malnutrition in young children (Surinder, 2020).

Maternal knowledge emerges as a key determinant in the nutritional well-being of children during their formative years. Despite its importance, limited research is available on the association of maternal knowledge about child feeding practices with the nutritional status of children in Nepal. Therefore, this research was designed to assess the association of maternal knowledge about nutrition and child feeding practices with nutritional status of children under 5 years of age residing in Arjundhara municipality which can used as a reference to guide policies and initiatives aimed at improving the nutritional well-being of children and similar contexts.

1.3 Objectives of study

1.3.1 General objectives

To assess the association of maternal knowledge about nutrition and child feeding practices with the nutritional status of children under 5 years of age residing in Arjundhara Municipality, Jhapa.

1.3.2 Specific objectives

i. To determine the nutritional status of children under 5 years of age residing in Arjundhara municipality.
ii. To find out the level of mother's knowledge about nutrition and child feeding practices in the community of Arjundhara municipality.
iii. To examine the association of maternal knowledge about child feeding practices with the nutritional status of children under 5 years of age.

1.4 Conceptual framework

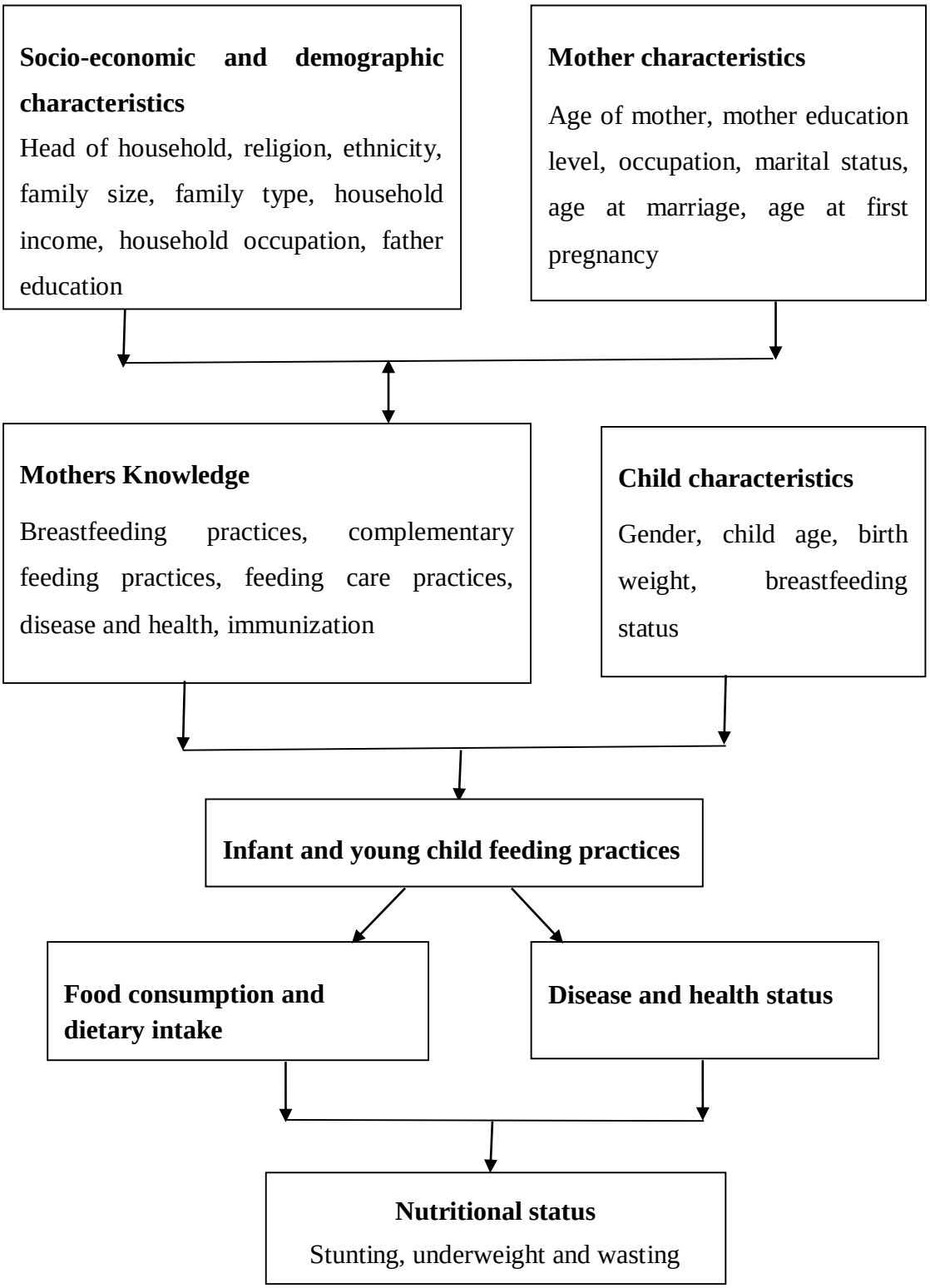

Fig.1.1: Conceptual framework for the study (adapted and modified from UNICEF conceptual framework, 2015)

1.5 Research questions

i. What was the nutritional status of children under 5 years of age residing in Arjundhara Municipality, Jhapa?
ii. What was the level of maternal knowledge about nutrition and child feeding practices in the study population?
iii. Was there any association between mother's knowledge and nutritional status of children under 5 years of age?

1.6 Significance of study

i. Provide nutritional knowledge to mothers and also encourage other people to improve current nutritional status of children by improving child feeding pattern, faulty food habits and food beliefs of under 5 year children.

ii. Identify the individuals or group of people who are at risk of being malnourished and who needs special care and attention.

iii. Disseminate information to the government, private sector, and voluntary institutions such as NGOs and INGOs regarding the nutritional status of children under the age of five in Arjundhara municipality which will be helpful to initiate corrective measures for the problem.

iv. Serve as a guide for developing an appropriate nutritional program in the community by utilizing the identified facts and information.

1.7 Limitation of the study

i. Seasonal variation may exist as this is cross sectional study done for specific period of time.

Part II

Literature review

2.1 Nutritional status

Nutrition is the science of foods, the nutrients and other substances, their action, interaction and balance in relationship to health and disease, the processes by which the organism ingests, digests, absorbs, transports and utilizes nutrients and disposes the end products (Srilakshmi, 2022). The science of human nutrition deals with all the effects of any component found in food, on people which starts with the physiological and biochemical processes involved in nourishment that is how the substances in food provide energy and are converted into body tissues and the diseases that might result from insufficiency or excess of essentials nutrients (Mann *et al.*, 2017). Nutritional status refers to the condition of health of the individual as influenced by the utilization of the nutrients. Accurately assessing nutritional status involves correlating information gathered from a thorough medical and dietary history along with physical measurements, clinical examinations and relevant laboratory investigations. (Srilakshmi, 2022).

Good nutrition is fundamental to child survival, health, and development. Children who are well-nourished are better positioned to grow and learn effectively, engage actively in their communities, and demonstrate resilience against diseases, disasters, and other global challenges (Kayastha *et al.*, 2022). Ensuring optimal nutrition during infancy and early childhood is crucial to support the rapid growth and development that takes place during this period. Under-nutrition reduces immunological capacity to defend against diseases and recurrent infections which in turn reduce and deprive the body from essential nutrients. This cycle of undernutrition and infections leads to the dismal growth of children which adversely affect child's physical and mental development and learning capacity in future life. Undernutrition is an important determinant of child health which has significant negative effects on brain and cognitive development of children (De and Chattopadhyay, 2019).

2.2 Nutritional status of under five children

According to report of NDHS 2022, 25% of children under age of 5 years are stunted, 8% are wasted, and 19% are underweight. The prevalence of stunting has declined from 57% in 1996 to 25% in 2022. During this same period, the prevalence of wasting has declined from 15% in 1996 to 8% in 2022 and the prevalence of underweight has declined from 42% to 19% in 2022. Although nutritional status of children has been improved, we still need to make progress as the current undernutrition rate remains unacceptably high. The government of Nepal's targets for the prevalence of stunting among children under 5 years to be at or below 29% by 2022 and at or below 15% by 2030 to meet Sustainable Developmental Goals (SDGs). Similarly, the SDG targets for the prevalence of wasting among children under 5 years to be 7% by 2022 and 4% by 2030 (MoHP *et al.*, 2022).

A study conducted among children of Satar community in Bhadrapur Municipality of Jhapa district showed that the prevalence of stunting, wasting and underweight was found to be 39.5 %, 14.2 % and 29.5% respectively. The study also found that maternal education, paternal education, family income, exclusive breastfeeding and food frequency was significantly associated with under nutrition (Sangroula and Uprety, 2020). A study conducted among under-five children residing in Kamal Gaupalika, Jhapa revealed higher prevalence rates of stunting (20%), wasting (25%), and underweight (31.7%). The findings highlight significant concerns regarding the nutritional status of young children in the area (Kayastha *et al.*, 2022).

2.3 Malnutrition

Malnutrition among under-five is a major global health problem in developing countries. It directly or indirectly affects many aspects of the child's health, which may adversely affect growth and development and their ability to learn and process information and growth (Kayastha *et al.*, 2022). Malnutrition refers to deficiencies or excesses in nutrient intake, imbalance of essential nutrients or impaired nutrient utilization (WHO, 2023). Malnutrition refers to a pathological condition that arises from an imbalance, either in terms of a shortage or an excess, of one or more essential nutrients essential for proper health. It consists of following four forms:

a. Undernutrition: This condition occurs when an inadequate amount of food is consumed for an extended duration leading to reduced physical and mental development along with weakened immunity.
b. Over nutrition: This pathological state arises from prolonged excessive food intake potentially causing conditions such as obesity and metabolic syndrome.
c. Imbalance: This pathological condition stems from an uneven distribution of essential nutrients either with or without the absolute deficiency of any specific nutrient.
d. Specific deficiency: This pathological state results from either a relative or absolute insufficiency of a particular nutrient (Srilakshmi, 2022).

Etymologically, the term "malnutrition" refers to "bad nutrition" and encompasses both under nutrition and over nutrition. Under Nutrition includes conditions such as stunting, wasting, underweight, and micronutrient deficiencies. Stunting is chronic malnutrition characterized by low height-for-age. Wasting is acute malnutrition indicated by low weight-for-height. Underweight reflects either acute or chronic malnutrition, defined as low weight-for-age. Micronutrient deficiencies are a lack of vitamins and minerals that are essential for body functions such as vitamin A, iron and iodine deficiency. Over nutrition includes obesity and diet-related non-communicable diseases, resulting from excessive nutrient intake. Malnutrition in children impairs physical and cognitive growth and development that contributes to the intergenerational cycle of malnutrition. It increases the risk of mortality in the early stages of infancy and childhood, impair cognitive function of those who survive and hinders efforts to enhance national social and economic development goals (Mandal, 2021).

2.4 Types of malnutrition

The primary forms of malnutrition affecting humans are Protein-Energy Malnutrition (PEM) and micronutrient deficiencies. A brief overview of each is provided in the following sections:

2.4.1 Protein-energy malnutrition

Protein energy malnutrition or Protein energy undernutrition is a form of malnutrition that is defined as a range of conditions arising from coincident lack of dietary protein and/or energy (calories) in varying proportion. This form of malnutrition is prevalent globally among both

children and adults contributing to approximately 6 million deaths annually. PEM is a critical concern in infant and young child health, commonly linked to infections and characterized by a range of related disorders. In developing countries, PEM is notably prevalent among children under five years of age, with severe forms affecting 1-10% of this population and underweight occurring in 20-40% of cases. Children suffering from PEM invariably experience micronutrient deficiencies, compounding the severity of their malnutrition. Malnutrition results from underlying health issues or inadequate care that disrupt nutrient absorption and utilization. Poor breastfeeding practices, including early cessation due to maternal work or lack of knowledge about proper weaning, lower socioeconomic status also contribute to malnutrition (Jee, 2021).

The term PEM applies to a group of related disorders that include:

a) **Marasmus:** The term marasmus is derived from the Greek word “marasmos” which means withering or wasting. It is a severe form of malnutrition that consists of the chronic wasting away of fat, muscle and other tissue in the body. It involves inadequate intake of protein and calories characterized by emaciation. It usually occurs in the first year of life resulting in wasting & growth retardation (Jee, 2021).
b) **Kwashiorkor:** The term kwashiorkor is taken from the Ga language of Ghana which means "the sickness of the weaning”. Kwashiorkor, also called wet protein energy malnutrition, is a form of PEM characterized primarily by protein deficiency with reasonable caloric (energy) intake. This condition usually appears at the age of about 12 months when breastfeeding is discontinued but it can develop at any time during a child's formative years. It causes fluid retention (edema), dry and peeling skin with hair discoloration (Jee, 2021).
c) **Marasmic-Kwashiorkor:** It refers to severely malnourished child with features of both Marasmus and Kwashiorkor. The features of Kwashiorkor are severe edema of feet, legs, hands, lower arms, abdomen and face. Also there is pale skin and hair, and the child is unhappy. There are also signs of marasmus, wasting of the muscles of the upper arms, shoulders and chest so that you can see the ribs (Jee, 2021).

2.4.2 Micronutrient deficiency diseases

Micronutrient deficiencies can arise from inadequate intake or impaired absorption, often exacerbated by factors such as infections or chronic inflammation. These inadequacies mostly occur when the intake of a nutrient is above the deficiency level but below the recommended dietary intake. Micronutrient inadequacies can cause subtle symptoms that are hard to detect. An energy-rich, nutrient-poor diet can lead to "hidden hunger," where there is a lack of essential micronutrients despite adequate or excessive calorie intake (Kiani *et al.*, 2022).

Globally, more than 2 billion people across industrialized and developing countries particularly pregnant women and children under 5 years old are affected by micronutrient deficiencies. These deficiencies are associated with nearly 10% of child deaths. Common micronutrient deficiencies worldwide include those of iron, folate, zinc, iodine and vitamin A that contribute to a range of adverse health outcomes with increased morbidity and mortality (Kiani *et al.*, 2022). Many of these deficiencies are preventable through nutrition education and consumption of a healthy diet containing diverse foods as well as food fortification and supplementation where needed (WHO, 2023).

2.4.2.1 Vitamin A deficiency (VAD)

Vitamin A deficiency is a common issue in developing countries, primarily affecting eye health. Vitamin A is essential for maintaining the health of epithelial tissues in the eyes, urinary tract, intestines, and respiratory system. Early signs of deficiency include dry eyes (xerophthalmia), white patches on the eye (Bitot spots), and night blindness. If the deficiency worsens, it can lead to severe conditions like corneal damage (keratomalacia) and permanent blindness. Additionally, children with vitamin A deficiency may suffer from protein-energy malnutrition (Kiani *et al.*, 2022).

In the context of Nepal, a total of 4% of children 6-59 months were vitamin A deficient. The prevalence of vitamin A deficiency varied by region, with no cases reported in the Western and Far-Western regions, and a 7% prevalence in both the Central and Eastern regions. In the Mountain and Hill areas, 1% of children had vitamin A deficiency, while 7% in the Terai region were affected. Higher prevalence of Vitamin A deficiency was observed among children whose mothers had no education (MoHP, 2016).

2.4.2.2 Iron deficiency anemia (IDA)

Anemia is a condition characterized by insufficient hemoglobin, a protein responsible for transporting oxygen in the blood. Severe anemia can even be fatal (Chaparro and Suchdev, 2019). Iron deficiency is the most common nutritional deficiency, particularly affecting young children and premenopausal women. Iron is crucial for hemoglobin production, and a lack of it can lead to microcytic hypochromic anemia, where red blood cells are smaller and contain less hemoglobin than normal. Symptoms of anemia include fatigue, lethargy, pallor, weakness, difficulty breathing with exertion, and increased sensitivity to cold. Iron deficiency can impact a child's physical and cognitive development, behavior, learning and growth. Severe anemia may also heighten risks during pregnancy and increase the likelihood of maternal death. The primary causes of iron deficiency are inadequate dietary intake, menstrual blood loss, intestinal bleeding, and blood loss from conditions such as hookworm infections, tumors, hemorrhoids, and regular use of certain medications like aspirin (Kiani *et al.*, 2022).

