ASSOCIATION BETWEEN MOTHER'S NUTRITIONAL KNOWLEDGE IN CHILDCARE PRACTICES AND NUTRITIONAL STATUS OF 6-59 MONTHS CHILDREN OF PATHARI SANISCHARE MUNICIPALITY, MORANG

By

Roshani Thapa

Department of Nutrition and Dietetics

Central Campus of Technology

Institute of Science and Technology

Tribhuvan University, Nepal

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Association Between Mother's Nutritional Knowledge in Childcare Practices and Nutritional Status of 6-59 Months Children of Pathari Sanischare Municipality, Morang

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By

Roshani Thapa

Exam Roll no.: 80023

T.U. Registration No.:5-2-8-138-2017

Department of Nutrition and Dietetics

Central Campus of Technology, Dharan

Institute of Science and Technology,

Tribhuvan University, Nepal

December,

Tribhuvan University

Institute of Science and Technology

Nutrition and Dietetics Department

Central Campus of Technology, Dharan

Approval Letter

This ***dissertation*** entitled ***Association Between Mother's Nutritional Knowledge in Childcare Practices and Nutritional Status of 6-59 Months Children of Pathari Sanischare Municipality, Morang*** presented by **Roshani Thapa** has been accepted as the partial fulfillment of the requirements for the **B.Sc. degree in Nutrition and Dietetics.**

Dissertation Committee

1. Head of the Department .....

(Mr. Kabindra Bhattarai, Asst. Prof.)

2. External Examiner .....

(Mr. Dinesh Subedi, Food Research Officer, FTQCO)

3. Supervisor .....

(Mr. Sabin Bahadur Khatri, Teaching Assistant)

4. Internal Examiner .....

(Mr. Kabindra Bhattarai, Asst. Prof.)

December, 2023

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(Roshani Thapa)

Abstract

This study aimed to determine the nutritional status of 6-59 months children of Pathari Sanischare Municipality, Morang and its association with mother's knowledge in childcare practices. Pathari Sanischare was selected by purposive sampling method whereas simple random sampling technique was used to select ward no.6 from Pathari Sanischare municipality. Similarly, 131 children were selected from household by simple random sampling technique. The child's anthropometric measurement (height, weight, MUAC) was taken to determine if the children were wasted, stunted, or underweight based on World Health Organization (WHO) reference. Data were collected by using pretested, semi-structured questionnaires to obtain information on socio-economic and demographic characteristics, child characteristics, child caring practices, maternal characteristics, mother's knowledge in childcare practices and household characteristics. Collected data were analyzed using Statistical Package for Social Science (SPSS) version 25 and WHO Anthro 3.3.2 version. Chi-square test and Fischer exact test were used to test the significant association between factors of malnutrition.

The prevalence of wasting, stunting and underweight was 19%, 22.1% and 24.4% respectively. Wasting and underweight were found to be higher in female children whereas stunting was higher in male children. Prevalence of wasting was high among 36-47 months of children (43.4%), stunting was high among 24-35 months of children (38.4%) and the prevalence of underweight was high among the children of age group 48-59 months (42.9%). Majority of mothers (54.2%) had average knowledge score followed by good knowledge score (23.7%) and poor knowledge score (22.1%) regarding childcare practices. Family type, toilet facility in house and kitchen garden were significantly associated with wasting ($P<0.05$). Family type, house structure and kitchen garden were significantly associated with underweight ($P<0.05$). Similarly, ethnicity, birth weight of a child, house structure, use of maad in the household and drinking water were significantly associated with stunting ($P<0.05$).