In the context of Nepal, overall 43% of children aged 6–59 months are anemic, with 25% experiencing mild anemia, 18% moderate anemia and 1% severe anemia. Anemia is more common in children aged 6–23 months (66%) compared to those aged 24–59 months (34%). In terms of geographic distribution, the prevalence of anemia is highest in the Terai zone (49%), followed by the Mountain (43%) and Hill (34%) zones. Regionally, Madhesh Province has the highest rate of anemia among children at 51%, while Gandaki Province has the lowest at 31%. The education level of mothers also affects anemia rates in children. Children whose mothers have no education have a higher prevalence of anemia (52%) compared to those whose mothers have more than a secondary education (36%) (MoHP *et al.*, 2022).

2.4.2.3 Iodine deficiency disorder (IDD)

Iodine is a micronutrient that plays an important role in thyroid function, which is critical for reproductive function, growth, and development (MoHP *et al.*, 2022). Thyroid hormones are essential for proper fetal and postnatal brain development. It is found naturally in some foods and is also added to salt or used in dietary supplements. Sufficient iodine prevents goiter, brain damage, and other thyroid-related health problems. Maternal iodine deficiency

during early pregnancy can cause iodine deficiency disorders in the offspring, leading to permanent neurological damage and mental retardation. Iodine deficiency disorders can range from impaired mental function and goiters to cretinism and thyroid dysfunction. Infants and pregnant women are particularly vulnerable. To combat iodine deficiency globally, salt iodization is the most effective and practical strategy (Kiani *et al.*, 2022).

The Government of Nepal prioritizes the control of iodine deficiency disorders and universal salt iodization. It is recommended that household salt be fortified with iodine. The Ministry of Health and Population is tasked with enhancing awareness and promoting the use of iodized salt at the household level. As a result, nearly all households in Nepal (98%) use iodized salt (MoHP *et al.*, 2022).

2.4.2.4 Zinc deficiency

Zinc is an essential trace mineral important for health and cellular metabolism. It supports the function of enzymes and is vital for normal growth, immune system function, DNA and protein synthesis and cell division. Since the body cannot store zinc for long, it must be continuously obtained through diet. Zinc is mainly found in seafood, animal products and breast milk. Symptoms of zinc deficiency include skin lesions, increased infection risk, diarrhea, poor appetite, night blindness, reduced taste and smell, hair loss, low sperm count, impotence, and slow wound healing. In developing countries, zinc deficiency is a major cause of morbidity. Additionally, zinc supplementation during pregnancy is associated with a significant reduction in preterm births, though it does not affect birth weight (Kiani *et al.*, 2022).

Diarrheal disease remains a significant cause of illness and death among young children in Nepal. To treat diarrhea, the recommended approach includes oral rehydration therapy (ORT) and supplemental zinc, along with continued feeding. ORT can be administered through increased fluid intake (especially breastfeeding), oral rehydration solution (ORS), or homemade fluids. Zinc helps reduce the severity and duration of diarrhea (MoHP *et al.*, 2022).

In Nepal, the hill zone shows a higher percentage (56%) of children with diarrhea receiving ORT and continued feeding, compared to the Terai zone (39%), This suggests a

better implementation of treatment practices in the hill zone. The likelihood of receiving ORT and continued feeding increases with the mother's education level, rising from 36% among children of uneducated mothers to 47% among children whose mothers have secondary education. Similarly, children with uneducated mothers are less likely to receive both ORS and zinc, with only 8% receiving these treatments compared to 12% among children with mothers who have secondary education (MoHP *et al.*, 2022).

2.5 Factor affecting nutritional status

The UNICEF conceptual framework provides a comprehensive definition of nutrition encompassing the complex causality of undernutrition. They are classified as immediate, underlying and basic causes whereby factors at one level influence the other levels. The interplay between undernutrition and infection establishes a potentially lethal cycle where worsening illness and deteriorating nutritional status reinforce each other (UNICEF, 2020).

2.5.1 Immediate causes of malnutrition

Immediate causes of malnutrition are primarily inadequate dietary intake and disease. Malnutrition arises when there is a mismatch between the body's nutrient needs and the actual nutrients consumed or absorbed. Contributing factors include food insecurity, poor care for women and children, inadequate healthcare services, and unsanitary conditions. Immediate malnutrition can result from reduced dietary intake, impaired absorption of nutrients, increased nutrient losses or altered needs and elevated energy expenditure due to certain diseases. Health and nutrition are closely related in a “malnutrition-infection cycle” in which diseases contribute to malnutrition, and malnutrition makes an individual more vulnerable to disease (Ersado, 2022).

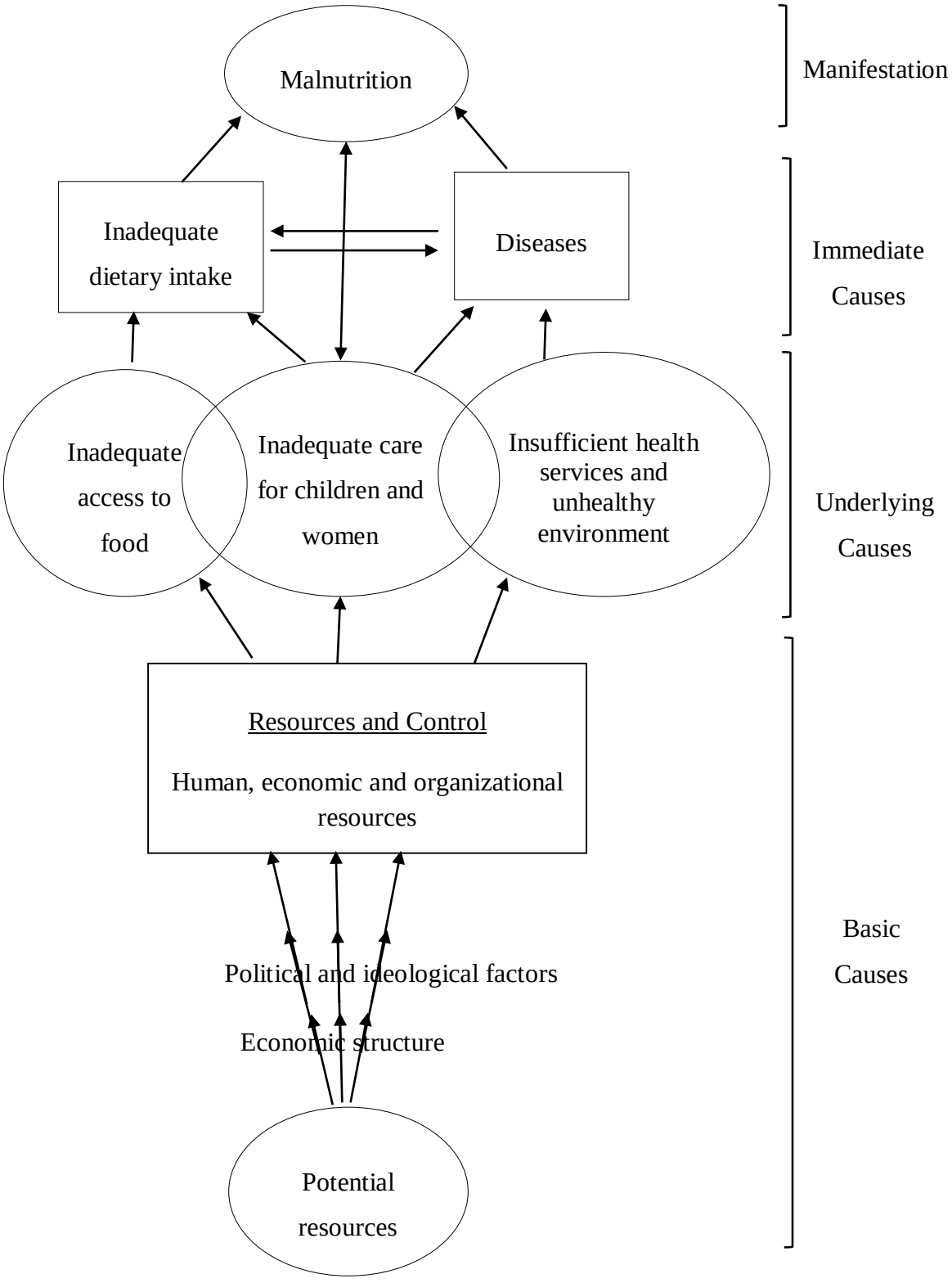

Fig.2.1: Conceptual framework of malnutrition by UNICEF, 2015

2.5.2 Underlying causes of malnutrition

Underlying causes of malnutrition include household food insecurity, poor social and care environments, limited access to healthcare and unhealthy living conditions. These issues often arise from broader problems such as conflict, inadequate education, poverty, gender inequality and poor infrastructure. Food insecurity, where people struggle to access enough safe and nutritious food, is a major cause of undernutrition, particularly for displaced populations. Poor social and care environments, including inadequate infant feeding practices, inadequate child care practices, poor health care services, poor hygiene and sanitation, unsafe water and insufficient care for sick children, further contribute to malnutrition (Ersado, 2022).

2.5.3 Basic causes of malnutrition

Basic causes of malnutrition include poverty, lack of information, political and economic instability, war, resource scarcity, gender inequality, and natural disasters. In basic causes, three critical resource components are identified: human resources (knowledge, skills, and time), economic resources (assets, land, income) and organizational resources (formal and informal institutions, extended families, child care organizations) (Ersado, 2022). The underlying factors are influenced by the basic causes, socioeconomic and political conditions within which poor families are attempting to raise well-nourished children (Hassan *et al.*, 2014).

According research conducted in Belahara VDC of Dhankuta district in Nepal located in south Asia, poor socioeconomic status was found risk factors for both stunting and underweight. Children reared in the jointly family were found less like to be stunted than those in nuclear family. Additionally, ethnic group seems to have significance association with stunting. Interestingly, children raised in joint families were observed to be less likely to experience stunting compared to those from nuclear families (Gurung and Sapkota, 2009).

2.6 Mothers nutritional knowledge

A mother is the major provider of the principal care that her child needs during the first five years of life. Sometimes mothers do not know the importance of variety and balance in the diet and the right amount and types of foods needed by children to meet these dietary needs

(Jemide et al., 2016). Nutritional awareness of mothers plays an important role in the health of children aged 0-5 years. The type of care she provides depends to a large extent on her knowledge and understanding of some aspects of basic nutrition and health care. Mothers educational level, position, health and nutritional status is central to the quality of life and is a key ingredient of her child's health, nutritional status, behavioral and other aspects of child welfare in developing countries.

Essential factors such as a mother's educational level, social standing, and health and nutritional status play a central role in determining quality of life and serve as key components influencing her child's health, nutritional status, behavioral and various other aspects of child welfare particularly in developing countries. Knowledge of mothers has an important role in the maintenance of nutritional status of the children. Adequate knowledge regarding various aspects of feeding practices during infancy is very essential especially among females as they are going to influence the feeding practices of this vulnerable group (Kaur *et al.*, 2015).

Inadequate information regarding complementary feeding practices among mothers is the one among underlying causes of undernutrition among children (Binamungu *et al.*, 2023). Knowledge of mothers has an important role in the maintenance of nutritional status of the children. Adequate knowledge regarding various aspects of feeding practices during pregnancy and during infancy is very essential especially among females as they are going to influence the feeding practices of this vulnerable group. The knowledge of child nutrition and caring practices can be expected to have significant bearing on their children nutritional status (Kaur *et al.*, 2015). Studies (Daba *et al.*, 2013) (Shettigar *et al.*, 2013) have observed a positive relationship between childhood malnutrition with maternal knowledge and beliefs regarding nutrition.

A study revealed that a mother's knowledge about breastfeeding, bottle feeding, and weaning is influenced by her socio-demographic characteristics. Additionally, the mother's education level is related to her understanding of breastfeeding practices, bottle feeding, and weaning. Moreover, the mother's occupation affects her knowledge about exclusive breastfeeding and its duration (Hassan *et al.*, 2014). A study conducted in Nigeria found that most mothers had inadequate nutrition knowledge. Specifically, only 20% of mothers had

good knowledge about their children's health and nutrition, 44.6% had fair knowledge, and 35.5% had poor knowledge (Jemide *et al.*, 2016).

2.7 Breastfeeding practices

The major foundation for childhood development is infant and young child feeding practices. Factors such as inappropriate breastfeeding and infants feeding practices have adverse effects on the health and nutritional status of the children (Binns *et al.*, 2017). Initiating breastfeeding soon after birth lowers the risk of neonatal mortality. The colostrum produced in the first few days is packed with essential nutrients and antibodies that strengthen the baby's immune system and help prevent early death. Early breastfeeding not only saves lives but also supports stronger uterine contractions, which lowers the chance of uterine bleeding. It helps prevent hypothermia, enhances the bond between mother and child, and stimulates early milk production.

Exclusive breastfeeding is the safest and healthiest option for children everywhere guaranteeing infants a food source that is uniquely adapted to their needs while also being safe, clean, healthy and accessible. Exclusive breastfeeding protects against diarrhea, lower respiratory infections, and childhood overweight and obesity. Exclusive breastfeeding during this period reduces the risk of infections that can cause diarrhea and respiratory illnesses and provides all the essential nutrients and fluids needed for optimal growth and development (WHO and UNICEF, 2003).

Breastfeeding should be continued for at least the first 2 years or longer because it significantly reduces the risk of illness in children, aids in their recovery when they are sick, and provides essential nutrients for healthy growth and development. Extended breastfeeding also offers health benefits for mothers, including a reduced risk of certain types of breast and ovarian cancers and diabetes (WHO and UNICEF, 2021).

WHO Global Strategy for IYCF recommends that infants needs to be breastfed immediately within one hour after birth or delivery and exclusively breastfed for the first six months of age. WHO Global Strategy for IYCF recommends that children should be given complementary foods from six months of age with continued breastfeeding up to two years

of life. Children who are still breastfed after one year of age can meet a substantial portion of their energy needs with the breast milk in their diet (WHO and UNICEF, 2021).

In the first 6 months of life, infants should be exclusively breastfed, receiving only breast milk. Introducing formula or animal milk, known as mixed feeding, can negatively impact breast milk production because milk supply is closely linked to the frequency and intensity of breastfeeding. Additionally, mixed feeding can increase the risk of diarrhea, disrupt the infant's intestinal microflora, and contribute to the premature discontinuation of breastfeeding (WHO and UNICEF, 2021). Bottle feeding, due to the risk of contamination of the nipple, can increase the likelihood of disease in children. Therefore, bottle feeding is not recommended for children under the age of 2 years (MoHP *et al.*, 2022).

2.8 Complementary feeding

Inadequate knowledge about appropriate foods and feeding practices is often a greater determinant of malnutrition than the lack of food. WHO Global Strategy for IYCF recommends that solid, semi-solid and soft foods should be introduced at six months of age. After the first six months of life, infant’s nutrient demands start to exceed what breast milk alone can provide and this leaves them vulnerable to malnutrition unless solid foods are introduced. It also recommends that children aged 6–23 months should be fed with a variety of foods to ensure that nutrient needs are met. Food group diversity is associated with improved linear growth in young children. WHO guiding principles for feeding the breastfed child recommends that breastfed infants aged 6–8 months should be provided with complementary foods 2–3 times per day and breastfed children aged 9–23 months be provided complementary foods 3–4 times per day with additional nutritious snacks offered 1–2 times per day (WHO and UNICEF, 2021).

Moreover, diversified approaches are required to ensure access to foods that will adequately meet energy and nutrients needs of growing children. Infants are particularly vulnerable during the transition period when complementary feeding begins. Ensuring that their nutritional needs are met thus requires that complementary foods be:

- timely – meaning that they are introduced when the need for energy and nutrients exceeds what can be provided through exclusive and frequent breastfeeding.

- adequate – meaning that they provide sufficient energy, protein and micronutrients to meet a growing child's nutritional needs;
- safe – meaning that they are hygienically stored, prepared and fed with clean hands using clean utensils and not bottles and teats.
- properly fed – meaning that they are given consistent with a child's signals of appetite and satiety, and that meal frequency and feeding method – actively encouraging the child, even during illness to consume sufficient food using fingers, spoon or self-feeding –are suitable for age (WHO and UNICEF, 2003).

2.9 Immunization

Immunization is one of the most effective and successful public health initiatives, crucial for fostering a healthy future generation. It involves the process of inducing immunity in individuals against infectious organisms or agents, providing essential protection for both children and adults from numerous diseases. Immunization not only shields children from life-threatening illnesses but also strengthens their immune systems. As a result of widespread immunization, some infections and diseases have been nearly eradicated globally. Universal immunization of children against common vaccine-preventable diseases is crucial in reducing infant and child morbidity and mortality. Ensuring that children receive these vaccines according to the national schedule is vital for protecting them from serious, often life-threatening diseases. However, achieving and maintaining high vaccination coverage requires addressing various challenges, including accessibility, parental awareness, and adherence to the complete immunization schedule (Vaithilingan *et al.*, 2017).

In Nepal, routine childhood vaccines include Bacillus Calmette-Guérin (BCG) for tuberculosis, Oral Polio Vaccine (OPV) or Fractional In-activated Polio Vaccine (fIPV), pentavalent or DPT-HepB-Hib vaccine (Diphtheria, Pertussis, Tetanus, Hepatitis B, and Haemophilus influenzae type b), Pneumococcal Conjugate Vaccine (PCV), Rotavirus vaccine, Measles-Rubella vaccine (MR) and Japanese Encephalitis vaccine. A child aged 12–23 months is considered fully vaccinated according to the national schedule if the child has received all basic antigens, as well as two doses of fIPV, three doses of the pneumococcal vaccine, two doses of the rotavirus vaccine, and one dose of the Japanese encephalitis vaccine.

Nationally, only 52% of children aged 12–23 months are fully vaccinated according to the national immunization schedule. The percentage of fully vaccinated children increases with the mother's education level, from 39% among children whose mothers have no education to 59% among those whose mothers have a secondary education. It indicates that maternal education plays a significant role in ensuring that children complete their vaccination schedules. Higher education levels among mothers are likely associated with better awareness of the importance of vaccines and greater access to healthcare resources, leading to higher vaccination rates (MoHP *et al.*, 2022).

2.10 Nutritional requirement

Nutritional requirement can be defined as the minimum amount of the nutrient that is necessary per day for maintaining the normal physiological functions of the body which varies with specific age group and sex in healthy individuals. Nutritional requirement during childhood are proportional with children's growth rate. Much of the nutrients requirements are met by breastfeeding and RDA of an infants is based on composition of breast milk. The years between 1 and 6, growth is generally slower than in the first year of life but continues gradually. The child may gain in weight 150-200g per month between one and two years. Activity also increases markedly during the second year of life as the child becomes increasingly mobile. Development of a full dentition by about the age of 2years also increases the range of foods that can safely be eaten. There is an increased need for all nutrients but the pattern of increase varies for different nutrients in relation to their role in growth of specific tissues (Srilakshmi, 2019). Table 2.1 shows RDA of nutrients for infants and children.

Table.2.1: RDA for infants and children (ICMR, 2020)

Nutrients	(0-6) months	(6-12) months	(1-3) years	(4-6) years
Energy (kcal)	530	660	1110	1360
Protein (g)	8.0	10.5	12.5	16.0
Calcium (mg)	300	300	500	550
Magnesium (mg)	30	75	90	125
Iron (mg)	-	3	8	11
Zinc (mg)	-	2.5	3.3	4.5
Thiamine (mg)	0.2	0.4	0.7	0.9
Riboflavin (mg)	0.4	0.6	1.1	1.3
Niacin (mg)	2	5	7	9
Vitamin B6 (mg)	0.1	0.6	0.9	1.2
Folate (µg)	25	85	120	135
Vitamin B12 (µg)	1.2	1.2	1.2	2.2
Vitamin A (µg)	350	350	390	510

2.11 Assessment of nutrition status

Nutritional assessment is the cornerstone in comprehensive child health care. The information obtained is used to determine the health status of individual or population which in influenced by their intake and utilization of nutrients. The purpose of nutritional assessment is to identify individual or group at risk of becoming malnourished or who are malnourished (Gibson, 2005). Nutritional assessment can be done by following methods:

2.11.1 Direct method

The method of direct nutritional assessment includes anthropometric measurement, biochemical measurement, clinical assessment and dietary assessment which directly indicates the nutritional status of an individual.

2.11.1.1 Anthropometric measurement

Anthropometric measurement includes physical measurements of weight, height, head circumference, mid upper arm circumference and skin fold thickness that are compared to reference values (Gibson, 2005). Anthropometry is the single most universally applicable, inexpensive and non-invasive method available to assess the size, proportions and composition of the human body. Since growth in children and body dimensions at all ages reflect the overall health and welfare of individuals and populations, anthropometry may also be used to predict performance, health and survival (WHO, 2006).

a. **Height-for-Age:** Height-for-age is a measure of growth faltering. Children whose height-for-age z-score is below minus two standard deviations (-2 SD) from the median of the reference population are considered short for their age (stunted). Children who are below minus three standard deviations (-3 SD) are considered severely stunted (WHO, 2006).
b. **Weight-for-Height**: The weight-for-height index measures body mass in relation to body height (or length) and describes acute undernutrition. Children whose z-score is below minus two standard deviations (-2 SD) from the median of the reference population are considered thin (wasted). Children whose weight-for-height z-score is below minus three standard deviations (-3 SD) from the median of the reference population are considered severely wasted (WHO, 2006).
c. **Weight for Age:** Weight-for-age is a composite index of height-for-age and weight-for-height that takes into account both wasting (acute undernutrition) and stunting (chronic undernutrition). Children whose weight-for-age z-score is below minus two standard deviations (-2 SD) from the median of the reference population are classified as underweight. Children whose weight-for-age z-score is below minus three standard deviations (-3 SD) from the median are considered severely underweight (WHO, 2006).
d. **Mid Upper Arm Circumference (MUAC):** MUAC is useful for assessing thinness or muscle wasting and helps to indicate that the child is suffering from PEM. It is useful for

assessing global nutritional status especially the reserves of energy (adipose tissue) and protein (muscle tissue) of the body. In case of undernutrition, especially deficient intakes of energy and protein, these reserves are reduced thereby decreasing the arm circumference. Arm circumference is used as a proxy for soft tissue mass and provides an indication of the total amount of bone, muscle and fat at the mid-point of the upper arm (Bates *et al.*, 2017).

Table 2.2: Assessment of nutritional status using MUAC classification

MUAC Category	Range	Indicating color
Normal	≥12.5 cm	Green
Moderate Acute Malnutrition (MAM)	≥11.5- <12.5 cm	Yellow
Severe Acute Malnutrition (SAM)	<11.5 cm	Red

Source: (WHO and UNICEF, 2009)

2.11.1.2 Biochemical measurement

Biochemical assessment is the most objective method of assessment of nutritional status analysis in which chemical analysis of biological fluids mainly blood and urine or tissues such as liver, muscle, bone is done for the determination of the levels of nutrients and their metabolites in these fluids or tissues. Biochemical assessment is used primarily to detect the subclinical sub-clinical deficiency states or to confirm clinical diagnosis. Most useful are nutritional biomarkers that distinguish deficiency, adequacy and toxicity which assess aspects of physiological function and current or future health. Nutritional biomarkers can be measurements based on biological tissues and fluids on physiological or behavioral functions and more recently on metabolic and genetic data which in turn influence health, well-being and risk of disease. Examples includes serum ferritin for risk of iron deficiency anemia, glycosylated hemoglobin (HbA1c) for risk of diabetes, alterations in bone mineral density for changes in fracture risk (Pico *et al.*, 2019**).**

2.11.1.3 Clinical assessment

Clinical assessment evaluates a child's nutritional status through physical examination, including checking vital signs like blood pressure and assessing signs of nutrient deficiencies

or toxicities. A medical history and a physical examination are the clinical assessment methods used to detect signs and symptoms associated with malnutrition or risk of chronic disease. To confirm clinical findings, further analysis is needed, including anthropometric measurements (height, weight, BMI), biochemical tests (blood and urine analysis), and dietary evaluation to ensure a comprehensive understanding of the child's nutritional status (Bauer, 2002).

2.11.1.4 Dietary assessment

The dietary component of a nutritional assessment consists of the assessment of food intake. Dietary data collection provides information on a child's current food intake and can be used to estimate the child's usual intake, compare the child's nutrient intake to different group references or standards and to rank the child within the group reference. The dietary data collection can be done using different instruments and methods. Dietary assessment methods provide data used to describe exposure to food and nutrient intakes as well as information on food behaviors and eating patterns that cannot be obtained by any other method. Different dietary assessment methods consist of:

i. Dietary history
ii. Food frequency questionnaire
iii. Food record
iv. 24-hour dietary recall
v. Observed food consumption
vi. Repeated 24-hour dietary recall

A food frequency questionnaire (FFQ) assesses how often different food groups are consumed, rather than focusing on specific nutrient intakes. To facilitate evaluation, foods are typically organized into groups based on similar nutrient profiles. When designing an FFQ, it's crucial to group foods effectively and to consider whether portion sizes are included, as this can impact the accuracy of the dietary assessment (Bauer, 2002).

2.11.2 Indirect method

The indirect methods of assessment of the factors which influences nutritional status includes assessment of vital health statistics, ecological factors and socio-economic factors (Jelliffe and WHO, 1966).

Vital statistics are gathered from various sources, including community reports, healthcare professionals and surveillance networks, to provide a comprehensive overview of a population's nutritional status. For instance, analyzing morbidity and mortality data allows for estimating disease prevalence and identifying high-risk groups within a community. This collective data helps governments make informed policy decisions (Shrivastava *et al.*, 2014).

Malnutrition usually arises from a combination of factors such as socio-economic conditions, the quality and accessibility of healthcare, and the prevalence of diseases. To grasp how these factor affects community nutrition, it is important to perform an "ecological factor assessment." This process helps to identify which specific factors are influencing nutrition. However, quantifying the exact effect of these ecological factors can be difficult, making it challenging to determine how they contribute to poor nutritional outcomes. These factors may be classified as: conditioning infections, food consumption, cultural influences, socio-economic factors, food production, medical and educational services (Shrivastava *et al.*, 2014).

Part III

Materials and methods

3.1 Research design

A community based cross sectional study was conducted among the children under 5 years of age residing in Arjundhara municipality to find out association between maternal knowledge about nutrition and child feeding practices with the nutritional status of children. It consisted of;

a) Anthropometric measurement of children.
b) Household survey with the help of questionnaire.

3.2 Study site

The study was conducted in Arjundhara municipality which is located in Jhapa district of Koshi province, Nepal as shown in appendix D. It is situated within the area of 109.9 km^2 and has 11 wards. It has a total population of 84,018, of which 40,180 are males and 43,838 are females living in 20,935 households. It has the total population of 6162 children under 5 years of age (CBS, 2021).

3.3 Target population

The target population of the study was children under 5 years of age of Arjundhara municipality and mothers of respective children.

Criteria for Sample Collection

a) Inclusion criteria:

Only the children above 6 months and children below five years whose mothers voluntarily accepted to participate by signing the consent form after being explained to what the study entails and gave permission for their child assessment were included in the study.

b) Exclusion criteria:

i. Children who were seriously ill or physically deformed based on maternal report as well as the children below 6 months and above 5 years were not included in the study.

ii. Children accompanied by members of the family or caretaker others than their own mothers were not included in the study.

iii. Children whose parents did not give consent were excluded from the study.

3.4 Sample size:

The sample size was determined by using a single proportional formula where the prevalence rate of underweight was taken as 19 % (MoHP *et al.*, 2022), 95% confidence interval (CI), 7% margin of error (d) and 10% non-response rate was added to the total calculated sample size (Nsiah-Asamoah *et al.*, 2022).

Sample size (N) = $z^2 \times \frac{p(1-p)}{d^2}$

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

p =estimated prevalence of malnutrition in project area

m =margin of error

Calculation of sample size for infinite population;

Sample size (N_0) = $z^2 \times \frac{p(1-p)}{d^2}$

$$N_0 = 1.96^2 \times \frac{0.19(1-0.19)}{(0.07)^2} = 120.65 \approx 121$$

According to the report of NPHC 2021, the total numbers of children under 5 years of age is 6162 (CBS, 2021). Thus, we applied finite population sample formula to obtain new sample size to conduct the survey.

Therefore, New SS = $\frac{N}{[1+\frac{(N-1)}{POP.}]}$

Where, New SS (N) = New sample size for finite population

N_0 = Sample size in infinite population

POP=Total number of population (in this case total number of populations is number of children under 5 years of children in Arjundhara municipality).

New Sample Size is obtained as;

$$N = \frac{N_0}{[1+\frac{(N_0-1)}{POP.}]}$$

$$= \frac{121}{[1+\frac{(121-1)}{6162}]}$$

$$= 118.69$$

Thus, calculated sample size was adjusted for non-response. So, considering non-response rate as 10%, the adjusted sample size was calculated as 130.34 i.e.130.

3.5 Sampling technique

A community based cross sectional study was conducted in Arjundhara Municipality, Jhapa. The selection of Arjundhara Municipality was carried out using purposive sampling. Proportional sampling was then used to determine sample size from each ward within the municipality based on their population and household distribution which is shown in the table 3.1. Within each ward, households were selected by sequential sampling. The basic criterion for household selection was that each household must have at least one child under 5 years of. In households with more than one child under 5, only one child was randomly chosen using the lottery method.

Table 3.1 shows the population and household distribution in each ward of Arjundhara Municipality (CBS, 2021). It also presents the number of samples collected from each ward using proportional sampling method.

Table 3.1: Population and household distribution in the study area

Ward	Total population	Population of under 5 years of children	Number of households	Percentage of household	Sample calculated in each ward
1	6604	539	1650	8%	11
2	5523	405	1397	7%	9
3	6676	472	1670	8%	11
4	6376	475	1564	7%	9
5	9818	719	2413	11%	14
6	11353	838	2895	14%	18
7	4722	291	1161	6%	7
8	6510	464	1588	8%	11
9	7897	571	1983	9%	12
10	6898	479	1656	8%	10
11	11641	909	2958	14%	18
Total	84018	6162	20935	100%	130

3.6 Data collection tools and techniques

Data was collected through face to face interview using semi structured questionnaires and anthropometric measurements. Face to face interview was conducted after an informed consent with mother of child to fill the pre-designed questionnaire. Instrument and equipment used during the survey and data recorded were as follows;

a) **Immunization card**: The date of birth for each child was obtained from their immunization card or birth registration certificate and recorded in months. Additionally, vaccination information was collected from the immunization card.

b) **Digital weighing balance:** Child weighing machine having capacity of 180 kg (1 piece) was used. The minimum capacity of weighing machine was 0.1 kg. The child's weight was measured using a digital weighing balance.

The child was positioned in the center of the scale platform with their weight evenly distributed on both feet, without shoes and in minimal clothing. For infants who could not stand alone, their weight was measured while being held by their mothers, and the mother's weight alone was subtracted from it to calculate the infant's weight.

c) **Height measuring scale (Stadiometer):** The height measuring scale of 2 m capacity (1 piece). The instrument was designed according to UNICEF standards which was easily transportable and accurate within the limits required (0.1 cm).

For children under 24 months, recumbent or supine length was measured, while for those over 24 months, standing height was measured using a stadiometer. The child was instructed to stand barefoot with heels together and head positioned so that their line of sight was perpendicular to their body. The child's buttocks, heels and the back of their head were kept in contact with the vertical board and their arms were allowed to hang naturally. The movable blade of the stadiometer was used to apply gentle pressure to compress any hair and the height was recorded.

d) **Mid-Upper Arm Circumference (MUAC) Tape:** Flexible and non-stretchable MUAC tape was used to measure mid upper arm circumference of children having least count of 0.1cm. The child was asked to bend their arm at a 90-degree angle with the palm facing upward. The distance between the acromion (bony protrusion on the back of the shoulder) and the olecranon (tip of the elbow) was measured. The midpoint between these two points was marked and the child was instructed to let their arm hang relaxed and parallel to the body. A measuring tape was placed at the mark to measure the circumference to the nearest 0.1 cm, ensuring the tape was not applied too tightly.

3.6.1 Questionnaire

A well designed and pretested set of questionnaire was used to collect information on household characteristics, maternal characteristics, child characteristics, maternal

knowledge, breastfeeding, feeding practices, immunization, food frequency table, etc. For collecting household information and knowledge of mothers regarding nutrition and child feeding practices, a well-designed questionnaire was developed based on the review of various literature (WHO and UNICEF, 2021), (Binamungu *et al.*, 2023), (Forh *et al.*, 2022) (Jemide *et al.*, 2016). Questionnaire was first developed in English language and later on it was changed into Nepali language for the better understanding to respondents at the time of administration.

It was divided into three parts:

First Part: It includes the characteristics of studied subjects. It was divided into three sections and entitled the following items:

Section (I): Socio-demographic characteristics for the family which include questions related to following items such as head of household, ethnicity of family, family size, family type, income source, occupation and education of father.

Section (II): Characteristics related to mothers such as age, education, occupation, marital status, age at marriage and age at first pregnancy.

Section (III): Characteristics related to child such as weight at birth, gender, age, birth weight, currently breastfeeding status along with their anthropometric measurements.

Second Part: It includes the mother knowledge regarding nutrition and child feeding practices. It is divided into five sections and entitled the following items:

Section (I): It includes questions related to mothers' knowledge regarding breastfeeding practices such as importance of colostrum feeding, pre-lacteal feeding, early initiation of breastfeeding, exclusive breastfeeding, extended breastfeeding and mixed milk feeding.

Section (II): Questions related to mothers' knowledge regarding complementary and supplementary feeding practices such as start of complementary feeding, feeding frequency, frequency of additional nutritious snacks, *Harek Baar Khana Chaar*, Sarbottam pitho, use of iodized salt, Baal vita, foods during diarrhea and preparation of ORS.

Section (III): Questions related to mothers' knowledge regarding feeding care practices such as bottle-feeding, cleanliness of bottle, sterilization, handwashing before preparation of feeding, use of boil drinking water, storage of food with lid container, avoidance of cross contamination, reheating of left over foods and washing of utensils.

Section (IV): Questions related to mothers' knowledge regarding disease and health status such as recent diseases, iron folic acid consumption and vaccination during pregnancy,

vitamin A and deworming tablets, growth monitoring card, complete immunization, causes of malnutrition and causes of diarrhea.

Third Part: It includes food consumption pattern presented in food frequency table.

3.6.2 Scoring for knowledge

A self-administered questionnaire with 28 questions related to mothers' knowledge about nutrition and child feeding practices was used. Each question was scored with 1 point for a correct answer and 0 point for an incorrect or "don't know" answer. A total score of 28 points were given for all questions (Gajula *et al.*, 2015). The total score for assessing maternal knowledge ranged from a minimum of 9 points to a maximum of 27 points, based on the responses.

Maternal knowledge was categorized into three groups: low, moderate and high, based on percentile ranges as shown in appendix E. A low level of knowledge was defined as a total score of less than 14 points (0-13), corresponding to below the 33rd percentile. A moderate level of knowledge was indicated by a total score between 14 and 17 points (14-17), which falls between the 33rd and 66th percentiles. A high level of knowledge was represented by a total score greater than 17 points (18-28), above the 66th percentile (Manzano-Felipe *et al.*, 2022).

3.7 Pre testing

The tools and questionnaires used in the study were pre-tested among mentioned age group children and their respective mother from a selected area before the final survey. The pre-testing was conducted to establish accuracy of questions and clarity and to check for consistency in the interpretation of question and to identify ambiguous items. Based on the feedbacks obtained during the pre-testing phase, necessary revisions were made to the instruments to enhance their effectiveness before administering them in the actual study.

3.8 Validity and reliability of the research:

To assess the accuracy of the data collection instruments in measuring their intended variables, they were validated by comparing them with standard weights for the weighing balance. Reliability, which assesses the quality control of the data collected, was ensured by checking the questionnaire for completeness, consistency, and clarity. Both validity and

reliability were upheld through pre-testing of the tools and the use of standardized instruments. Additionally, the instruments were calibrated to zero before measurements, using a standardized reference. Careful supervision was done in the field.

3.9 Data analysis

Data was checked for its completeness and consistency. The collected data was organized, coded and entered into Microsoft excel 2016 and then to Statistical Package for Social Sciences (SPSS) version 25. The collected data was analyzed by using both descriptive and interferential analysis and the data was presented in the table. The nutritional status was measured by WHO standard and MUAC standards. Anthropometric indices were calculated using reference medians recommended by WHO and classified according to standard deviations unit (z-scores) based on the WHO criteria. Anthropometric measurement taken was converted to nutritional status indicators; WFH, WFA and HFA, and is expressed as z-scores based on a standard reference of measurement using the WHO Anthro version 3.2.2. The chi-square test was applied to test the association between nutritional status and maternal knowledge.

3.10 Study approval

Study was conducted only after getting approval letter from Nutrition and Dietetics Department, Central Campus of Technology and from Arjundhara municipality. Consent was obtained from the respondents after explaining the purpose of the study. Confidentiality and privacy of the collected data was ensured. No information received from the study was given or disclosed to unauthorized persons external to the team implementing the study.

PART IV

Result and discussion

The survey was conducted in Arjundhara Municipality, Jhapa district from 25th of March to 24th of April. The study was mainly focused on the association between maternal knowledge about nutrition and child feeding practices with nutritional status children under 5 years of age residing in Arjundhara Municipality, Jhapa. The result and findings of the study are expressed into the following different headings.

4.1 Socioeconomic and demographic characteristics

As shown in table 4.1, among 130 households, the majority of households (94.6%) were headed by males while only few of them (5.4%) were headed by females. In terms of religious affiliation, most of the households (76.9%) were identified as Hindu, followed by Kirat (16.2%) with smaller percentages of Buddhist (3.8%), Muslim (1.5%) and Christian (1.5%) households. Similarly, 45.4% of the families belong to the Brahmin or Chhetri community, 33.8% to the Janjati community, 16.9% to the Dalit community with smaller representations from the Madhesi (0.8%) and Muslim (3.1%) ethnicity.

Family structure shows a higher prevalence of nuclear families, comprising 63.1% of the sample while joint families make up 36.9%. The main sources of income for these households include foreign employment (48.5%), agriculture (20.0%), employment or services (15.4%), business (13.1%) and daily labor (3.1%). Most of the households (53.1%) had a monthly income between Rs. 30,000 and Rs. 60,000, 27.7% of them had an income above Rs. 60,000 while only 19.2% had an income below Rs. 30,000. The education level of fathers in these households varied, with 52.3% having completed secondary education, 24.6% having higher secondary education or above and 23.1% having basic education.

Table 4.1 Distribution of socioeconomic and demographic characteristics of the family

Variables	Frequency	Percent
Head of the Household		
Male	123	94.6
Female	7	5.4
Religion Status		
Hindu	100	76.9
Buddhist	5	3.8
Muslim	2	1.5
Christian	2	1.5
Kirat	21	16.2
Caste of the Family		
Brahmin or Chhetri	59	45.4
Dalit	22	16.9
Janjati	44	33.8
Madhesi	1	0.8
Muslim	4	3.1
Type of Family		
Nuclear family	82	63.1
Joint family	48	36.9
Main Income Source of Family		
Agriculture	26	20.0
Business	17	13.1
Employment or Services	20	15.4
Foreign employment	63	48.5
Daily Laborer	4	3.1
Monthly income of household		
Below Rs. 30,000	25	19.2
Between Rs. 30,000 - 60,000	69	53.1
Above Rs. 60,000	36	27.7
Education level of Father		
Basic level education	30	23.1
Secondary level education	68	52.3
Higher Secondary level and above	32	24.6

4.2 Maternal characteristics

Table 4.2 shows that the majority of the respondent mothers (67.7%) were between age of 21 and 30 years, 27.7% were above 30 years old while only 4.6% were 20 years or below 20 years.

Table 4.2 Distribution of maternal characteristics

Variables	Frequency	Percent
Age of the Mothers		
less than or equal to 20 years	6	4.6
21 to 30 years	88	67.7
more than 30 years	36	27.7
Education Level of Mother		
No education	1	0.8
Basic level education (1-8)	15	11.5
Secondary level education (9-12)	74	56.9
Higher secondary level and above	40	30.8
Occupation of Mother		
Housewife	102	78.5
Agriculture	11	8.5
Business	2	1.5
Employment or Services	15	11.5
Age at Marriage		
Equal to or less than 15 years	2	1.5
15- 20 years	33	25.4
20-30 years	95	73.1
Age at First Pregnancy		
15-20 years	21	16.2
20-30 years	109	83.8
Marital Status		
Married (having both parent)	129	99.2
single parent (separated/divorced/widowed)	1	0.8

Regarding education, 56.9% of mothers had achieved secondary education, 30.8% had achieved higher secondary education or above, 11.5% had only basic education and only 0.8% had no formal education. Regarding occupation, the majority of mothers (78.5%) were housewives while few of them were involved in agriculture (8.5%), employment or services (11.5%) and business (1.5%).

Maximum mothers (73.1%) were married in the age group between 20 and 30 years, 25.4% were married between 15 and 20 years while only 1.5% were married below 15 years. Majority of the mothers (83.8%) had their first pregnancy between 20 and 30 years while 16.2% of them had their first pregnancy between 15 and 20 years. Nearly all the mothers (99.2%) were living with their husbands with both parents present in the household while very few cases of single parenthood (0.8%) due to separation, divorce or widowhood.

4.3 Child characteristics

Table 4.3 represents that the surveyed children were distributed across various age groups with the largest group (26.2%) being between 12 to 23 months, followed by those aged 36 to 47 months (24.6%) and 6 to 11 months (22.3%). Children aged 48 to 60 months comprised 18.5% of the sample while the smallest group was aged 24 to 35 months making up only 8.5%.

Gender distribution of survey children was relatively balanced with 53.1% of the children being male and 46.9% being female. In terms of breastfeeding status, just over half of the children (53.1%) were currently being breastfed whereas 46.9% were not breastfed. Additionally, the majority of children (90.8%) were born with a weight of 2.5 kg or more whereas minority of children (9.2%) were born with a weight less than 2.5 kg.

Table 4.3 Distribution of characteristics of the child

Variables	Frequency	Percent
Age of the child		
6 to 11 months	29	22.3
12 to 23 months	34	26.2
24 to 35 months	11	8.5
36 to 47 months	32	24.6
48 to 60 months	24	18.5
Gender of the Child		
Male	69	53.1
Female	61	46.9
Current Breastfeeding status of the child		
No	61	46.9
Yes	69	53.1
Weight of a newly born child		
equal to or more than 2.5kg	118	90.8
less than 2.5kg	12	9.2

4.4 Mother nutritional knowledge

4.4.1 Breastfeeding practices

The data in table 4.4 represents that the majority of mothers (90.0%) reported feeding colostrum to their newborns whereas only 10.0% of mothers did not practice colostrum feeding. The main reasons for this practice were its recognized health benefits, such as its rich nutrient and antibody content, to boost the child's immunity (49.2%) and instructions from health workers (40.8%). The majority of mothers (62.3%) refrained from giving any pre-lacteal feeds whereas 37.7% of mothers gave pre-lacteal feeds to their child. Out of those who did provide pre-lacteal feeds, the vast majority (36.2%) was given Lactogen, a type of infant formula while only 1.5% was given cow's milk.

Table 4.4 Mothers knowledge on breastfeeding practices

Variables	Frequency	Percent
Colostrum Feeding to Child		
No	13	10.0
Yes	117	90.0
Reasons for colostrum feeding		
It is nutritious and increases immunity of child.	64	49.2
It was instructed from health workers.	53	40.8
Pre-Lacteal feeding to Child		
No	81	62.3
Yes	49	37.7
If yes, what is that Pre-lacteal Feed?		
Cow's milk	2	1.5
Lactogen	47	36.2
Age of initiation of early breastfeeding		
Don't know	11	8.5
Within 1 hour of birth	66	50.8
Within 24 hours of birth	49	37.7
After 24 hours of birth	4	3.1
Age of exclusive breastfeeding to your child		
Don't know	1	0.8
Less than 5 months	24	18.5
Until 5 months	95	73.1
More than 5 months	10	7.7
Age of extended breastfeeding to your child		
Don't know	1	0.8
Less than 2 years	3	2.3
Until 2 years	74	56.9
More than 2 years	52	40.0
Practice of mixed feeding (formula or animal milk in addition to breast milk)		

No	15	11.5
Yes	115	88.5

Table 4.4 shows, about half of the mothers (50.8%) initiated breastfeeding within the first hour after birth, 37.7% began breastfeeding within the first 24 hours while 3.1% started after 24 hours. A small percentage (8.5%) of mothers were not aware about initiation of breastfeeding. In Nepal, breastfeeding practices are notably widespread and favorable. Nearly all children under the age of 2 years (99%) have been ever breastfed, with over half (55%) of children being put to the breast within the first hour of birth (MoHP *et al.*, 2022).

For exclusive breastfeeding, a significant number of mothers (73.1%) exclusively breastfed their children until five months of age, which is notably higher than the 56% national rate of exclusively breastfed children as reported by (MoHP *et al.,* 2022). A smaller proportion (18.5%) weaned their children before 5 months, 7.7% of them continued exclusive breastfeeding beyond 5 months while 0.8% of them were unaware of exclusive breastfeeding.

Most mothers (56.9%) reported to continue breastfeeding until the child reached two years old, 40.0% reported to follow extended breastfeeding beyond two years, 2.3% ceased breastfeeding before the child reached two years while 0.8% were unknown about its duration. A study conducted in Ludhiana, Punjab reveals that a significant portion of mothers (46.7%) of mothers were knowledgeable about the recommendation to continue breastfeeding up to two years (Kaur *et al.*, 2015).

A significant majority (88.5%) of mothers reported to provide formula or animal milk in addition to breast milk reflecting a common practice of mixed feeding while only 11.5% of mothers did not supplement breastfeeding with other milk sources. In contrast, the national data indicates that 20% of infants receive mixed milk feeding (MoHP *et al.*, 2022). This figure is notably lower than the 88.5% observed in your study, suggesting that mixed feeding is more prevalent in your study area compared to the national average.

4.4.2 Complementary feeding practices

The data in Table 4.5 reflects the responses of mother regarding complementary feeding practices. Most mothers (67.7%) reported introducing complementary foods to their children

at the recommended age of six months. However, some mothers responded to begin feeding earlier, with 13.8% introducing at four months and 13.1% at five months while a smaller group (5.4%) waited until seven months. The national data indicates that 85% of children are introduced to solid, semisolid, or soft foods at right age (MoHP *et al.*, 2022).

Regarding meal frequency, the majority of mothers (62.3%) reported feeding their children 2-3 times a day, 27.7% fed their children 3-4 times a day and a small group (10%) provided only one meal per day. For nutritious snacks, most mothers (56.9%) offered them once a day while 42.3% provided them twice a day whereas only 0.8% of mother did not feed her child any nutritious snacks in addition to meal. The national data indicates that 82% of children were fed the minimum number of times, which suggests a broad adherence to recommended feeding practices, essential for their growth and overall health (MoHP *et al.*, 2022).

Table 4.5 Mothers knowledge on complementary feeding practices

Variables	Frequency	Percent
Age of initiation of complementary feeding		
4 months	18	13.8
5 months	17	13.1
6 months	88	67.7
7 months	7	5.4
Frequency of complementary feeding (meal frequency)		
Once a day	13	10.0
2-3 times a day	81	62.3
3-4 times a day	36	27.7
Frequency of snacks in addition to complementary meals		
Do not feed	1	0.8
Once a day	74	56.9
2 times a day	55	42.3
Knowledge regarding *Hareek Baar Khana Chaar*		
No	123	94.6
Yes	7	5.4
Types of salt used at household		

Iodized salt	130	100
Knowledge about *Sarbottam Pitho* (Super Flour)		
No	61	46.9
Yes	69	53.1
Knowledge about Baal Vita		
No	124	95.4
Yes	6	4.6
Practices of giving Baal Vita to child		
No	125	96.2
Yes	5	3.8
Knowledge types of food given during diarrhea		
No idea	1	0.8
soup or liquid food	45	34.6
Same as usual	84	64.6
Knowledge about the preparation of ORS at home.		
No	84	64.6
Yes	46	35.4

The data given in table 4.5 on knowledge regarding the *"Hareek Baar Khana Chaar"* campaign reveals that the vast majority of mothers (94.6%) are not aware of this initiative while only a small percentage (5.4%) of mothers know about the campaign. All mothers (100%) reported using iodized salt in their households which is crucial for preventing iodine deficiency, which is slightly higher than the national average of 98% (MoHP *et al.*, 2022).

53.1% of the mothers were aware about *Sarbottam Pitho*, a nutritious super flour, whereas 46.9% were still unaware about it. A very high percentage of mothers (95.4%) are unaware of *Baal Vita*, a multiple micronutrient powder, whereas only 4.6% of mothers know about this supplement. According to the national data, 38% of women aged 15–49 with at least one child aged 0–59 months received counseling on multiple micronutrient powders (Baal Vita) and were aware about it (MoHP *et al.*, 2022). Furthermore, only 3.8% of them have actually given *Baal Vita* to their child, indicating both low awareness as well as low usage of *Baal Vita*.

Regarding types of food that should be given during diarrhea, 64.6% of mothers said same foods as usual should be given, 34.6% said soups or liquid foods while only one mother (0.8%) reported having no idea about the foods that should be given. According to national report, more than half (55%) of the children were provided with the same amount of food as recommended during diarrhea, while only 4% were given a smaller quantity of food and less than 1% of children did not receive any food, indicating that most children continued to receive some nourishment (MoHP *et al.*, 2022). Additionally, a significant portion of mothers (64.6%) did not know how to prepare Oral Rehydration Solution at home while 35.4% were knowledgeable about its preparation.

4.4.3 Feeding care practices

Table 4.6 shows that a majority of mothers (92.3%) used bottles to feed their babies while only 7.7% reporting that they did not use bottles. Among those who used bottles, 52.3% washed them after each feeding while 40.0% washed 1-2 times a day. In terms of bottle cleaning methods, 57.7% of mothers used hot water along with soap, 32.3% used tap water with soap and only a minimal number (2.3%) used tap water without soap. A significant number of mothers (71.5%) reported sterilizing the bottles while 20.8% of mothers did not practice sterilization.

Almost all mothers (98.5%) reported practicing handwashing before preparing or cooking food while only 1.5% did not follow this practice regularly. A high percentage of mothers (96.2%) washed their hands before feeding their child, with only 3.8% not consistently doing so. Regarding drinking water, 58.5% of mothers confirmed using boiled water for their child's drinking needs whereas 41.5% did not.

All mothers (100%) stored food covering with a lid and kept raw and cooked food separately which are good practices for preventing food contamination. 55.4% of mothers avoided giving leftover food to their child while 44.6% provided it after reheating. Most mothers (65.4%) used their hands to feed their child while 34.6% used a spoon. Only 21.5% of mothers washed used utensils with hot water and soap, as most (78.5%) did not follow this practice.

Table 4.6 Mothers knowledge on feeding care practices

Variables	Frequency	Percent
Use of bottle for feeding		
No	10	7.7
Yes	120	92.3
Frequency of washing bottle		
After every feed	68	52.3
1-2 times a day	52	40.0
Practice of cleaning bottle		
Using tap water without soap	3	2.3
Using tap water with soap	42	32.3
Using hot water along with soap	75	57.7
Practice of sterilizing bottle		
No	27	20.8
Yes	93	71.5
Practice of handwashing before preparing or cooking food		
No	2	1.5
Yes	128	98.5
Practice of handwashing before feeding child		
No	5	3.8
Yes	125	96.2
Practice of using boiled water for drinking		
No	54	41.5
Yes	76	58.5
Practice of storing food		
Yes	130	100.0
Practice of storing raw and cooked food separately		
Yes	130	100
Practice of giving left over food		
No	72	55.4
Yes	58	44.6
Methods of feeding to child		

Spoon	45	34.6
Hand	85	65.4
Practice of washing used utensils		
No	102	78.5
Yes	28	21.5

4.4.4 Diseases and health

Table 4.7 shows that nearly half of the children (48.5%) were reported to have been affected by some disease recently while the remaining half (51.5%) were not affected. Among those children who were affected by recent diseases, 10% experienced cough, 23.8% have fever, 9.2% were diagnosed with pneumonia and 5.4% suffered from diarrhea. Nationally, 23% of children under age 5 had a fever, 10% of them had diarrhea while only 1% of them had acute respiratory infections (ARI) in the 2 weeks before the survey (MoHP *et al.*, 2022).

All 130 mothers (100%) received vaccinations during pregnancy. Out of 130 respondent mothers, 97.7% consumed iron and folic acid during pregnancy while only 2.3% of them did not consumed. According to the national report, 96% of pregnant women took iron-containing supplements (MoHP *et al.*, 2022).

A majority of children in the study area (80.8%) received Vitamin A supplements while only 19.2% did not. Deworming tablet was received by 75.4% of children whereas 24.6% did not receive. Among them 22.3% were below 1 year of age so there were only 2.3% of them above 1 year who did not receive deworming tablets. In Nepal, 85% of children aged 6–59 months received vitamin A supplements in the last six months, 34% received iron-containing supplements in the past 12 months, and 84% of children aged 12–59 months were given deworming medication in the past six months (MoHP *et al.*, 2022).

Only 5.4% of mothers of Arjundhara Municipality were aware of the Growth Monitoring Card while majority of them (94.6%) were not familiar with it. Overall, 47% of children in Nepal had measurements taken for at least one key component of growth monitoring. Furthermore, only 2% of children in Koshi Province received these measurements. The percentage of children who had growth monitoring measurements taken increased from 8%

among children whose mothers had no education to 20% among those whose mothers had more than a secondary education (MoHP *et al.*, 2022).

Table 4.7 Mothers knowledge regarding diseases and health status

Variables	Frequency	Percent
Did your child affected by any disease recently?		
No	67	51.5
Yes	63	48.5
Recent diseases		
Cough	13	10.0
Fever	31	23.8
Pneumonia	12	9.2
Diarrhea	7	5.4
Consumption of Iron folic acid during pregnancy		
No	3	2.3
Yes	127	97.7
Vaccination during pregnancy		
Yes	130	100.0
Consumption of Vitamin A by the child		
No	25	19.2
Yes	105	80.8
Consumption of deworming tablets by the child		
No	32	24.6
Yes	98	75.4
Knowledge about Growth Monitoring Card		
No	123	94.6
Yes	7	5.4
Knowledge about malnutrition		
No	38	29.2
Yes	92	70.8
Causes of malnutrition		
don't know	45	34.6

Poor hygiene and sanitation	26	20.0
inadequate feeding practices	45	34.6
Illness and infections	5	3.8
Lack of nutritional knowledge	9	6.9
Knowledge about diarrhea		
No	10	7.7
Yes	120	92.3
Causes of diarrhea		
Don't know	18	13.8
Poor hygiene	59	45.4
Dirty water	43	33.1
Lack of diet	10	7.7

In the study, it was observed that a significant majority of the respondents (70.8%) had knowledge about malnutrition while 29.2% did not. Furthermore, regarding the causes of malnutrition, 34.6% identified inadequate feeding practices as a cause, and the same percentage (34.6%) admitted they did not know the causes. Another 20.0% pointed to poor hygiene and sanitation as contributing factors, while a smaller portion (6.9%) attributed malnutrition to a lack of nutritional knowledge and 3.8% associated it with illness and infections. Regarding diarrhea, nearly all respondents (92.3%) were knowledgeable about the condition, with only 7.7% did not know. When discussing the causes of diarrhea, 45.4% of the respondents identified poor hygiene as a major contributor and 33.1% believed dirty water was the primary cause. A smaller proportion (7.7%) associated diarrhea with a lack of diet while 13.8% admitted they were unaware of the causes.

Table 4.8 shows that all children (100%) were reported to have received vaccinations as per their age according to the recommended schedule during their first year of life. This includes BCG immediately after birth, a series of vaccines at 6 weeks, 10 weeks, and 14 weeks, such as Rota, Polio, PCV, and DPT-HepB-Hib. However, 89.2% of children received the FIPV 2nd dose, PCV 3rd dose at 9 months and MR 1st dose whereas the coverage for vaccines administered at 12 and 15 months such as Japanese Encephalitis, MR 2nd dose and Typhoid was 80%, 68.5% and 70%, respectively.

Table 4.8: Mothers knowledge regarding immunization coverage

Variables	Frequency	Percent
Immunization according to age of child		
Yes	130	100.0
BCG immediately after birth		
Yes	130	100
Rota 1st dose at 6 weeks		
Yes	130	100.0
Polio 1st dose at 6 weeks		
Yes	130	100
PCV 1st dose at 6 weeks		
Yes	130	100
DPT-HepB-Hip 1st dose at 6 weeks		
Yes	130	100
Rota 2nd dose at 10 weeks		
Yes	130	100
Polio 2nd dose at 10 weeks		
Yes	130	100
PCV 2nd dose at 10 weeks		
Yes	130	100
DPT-HepB-Hip 2nd dose at 10 weeks		
Yes	130	100.0
Rota 3rd dose at at 14 weeks		
Yes	130	100
FIPV 1st dose at 14 weeks		
Yes	130	100
DPT-HepB-Hip 3rd dose at 14 weeks		
Yes	130	100
FIPV 2nd dose at 9 months		
Yes	116	89.2

No	14	10.8
MR 1st dose at 9 months		
Yes	116	89.2
No	14	10.8
PCV 3rd dose at 9 months		
Yes	116	89.2
No	14	10.8
Japanese Encephalitis at 12 months		
Yes	104	80.0
No	26	20.0
MR 2nd dose at 15 months		
Yes	89	68.5
No	41	31.5
Typhoid at 15 months		
Yes	91	70.0
No	39	30.0

Nationally, 52% of children aged 12–23 months are fully vaccinated according to the national immunization schedule (MoHP *et al.*, 2022). This finding indicates that initial vaccination rates in the first year of survey area was exceptionally high, while there is a noticeable drop in vaccine coverage as children approach their second year. This decline could be attributed because some of children from the study had not yet reached the appropriate age to receive them while some didn't receive due to sickness as reported by their mother.

4.5 Food consumption pattern

The consumption of food items was categorized as "regular" if consumed daily for at least once, "frequent" when ingested 3-4 times a week, "rare" if consumed once a week or less, and "never" if not consumed at all. The data in Table 4.9 reveals that all participants (100%) consumed rice regularly indicating that rice is a staple food. Wheat consumption is more varied, with only 11.5% consumed it regularly, 23.8% frequently, 35.4% rarely and a significant portion (29.2%) never consumed it. For other grains like maize, millet and barley, 23.8% never consumed them, 30% consumed them frequently, 43.1% did so rarely and only

3.1% consumed them regularly. The majority (93.1%) regularly consumed starchy foods like potatoes and yams with, 6.2% consuming them frequently and only 0.8% consuming them rarely.

Table 4.9 Distribution of food consumption pattern of the surveyed population

Variables	Frequency	Percent
Consumption of rice		
Regular	130	100.0
Consumption of wheat		
Never	38	29.2
Regular	15	11.5
Frequent	31	23.8
Rare	46	35.4
Consumption of maize/millet/barley		
Never	31	23.8
Regular	4	3.1
Frequent	39	30.0
Rare	56	43.1
Consumption of potato, yam and starchy food		
Regular	121	93.1
Frequent	8	6.2
Rare	1	0.8
Consumption of whole daal and lentils		
Never	1	0.8
Regular	127	97.7
Frequent	2	1.5
Consumption of grams, beans and peas		
Never	3	2.3
Regular	50	38.5
Frequent	50	38.5
Rare	27	20.8
Consumption of nuts		

Never	26	20.0
Regular	33	25.4
Frequent	29	22.3
Rare	42	32.3
Consumption of milk		
Never	22	16.9
Regular	90	69.2
Frequent	12	9.2
Rare	6	4.6
Consumption of curd		
Never	30	23.1
Regular	35	26.9
Frequent	31	23.8
Rare	34	26.2
Consumption of paneer or cheese		
Never	59	45.4
Frequent	24	18.5
Rare	47	36.2
Consumption of meat		
Never	29	22.3
Regular	11	8.5
Frequent	36	27.7
Rare	54	41.5
Consumption of fish		
Never	54	41.5
Regular	7	5.4
Frequent	21	16.2
Rare	48	36.9
Consumption of poultry		
Never	15	11.5
Regular	20	15.4
Frequent	73	56.2

Rare	22	16.9
Consumption of Organ meat		
Never	17	13.1
Regular	18	13.8
Frequent	60	46.2
Rare	35	26.9
Consumption of eggs		
Never	22	16.9
Regular	57	43.8
Frequent	45	34.6
Rare	6	4.6
Consumption of fruits and GLV		
Regular	114	87.7
Frequent	13	10.0
Rare	3	2.3
Consumption of other vegetables		
Regular	95	73.1
Frequent	32	24.6
Rare	3	2.3
Consumption of sentinel unhealthy foods		
Never	26	20.0
Regular	68	52.3
Frequent	6	4.6
Rare	30	23.1

In the context of pulses and legumes, 97.7% of the participants regularly consumed whole daal (lentils) while 1.5% of them consumed it frequently. The consumption of legumes like grams, beans and peas was more varied, with 38.5% consuming them regularly, 38.5% consuming them frequently and 20.8% consuming them rarely. Nuts were less commonly consumed, with 25.4% consuming them regularly, 22.3% consuming them frequently, 32.3% consuming them rarely and 20.0% never consuming them.

Milk was regularly consumed by 69.2% of the population, though 16.9% did not consume it at all. Curd consumption was less consistent, 26.9% consumed it regularly, 23.8% frequently, 26.2% rarely and 23.1% never consumed it. Paneer or cheese was less common in the diet, with 45.4% never consuming it, 36.2% consuming it rarely and only 18.5% consuming it frequently.

The meat consumption pattern indicated that fish was less frequently consumed and egg consumption was relatively widespread. Mutton was frequently consumed by 27.7% but 22.3% never ate it. Fish was never consumed by 41.5% of the participants, consumed frequently by 16.2%, rarely by 36.9% and only 5.4% consumed it regularly. Poultry was more popular, with 56.2% consuming it frequently, 15.4% regularly, 16.9% rarely and 11.5% never consuming it. Organ meat was consumed frequently by 46.2%, rarely by 26.9% and regularly by 13.8% while 13.1% did not consume organ meat at all. Eggs were commonly consumed with 43.8% consuming them regularly, 34.6% frequently and 4.6% rarely though 16.9% did not consume eggs.

A large majority (87.7%) of the population consumed fruits and Green leafy vegetables (GLV) regularly, 10.0% consumed them frequently and only 2.3% consumed them rarely. Similarly, the majority (73.1%) consume other vegetables regularly, with a significant portion (24.6%) consuming them frequently and the remaining 2.3% consuming them rarely. Sentinel unhealthy foods, which likely include items like processed snacks and sugary products, were regularly consumed by 52.3%, though 20.0% never consumed them.

4.6 Mother's knowledge level score

The mothers' knowledge level scoring was done into three distinct groups based on their percentile scores; low (0-13), moderate (14-17) and high level of knowledge (18-28). As shown in table 4.10, 27.7% (36) of the mothers had low level of knowledge, 40% (52) had moderate level of knowledge and 32.3% (42) had high level of knowledge regarding nutrition and child feeding practices in the surveyed area. This finding indicates that majority of mothers had moderate level of knowledge about nutrition and child feeding practices in the study.

Table 4.10 Mother's knowledge level score

Level of Knowledge	Score	Frequency (%)
Low Knowledge	0-13	36 (27.7)
Moderate Knowledge	14-17	52 (40)
High knowledge	18-28	42 (32.3)

A study conducted in an urban area in Nigeria, found that only 20% of the mothers had good knowledge about nutrition, while 44.6% had average knowledge, and 35.3% had poor knowledge (Jemide *et al.*, 2016). Similarly, a cross-sectional study conducted in India, found that 35.3% of mothers had a good knowledge regarding nutrition, 38.7% had a moderate knowledge and 26% had a poor knowledge (Gajula *et al.*, 2015). These findings are consistent with the present study where majority of mother possessed average or moderate knowledge regarding nutrition.

However, the present study doesn't align with a cross-sectional descriptive study conducted in Pakistan where majority of mothers possessed poor nutritional knowledge. In that study, only 17% of mothers possessed adequate nutritional knowledge, while 40% had average knowledge and 43% possessed poor nutritional knowledge (Batool *et al.*, 2019).

4.7 Distribution of mothers' knowledge level in relation to age of their children

Table 4.11 presents the distribution of mothers' knowledge about nutrition and child feeding practices, categorized by the age of their children (in months), revealing noticeable trends across different age groups. For children aged 6 to 11 months, most mothers (44.8%) had moderate knowledge, though a significant portion (24.1%) had low knowledge. In the 12 to 23 months aged group, 29.4% of mothers had low knowledge, while 35.3% had moderate and 35.3% had high knowledge. This group exhibited a more evenly distributed knowledge level, with roughly equal proportions of mothers across the low, moderate, and high knowledge categories.

There was a balanced distribution of moderate and high knowledge among the mothers of children aged 24 to 35 months, while 27.3% of mothers still exhibited low knowledge. Mothers of children aged 36 to 47 months showed a significant increase in moderate

knowledge (53.1%), with fewer falling into the high (25%) and low (21.9%) knowledge categories. Lastly, mothers of children aged 48 to 60 months showed an equal proportion of mothers with low and high knowledge (37.5%), with a smaller percentage (25%) in the moderate category.

Table 4.11 Distribution of mothers' knowledge level in relation to age of their children

Age of children in months	Frequency	Mothers' Knowledge level		
		Low level of knowledge	Moderate level of knowledge	High level of knowledge
6 to 11 months	29	7 (24.1%)	13 (44.8%)	9 (31%)
12 to 23 months	34	10 (29.4%)	12 (35.3%)	12 (35.3%)
24 to 35 months	11	3 (27.3%)	4 (36.4%)	4 (36.4%)
36 to 47 months	32	7 (21.9%)	17 (53.1%)	8 (25%)
48 to 60 months	24	9 (37.5%)	6 (25%)	9 (37.5%)

4.8 Nutritional status of the children

Fig.4.1 shows the nutritional status of children in the study area with varying degrees of malnutrition. Among the 130 children surveyed, 6.1% were classified as wasted with a further breakdown indicating 2.3% were moderately wasted and 3.8% were severely wasted. In terms of stunting, 27.7% of the children were identified as stunted, with 15.4% being moderately stunted and 12.3% severely stunted. Underweight prevalence was recorded at 8.4%, including 6.9% moderately underweight and 1.5% severely underweight.

According to the report of NDHS 2022, 8% of under 5 years of children were wasted, 25% were stunted and 19% were underweight. Furthermore, in Koshi province, where Arjundhara municipality lies, prevalence of stunting, wasting and underweight was 20%, 4% and 13% respectively. This shows that the prevalence of stunting and wasting in the present study was higher while the prevalence of underweight was lower than that of result provincial result (MoHP *et al.*, 2022).

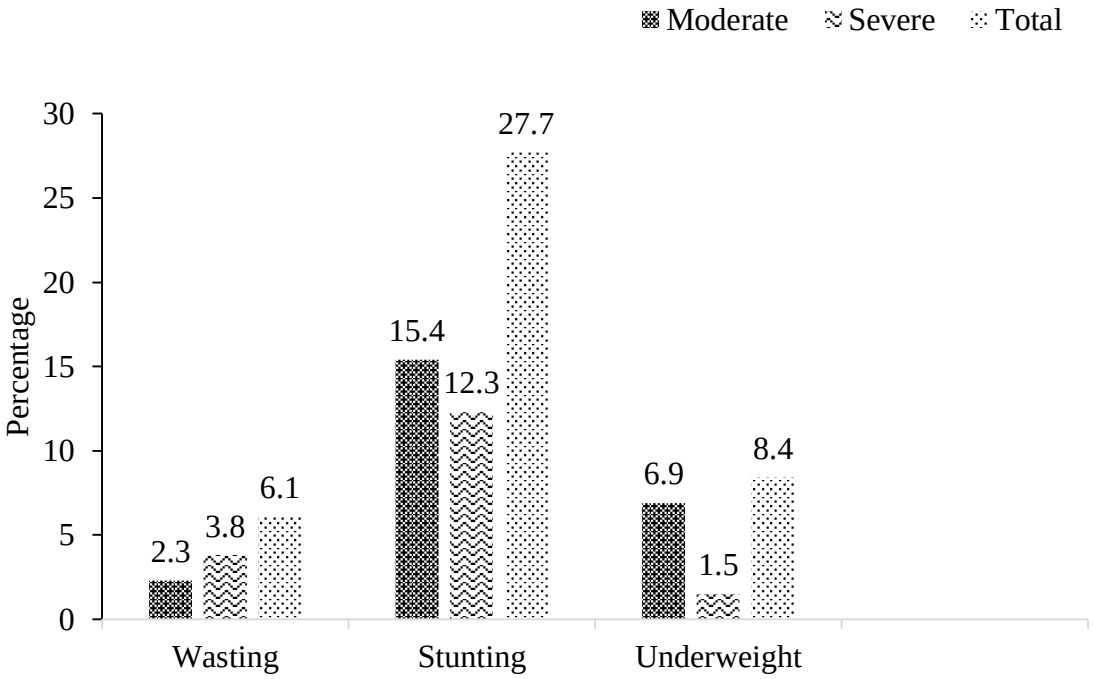

Fig 4.1: Prevalence of Malnutrition among Surveyed Children

A study conducted in Lamjung, Gorkha and Tanahun Districts of Nepal found that the prevalence of wasting, stunting and underweight was 10.6%, 53.9% and 20.8%, respectively (Dhungana, 2017). A community-based cross-sectional study conducted in Ethiopia revealed that 30.9% were underweight, 47.6% of the children were stunted and 16.7% were wasted (Mengistu *et al.*, 2013).

In the present study, stunting was found to be more prevalent than wasting and underweight. This finding aligns with similar results from the research conducted in Nepal (Dhungana, 2017), Kenya (Nungo *et al.*, 2012) and Ethiopia (Mengistu *et al.*, 2013).

In contrast to this study, a community-based cross-sectional study conducted in Bhadrapur Municipality, Jhapa district, revealed prevalence rates of 39.5% for stunting, 14.2% for wasting and 29.5% for underweight (Sangroula and Uprety, 2020). Likewise, in the study conducted in Sri Lanka (Peiris and Wijesinghe, 2011) 11.8% were stunted, 42.7% were wasted and 41.2% were underweight.

This scenario shows that there is wide variation in malnutrition within and between the countries. This may be due to the fact that malnutrition is widely affected by socio-economic

condition, socio-cultural practices, dietary habit, poverty, etc. and these factors are different by geographic locations (Dhungana, 2017).

4.9 Distribution of malnutrition according to age group

From the table 4.12, it is observed that the prevalence of severe wasting was highest among 12-23 months of children, where 11.8% were severely wasted. The same percentage (11.8%) of children in this same age group were also moderately wasted. In contrast, among children aged 24-35 months, the prevalence of moderate wasting is more pronounced, with 18.2% moderately wasted compared to 9.1% who were severely wasted. Notably, no cases of wasting were observed among children aged 36-47 months.

Table 4.12 Distribution of malnutrition according to age group

Age groups	**Frequency**	**WHZ (%)**		**HAZ (%)**		**WAZ (%)**	
		Wasting		**Stunting**		**Underweight**	
		< -3SD	**< -2SD**	**< -3SD**	**< -2SD**	**< -3SD**	**< -2SD**
(6-11)	29	Nil	3.4	20.7	48.3	3.4	10.3
(12-23)	34	11.8	11.8	5.9	11.8	Nil	11.8
(24-35)	11	9.1	18.2	27.3	36.4	Nil	27.3
(36-47	32	Nil	Nil	9.4	31.3	3.1	3.1
(48-60)	24	Nil	4.2	8.3	16.7	Nil	Nil

Stunting was generally high across all age groups but it is particularly more in 24-35 months of children who exhibited the highest percentages of both severe and moderate stunting. The prevalence of severe stunting was high among 24-35 months of children (27.3%), followed by 6-11 months (20.7%), 36-47 months (9.4%), 48-60 months (8.3%) and lowest among 12-23 months (5.9%). The prevalence of moderate stunting was high among 6-11 months (48.3%), followed by 24-35 months (36.4%), 36-47 months (31.3%), 48-60 months (16.7%) and lowest among 12-23 months (11.8%).

Regarding underweight, the highest prevalence of moderate underweight was seen among 24-35 months of children (27.3%), followed by 12-23 months (11.8%), 6-11 months (10.3%) and lowest among 36-47 months (3.1%). Similarly, 3.4% and 3.1% were found to be severely

underweight among the children of age group 6-12 months and 36-47 months respectively. There were no cases of underweight among 48-60 months of children.

In this study, the prevalence of wasting and underweight was highest among children aged 24–35 months, both at 27.3%. Conversely, stunting was most prevalent among children aged 6–11 months, at 69%. Nationally, the prevalence of stunting (27%) and underweight (20%) is higher among children aged 24–59 months. The higher prevalence of wasting and underweight among children aged 24–35 months in this study aligns with the national trend showing higher rates in the older age group (24–59 months). The significantly higher prevalence of stunting among younger children (6–11 months) in this study contrasts with the national data, where stunting rates are higher in the older age group (24–59 months) (MoHP *et al.*, 2022).

4.10 Nutritional situation according to gender

Out of the total 130 children, 53.1% were males and 46.9% were females. As shown in table 4.13, 4.3% of male children and 3.3% of female children were found to be severely wasted. Similarly, 1.4% of male children and 3.3% of female children were found to be moderately wasted.

Regarding stunting, 13.0% of male children and 11.5% of female children were found to be severely stunted whereas 7.2% of male children and 24.6% of female children were found to be moderately stunted.

In term of underweight, 1.4% of male children and 1.6% of female children were found to be severely underweight whereas 8.7% of male children and 4.9% of female children were found to be moderately underweight.

Overall, stunting was more prevalent among female children whereas underweight was more prevalent among male children. The prevalence of wasting was found to be equal among both male and female children. This result contrast with the study conducted in Lamjung, Gorkha and Tanahun Districts of Nepal, which revealed that these conditions were more prevalent among boys than girls (Dhungana, 2017).

Table 4.13 Nutritional situation according to gender

Variables	<-3 Z-score	<-2 Z-score	>-2 Z-score
Wasting			
Male	3 (4.3%)	1 (1.4%)	65 (94.2%)
Female	2 (3.3%)	2 (3.3%)	57 (93.4%)
Stunting			
Male	9 (13.0%)	5 (7.2%)	55 (79.7%)
Female	7 (11.5%)	15 (24.6%)	39 (63.9%)
Underweight			
Male	1 (1.4%)	6 (8.7%)	62 (89.9%)
Female	1 (1.6%)	3 (4.9%)	57 (93.4%)

4.11 Distribution of malnutrition according to MUAC measurement

Based on the Mid-Upper Arm Circumference (MUAC) measurements, 3.8% of the children were found to be moderately malnourished, 96.2% were found to have a normal nutritional status and none were severely malnourished as shown in Table 4.14.

Table 4.14 Distribution of malnutrition according to MUAC measurement

Variables	**Frequency**	**Percent**
MUAC measurement		
Severely malnourished	Nil	Nil
Moderately malnourished	5	3.8
Normal	125	96.2

4.12 Weight for height curve

The median weight for height z-score of surveyed children was found to be 0.97. As shown in the Fig.4.2, the curve is slightly skewed to the right side of the WHO standard curve, with a long tail on the left side. This right skewness indicates a generally better nutritional status among the surveyed children, with fewer instances of wasting for their height in the studied population.

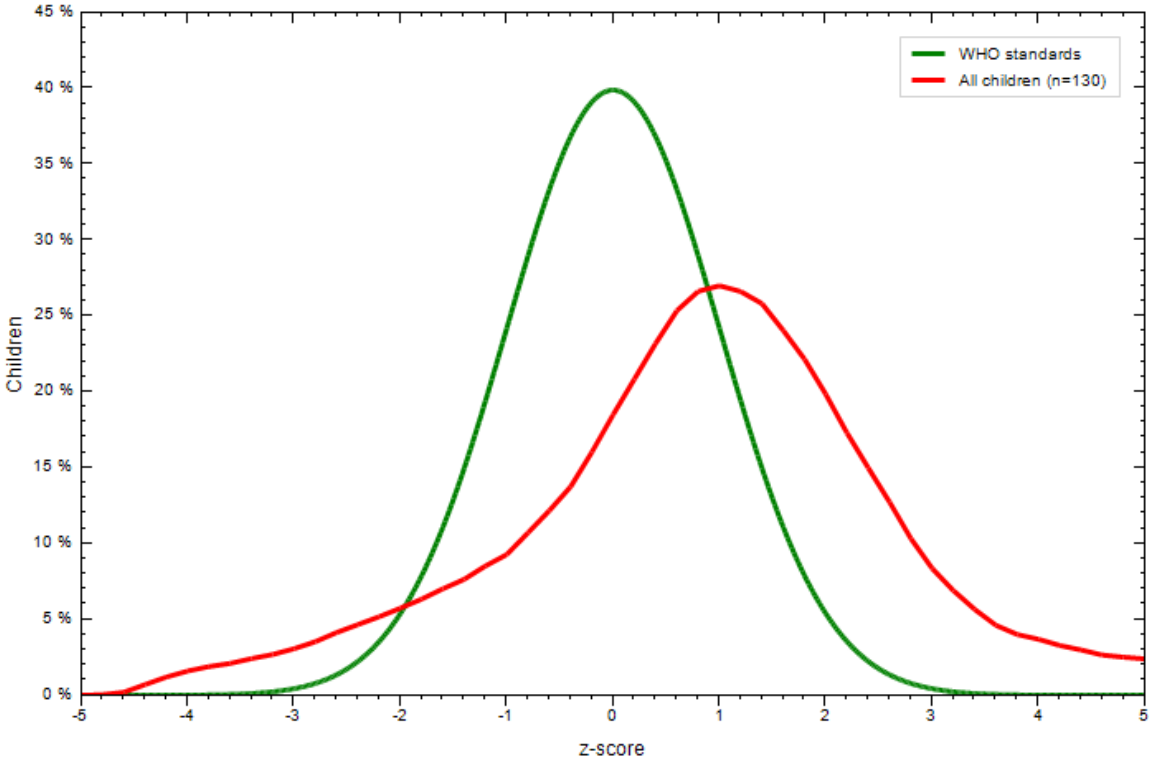

Fig.4.2 Weight for Height curve with reference to WHO standard

4.13 Height for age curve

The median height-for-age Z-score of the surveyed children was found to be -1.31. As shown in Fig. 4.3, the curve is skewed to the left compared to the WHO standard curve, indicating a higher prevalence of stunting among the studied population.

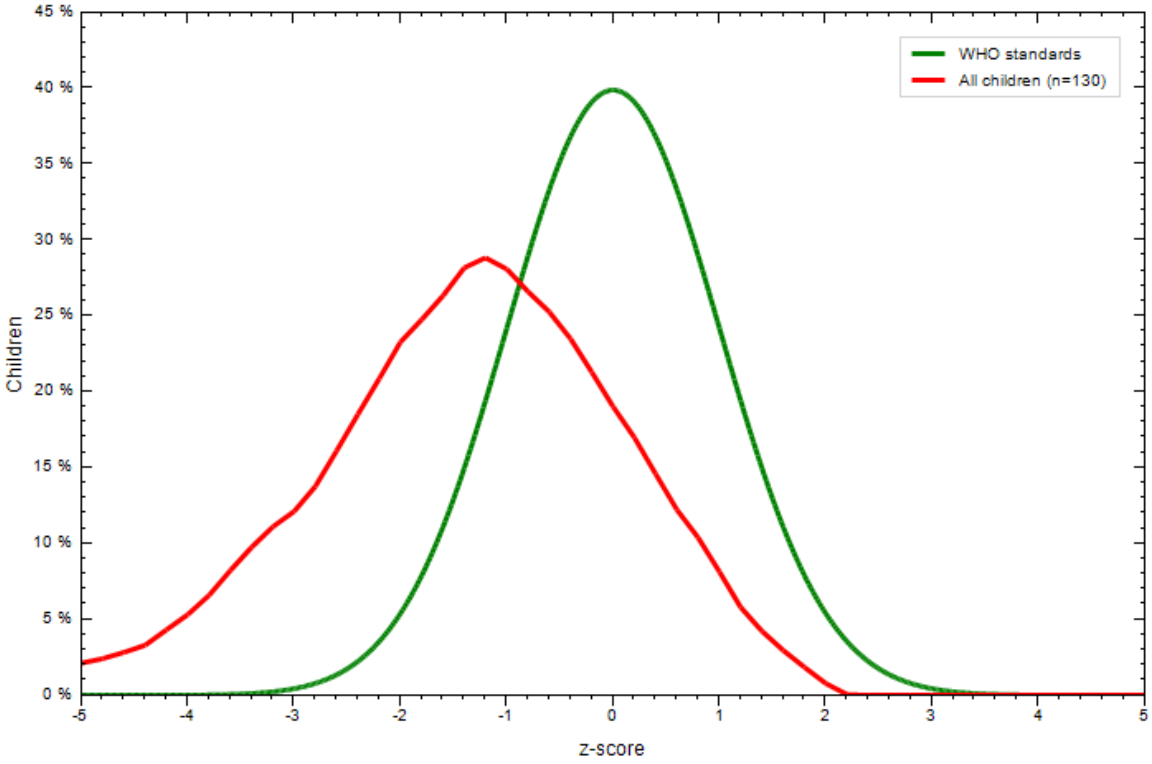

Fig.4.3 Height for Age curve with reference to WHO standard

4.14 Weight for age curve

The median weight-for-age Z-score of the surveyed children was found to be -0.205. As shown in Fig. 4.4, the curve is skewed to the right compared to the WHO standard curve, indicating that there are fewer cases of underweight in the surveyed population.

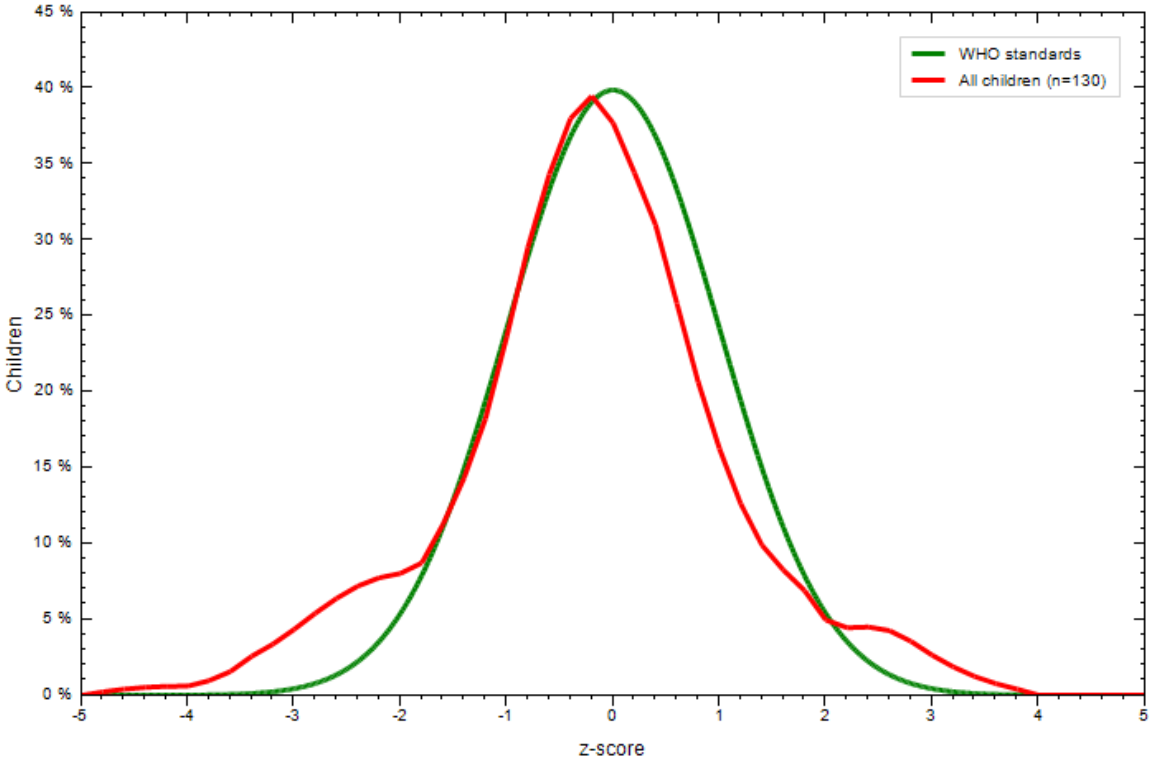

Fig.4.4 Weight for Age curve with reference to WHO standard

4.15 Association between mother's knowledge score and malnutrition

Table 4.15 shows a clear and statistically significant association ($p<0.05$) between mothers' knowledge levels with stunting and underweight in children but not with wasting in children. Specifically, children of mothers with higher knowledge levels were less likely to be underweight. However, the association between mothers' knowledge levels and wasting was not statistically significant.

A similar study conducted in Nigeria found a statistically significant association between maternal nutrition knowledge with both underweight and stunting, while no significant association was observed with wasting (Jemide *et al.*, 2016). Likewise, a cross sectional descriptive study conducted in Kasur District, Pakistan also revealed that there was significant association between child's nutrition status and mothers' nutritional knowledge. The majority of the children with mothers having adequate knowledge had normal nutrition status whereas the children with mothers having poor nutritional knowledge were presented

with highest prevalence of stunting (Batool *et al.*, 2019). These findings are consistent with the present study, although some differences are observed.

In contrast, the present study didn't align with a study conducted in Ghana which showed no association between maternal nutrition knowledge and the nutritional status of children, even though wasting showed a tendency to decrease with increasing nutritional knowledge (Forh *et al.*, 2022).

Table 4.15 Association between mother's knowledge score and malnutrition (n=130)

	WFH		$\tilde{\chi}^2$ value	P-value
	Normal	Wasted		
Low	32 (88.9%)	4 (11.1%)	1.955	0.376
Moderate	50 (96.2%)	2 (3.8%)		
High	40 (95.2%)	2 (4.8%)		
	HFA			
	Normal	Stunted		
Low	27 (75%)	9 (25%)	10.906	0.004*
Moderate	30 (57.7%)	22 (42.3%)		
High	37 (88.1%)	5 (11.9%)		
	WFA			
	Normal	Underweight		
Low	29 (80.6%)	7 (19.4%)	11.703	0.003*
Moderate	48 (92.3%)	4 (7.7%)		
High	42 (100%)	NIL		

*Statistically significant at 5% level of significance (P-value <0.05)

PART V

Conclusion and recommendations

5.1 Conclusion

This study has generally assessed the maternal knowledge about nutrition and child feeding practices in relation to the nutritional status of children under 5 years of age residing in Arjundhara Municipality, Jhapa. Based on the study, the conclusions are:

i) The prevalence of wasting, stunting and underweight among children under 5 years of age residing in Arjundhara Municipality, Jhapa was 6.1%, 27.7% and 8.4% respectively. Among them, 3.8% were found to be severely wasted, 12.3% were severely stunted and 1.5% were severely underweight. Additionally, 3.8% of children were found to be moderately malnourished based on the MUAC measurement,
ii) The prevalence of wasting (27.3%) and underweight (27.3%) was highest among 24-35 months of children while the prevalence of stunting (69%) was highest among 6-11 months of children.
iii) Stunting was more prevalent among female children whereas underweight was more prevalent among male children. The prevalence of wasting was found to be equal among both male and female children.
iv) The majority of mothers (40%) exhibited moderate level of knowledge regarding nutrition and child feeding practices while 32.3% of mothers exhibited high level of knowledge and 27.7% exhibited low level of knowledge.
v) Maternal knowledge about nutrition and child feeding practices was significantly associated with both stunting and underweight but showed no significant association was observed with wasting.

5.2 Recommendations

Based on the results and findings obtained from the survey, following recommendations could be made to improve maternal knowledge and nutritional status of children in the survey area:

i) There is a need to implement nutritional and health education interventions as mothers with better education are more likely to offer improved care through better nutrition and hygiene practices which can enhance the nutritional status of their children.
ii) Additionally, promoting the use of locally available nutritious foods and encouraging the practice of home gardening should be emphasized to mothers.
iii) Public health campaigns should be promoted to increase awareness about the critical role of early childhood nutrition and the influence of maternal knowledge on child health.
iv) Additional cross-sectional descriptive or longitudinal surveys should be conducted to assess the extent and distribution of malnutrition as well as to investigate other potential causes of malnutrition.
v) Further study should be done to see other unexplored factors that were not included in the present study.

PART VI

Summary

Malnutrition in the form of stunting and underweight is a critical public health issue. A community-based cross-sectional study was conducted in Arjundhara Municipality, Jhapa, to examine how maternal knowledge about nutrition and child feeding practices correlates with the nutritional status of children under five years. The study involved 130 children who were selected using proportional sequential sampling technique, with anthropometric measurements (height, weight, MUAC) used to evaluate their nutritional status. Data on maternal knowledge was gathered through a structured questionnaire and analyzed with WHO Anthro version 3.2.2 and SPSS version 25, using the Chi-square test to explore associations between maternal knowledge and children's nutritional status.

Among the 130 children, 69 were male and 61 were female. The prevalence of wasting, stunting, and underweight was 6.1%, 27.7%, and 8.4%, respectively. Wasting and underweight were more common in children aged 24-35 months, while stunting was more prevalent in those aged 6-11 months. Stunting was higher among female children, whereas underweight was more common in male children, although wasting rates were similar for both genders.

Household characteristics showed that 94.6% of households were male-headed, with nuclear families (63.1%) being more common than joint families (36.9%). Monthly household incomes were predominantly between Rs. 30,000 and Rs. 60,000 (53.1%), with a smaller portion earning above Rs. 60,000 (27.7%) or below Rs. 30,000 (19.2%). Fathers' educational levels varied: 52.3% had secondary education, 24.6% had higher secondary or above, and 23.1% had basic education.

For mothers, 56.9% had secondary education, 30.8% had higher secondary or above, 11.5% had basic education and 0.8% had no formal education. Most mothers (73.1%) were married between ages 20 and 30, with 83.8% experiencing their first pregnancy during this age range. A majority (90.0%) fed colostrum to their newborns, primarily due to its health benefits (49.2%) and health worker recommendations (40.8%). Breastfeeding was initiated within the first hour by 50.8% of mothers and 73.1% practiced exclusive breastfeeding until

five months. Complementary foods were introduced at six months by 67.7% of mothers, with some starting earlier or later.

The study found that 40% of mothers had moderate knowledge regarding nutrition and child feeding practices, 32.3% had high knowledge and 27.7% had low knowledge. The study found a significant association between maternal knowledge with the prevalence of stunting and underweight among children. However, no significant association was observed between maternal knowledge with wasting.

To improve child malnutrition, a coordinated effort by government, NGOs and the community is essential. Key strategies include enhancing maternal education on nutrition, strengthening community health programs and promoting timely complementary feeding. Regular growth monitoring and addressing socioeconomic factors are also crucial. The findings of this study can guide government and organizational efforts to improve child nutrition and reduce malnutrition. The result obtained from this dissertation can be used by the government as well as other organizations for eradicating the malnutrition problem.

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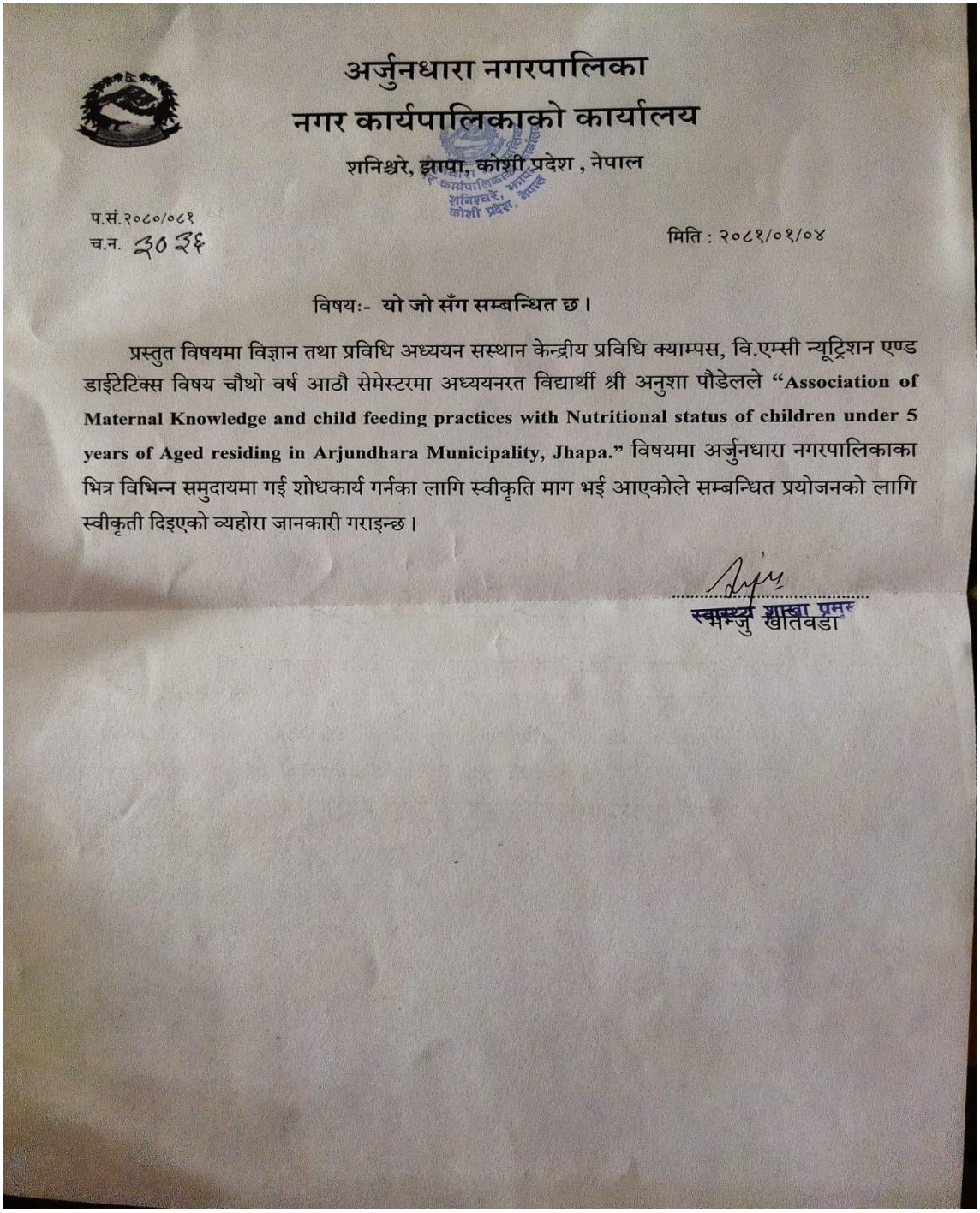
Appendices

Appendix-A Permission letter from Arjundhara municipality



अर्जुनधारा नगरपालिका
नगर कार्यपालिकाको कार्यालय
शनिश्चरे, झापा, कोशी प्रदेश , नेपाल

प.सं.२०८०/०८१
च.न. ३०३६

मिति : २०८१/०१/०४

विषयः- **यो जो सँग सम्बन्धित छ ।**

प्रस्तुत विषयमा विज्ञान तथा प्रविधि अध्ययन सस्थान केन्द्रीय प्रविधि क्याम्पस, वि.एम्सी न्यूट्रिशन एण्ड डाईटेटिक्स विषय चौथो वर्ष आठौ सेमेस्टरमा अध्ययनरत विद्यार्थी श्री अनुशा पौडेलले **"Association of Maternal Knowledge and child feeding practices with Nutritional status of children under 5 years of Aged residing in Arjundhara Municipality, Jhapa."** विषयमा अर्जुनधारा नगरपालिकाका भित्र विभिन्न समुदायमा गई शोधकार्य गर्नका लागि स्वीकृति माग भई आएकोले सम्बन्धित प्रयोजनको लागि स्वीकृती दिइएको व्यहोरा जानकारी गराइन्छ ।

स्वास्थ्य शाखा प्रमुख
भम्जु खतिवडा

P1: Letter of permission from Arjundhara Municipality

Appendix-B Informed consent letter

INFORMED CONSENT LETTER

Namaste! I am Anusha Poudel, undergraduate student of BSc. Nutrition and Dietetics in Central Campus of Technology, Dharan and I am here for my dissertation work in Arjundhara municipality, for the partial fulfillment of my bachelor's degree in Nutrition and Dietetics. The topic for the study is "**ASSOCIATION OF MATERNAL KNOWLEDGE ABOUT NUTRITION AND CHILD FEEDING PRACTICES WITH NUTRITIONAL STATUS OF CHILDREN UNDER 5 YEARS OF AGE RESIDING IN ARJUNDHARA MUNICIPALITY, JHAPA.**"

You will be asked some questions and some physical measurements from your child will also be taken with your approval to participate in this study. This study also aims to make you aware about your child's nutritional status. Your participation in this study will be voluntary. You might have the privilege of not answering the questions if you feel them sensitive. The privacy of your information will be maintained and it will not be misused. I am hopeful that you will be helping me in this study with your participation.

Do you want to get participated in this study?

Yes, I want to participate in this study and give my consent to take all the required measurements from my child and the answers for this study.

Signature of participants: *Signature of surveyor:*

Date:

Place:

Appendix C Questionnaire

General Information

Code No…….. Ward No. …….

A. Demographic and socio-economic characteristics of family

1. Who is the head of the household/family?
   a) Male b) Female
2. What is your religion?
   a) Hindu b) Buddhist c) Muslim d) Christian e) Kirat f) Others
3. What is your caste?
   a) Brahmin/Chhetri b) Dalit c) Janjati d) Madhesi e) Muslim f) Others
4. Family type.
   a) Nuclear family b) Joint family
5. What is the main income source of your family?
   a) Housewife b) Agriculture c) Business d) Employment/Services e) Daily Laborer f) Others
6. What is your household's monthly income?
   a) Below Rs. 30,000 b) Between Rs. 30,000-60,000 c) Above 60,000
7. Father's education level?
   a) No education b) Basic level education (1-8) c) Secondary level education (9-12) d) High Secondary Level and above

B. Mother's characteristics

1. Mother's age:……
2. Mother's education level?
   a) No education b) Basic level education (1-8) c) Secondary level education (9-12) d) High Secondary Level and above
3. Mother's occupation?
   a) Housewife b) Agriculture c) Business d) Employment /Services e) Labor f) other
4. What is your age at marriage?
   a) 15 or less than 15 years b) 15-20years c) 20 years-30 years d) ≥30 years

5. Age at first pregnancy?

   a) 15 or less than 15 years b) 15-20 years c) 20 years-30 years d) ≥30 years

6. What is your marital status?

   a) Married/ living together c) Single parent (separated/divorced/widowed)

A. Child's characteristics

1. Child's Name:……..…….
2. Date of birth:……
3. Age:……
4. Gender: a) Male b) female
5. Anthropometric measurement of children:

Height (cm)	Weight (kg)	MUAC (cm)

6. Is your child currently breastfeeding?

   a) Yes b) No

7. Weight of a newly born child?

   a) ≥ 2.5kg b) <2.5kg c) no idea

B. Mother Nutritional Knowledge

❖ **Breastfeeding practices**

1. Did you feed colostrum to your child?

   a) Yes b) No

   If yes, why……..

2. Before giving colostrum to the baby did you fed any other thing (pre-lacteal feeding)?

   a) Yes b) No

   If yes, then which of the following is it?

   a) Honey, water and ghee b) Cow's milk c) Alcohol d) Others

3. When did you initiate early breast feeding?

   a) Within 1hr of birth b) Within 24hrs c) After 24hrs d) don't know

4. How long did you feed your child exclusively with breast milk?

   a) <5 months b) until 5 months c) >5 months d) don't know

5. What was your child's age up to which you breast-fed?

   a) <2 years b) until 2 years c) >2 years d) don't know

6. Do you feed formula milk or animal milk in addition to breast milk?

   a) Yes b) No

❖ **Complementary feeding practices**

1. At which age did you start feeding other foods (solid, semi-solid or soft foods) to the child?

   a) 4 months b) 5 months c) 6 months d) 7 months

2. How often per day did you feed your child with solid, semi-solid or soft food meal?

   a) Once b)2-3 times c) 3-4 times d) 4-5 times

3. How often per day did you feed your child with additional nutritious snacks along with meals?

   a) Once b) 2 times c) do not feed

4. Do you have knowledge regarding *'Harek Baar Khana Chaar'*?

   a) Yes b) No

5. What kinds of salt are good to use at home?

   a) Iodized salt b) non-iodized salt c) both (iodized, non-iodized)

6. Do you know about sarbottam pitho (super flour)? a) Yes b) No

   If yes, how is it prepare……..

7. Do you know about Baal-Vita? a) Yes b) No
8. Have you given Baal-vita to your baby? a) Yes b) No
9. What kinds of food should be given to the children during diarrhea?

   a) Soup b) Same as usual c) No idea

10. Do you know the process of preparing Oral Rehydration Solution (*jeevan jaal/ salt-sugar solution*) at home?

    a) Yes b) No

    If yes, explain how……

❖ **Feeding care practices**

1. Do you use bottle to feed your baby?

   a) Yes b) No

   If yes,

   i. how often do you wash it in a day?

      a) After every feed b) 1-2 times c) 3-4 times d) never

   ii. How you do clean used bottle?

a) Using tap water without soap b) using tap water and soap c) using hot water along with soap

iii. Do you sterilize cleaned bottle by boiling feeding equipment in large pan with water?

a) Yes b) No

2. Do you wash your hand before preparing or cooking food?

a) Yes b) No

3. Do you wash your hand with soap and water before feeding child?

a) Yes b) No

4. Do you use boil water for drinking?

a) Yes b) No

5. Do you store the food by covering it with lid container?

a) Yes b) No

6. Do you store/keep raw and cooked food separately in separate utensils?

a) Yes b) No

7. Do you reheat left over foods before feeding to your child?

a) Yes b) No

8. What do you use to feed your child?

a) Spoon b) Hand

9. Do you wash/clean utensils with hot water?

a) Yes b) No

❖ **Disease and health:**

1. Did your child is affected by any disease recently?

a) Yes b) No

If yes, what is it?

a) Cough b) Fever c) Pneumonia d) Diarrhea e) Others

2. Did you take iron and folic acid tablet during your pregnancy?

a) Yes b) No

3. Did you take vaccinations during pregnancy?

a) Yes b) No

4. Did you give Vitamin A capsule to your child?

a) Yes b) No

5. Did you give de-worming tablet supplementation to your child?
   a) Yes b) No
6. Do you know about Growth Monitoring Card? a) Yes b) No
7. Has your child received all the immunization according to the age?

S.N	At which age	Vaccine	Yes	No
i.	Immediately after birth	BCG		
ii.	6 weeks	Rota (1st dose) Polio (1st dose) PCV (1st dose) DPT-HepB-Hip (1st dose)		
iii.	10 weeks	Rota (2nd dose) Polio (2nd dose) PCV (2nd dose) DPT-HepB-Hip (2nd dose)		
iv.	14 weeks	Polio (3rd dose) FIPV (1st dose) DPT-HepB-Hip (3rd dose)		
v.	9 months	FIPV (2nd dose) MR (1st dose) PCV (2nd dose)		
vi.	12 months	Japanese encephalitis (JE)		
vii.	15 months	MR (2nd dose) Typhoid		

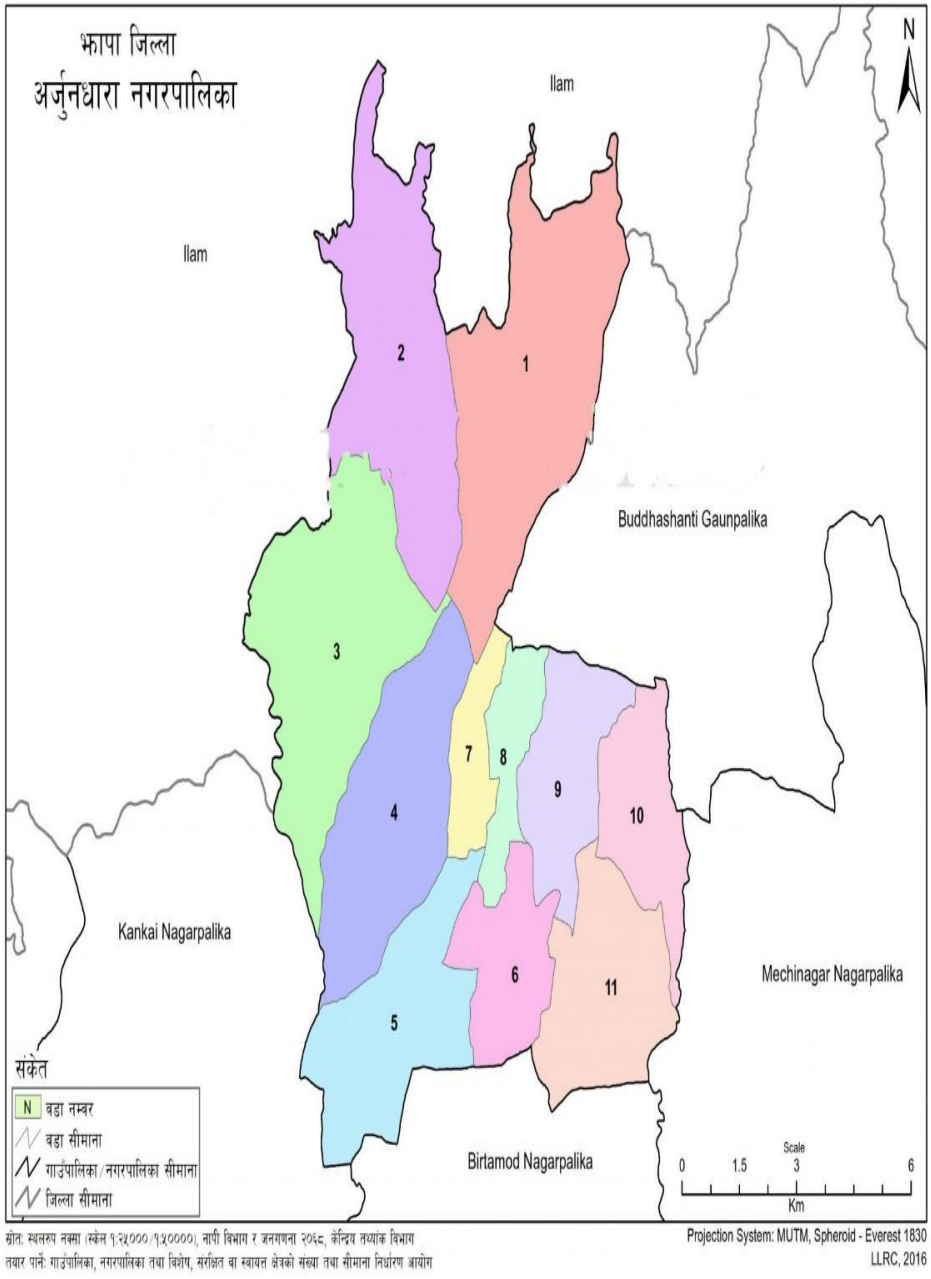
8. Do you have knowledge about malnutrition? a) Yes b) No
   If you know about malnutrition, what may be the cause of it?
   a) Poor hygiene and sanitation b) Inadequate feeding practices
   c) illness and infections d) Lack of nutritional knowledge e) God's curse
   f) Don't know
9. Do you have knowledge about diarrhea? a) Yes b) No
   If you know about diarrhea, what may be the cause of it?
   a) Poor hygiene b) Superstition c) Dirty water d) Lack of diet e) Poor sanitation f) God's curse g) Don't know

C. Food frequency table:

S.N	Type of food	Regularly (at least once a day)	Frequently (3/4 times a week)	Rarely (once in a week or less)	Never
1.	**Cereals, roots and tubers**				
	Rice				
	Wheat				
	Maize/Millet/Barley				
	Potato, yam and starchy tubers				
2.	**Pulses/Legumes, nuts and seeds**				
	Whole daal/lentils				
	Grams/Beans/Peas				
	Nuts (almonds, flaxseed, groundnut, walnut)				
3.	**Dairy products**				
	Milk				
	Curd				
	Paneer/Cheese				
4.	**Flesh food**				
	Mutton				
	Fish				
	Poultry				
	Organ meat (kidney, liver, heart)				
5.	**Eggs**				
6.	**Vitamin A sources**				

	(Fruits and Green leafy vegetables)				
7.	**Other vegetables**				
8.	**Sentinel unhealthy food** **(**Candies, chocolate, ice cream, cakes, pastries, sweet biscuits, chips, crisps, cheese balls, etc.)				

Appendix-C Study site



P2: Map of Arjundhara municipality, Jhapa

Appendix-D Photo gallery

P3: Measurement of height

P4: Measurement of weight

P5: Asking questionnaire to mother

Appendix-E Percentile categorization of maternal knowledge about nutrition and child feeding practices

Category	Percentile range	Score range
Low level of knowledge	Below 33rd percentile	<14 (0-13)
Moderate level of knowledge	33rd to 66th percentile	14-17 (14-17)
High level of knowledge	Above 66th percentile	>17 (18-28)

Appendix-F Relationship of maternal knowledge with nutritional status of children

	WFH		$\tilde{\lambda}^2$ value	P-value
	Normal	Wasted		
Low	32 (88.9%)	4 (11.1%)	1.955	0.376
Moderate	50 (96.2%)	2 (3.8%)		
High	40 (95.2%)	2 (4.8%)		
	HFA			
	Normal	Stunted		
Low	27 (75%)	9 (25%)	10.906	0.004*
Moderate	30 (57.7%)	22 (42.3%)		
High	37 (88.1%)	5 (11.9%)		
	WFA			
	Normal	Underweight		
Low	29 (80.6%)	7 (19.4%)	11.703	0.003*
Moderate	48 (92.3%)	4 (7.7%)		
High	42 (100%)	NIL		

*Statistically significant at 5% level of significance (P-value <0.05)