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List of Abbreviations

Abbreviation	Full form
DALYs	Disability-Adjusted Life Years
EBF	Exclusive Breast Feeding
FAO	Food and Agriculture Organizations
GoN	Government of Nepal
HAZ	Height for Age Z-score
ICMR	Indian Council of Medical Research
INGOs	International Non-Governmental Organizations
GM	Growth Monitoring
NGOs	Non-Governmental Organisation
ID	Iron Deficiency
IDA	Iron Deficiency Anemia
IDD	Iodine Deficiency Disorder
MNDs	Micronutrient Deficiencies
MAM	Moderate Acute Malnutrition
MoHP	Ministry of Health and Population
MUAC	Mid Upper Arm Circumference
NDHS	Nepal Demographic Health Survey
ORS	Oral Rehydration Solution
PEM	Protein Energy Malnutrition
RDA	Recommended Dietary Allowance
SAM	Severe Acute Malnutrition
SD	Standard Deviation
PPM	Parts Per Million
SPSS	Statistical Package for Social Science
UNICEF	United Nations Children's Fund
VAD	Vitamin A Deficiency
WAZ	Weight for Age Z-score
WFP	World Food Program
WHO	World Health Organization
WHZ	Weight for Height Z-score

Part I

Introduction

1.1 Background of the study

Nutrition is the fundamental pillar of human life, health and development across the life span which is essential for survival from the earliest stage of fetal development, at birth to old age (Pan, 2007). Nutrition is the combination of process by which all parts of the body receive and utilize the materials necessary for the performance of their function and for growth and renewal of all the components. Optimum nutrition means that a person is receiving and utilizing essential nutrient in proper proportion as required by the body. Nutrition status is the condition of the body as it relates to consumption and utilization of food. The nutrition status of a person may be either good or poor (Joshi, 2016). Good nutrition allows children to survive, grow, develop, learn, play, participate and contribute – while malnutrition robs children of their futures and leaves young lives hanging in the balance (WHO, 2020).

Early childhood is a time of rapid physical growth and brain development so, lack of proper nutrition and exposure to illness and infection during these early years can have lifelong consequences on child health and development. At least one in three children is not getting the nutrition they need to grow well, particularly in the crucial first 1,000 days – from conception to the child's second birthday – and often beyond (UNICEF, 2019). Malnourished children have lowered resistance to infection; therefore, they are more likely to die from common childhood ailments such as diarrhoeal diseases and respiratory infections and those who survive are more likely to suffer from frequent illness, which adversely affects their nutritional status and locks them into a vicious cycle of recurring sickness, faltering growth and diminished learning ability (UNICEF, 2006). Long-term malnutrition among children under five years of age results from poor dietary intake which can adversely lead to dysfunction of the physical and mental health (Talukder, 2017).

Nutrition education generally seeks to increase nutritional knowledge, thereby influencing attitude and practices towards good nutrition. Nutritional knowledge and attitude are important factors of dietary practices, so mother's knowledge of nutrition is critical in improving children's nutritional status (Saaka *et al.*, 2021). The aspects of nutrition knowledge include; age for introducing solid foods into a child’s diet and the type of solid foods to introduce, frequency of child feeding, diet during diarrhoea and the mother’s

perceptions of her own child's nutritional status. Mothers' practical nutrition knowledge is important for child outcome (Gichana, 2013). In Nepal, mothers are primarily responsible for creating their children's environment and lifestyle, which may affect children throughout life. Good nutritional knowledge is associated with a healthier lifestyle in children (Oli *et al.*, 2018). 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).

Malnutrition represents poor nutrition and ranges from extreme hunger and undernutrition to obesity. In 2015, inadequate food intake and poor dietary quality were responsible directly or indirectly for causing ill-health (Webb *et al.*, 2018) and in 2017, 11 million deaths and 255 million disability-adjusted life years (DALYs) were attributed to dietary risk factors (Afshin *et al.*, 2019). Globally in 2019, 21.3% of children under the age of 5 were stunted, 6.9% were wasted, and 5.6% were overweight (WHO, 2020).

Nepal is a developing country, where a huge number of people live below the poverty line and has got a high proportion of malnourished children of under-five years of age. The prevailing high rate of child under nutrition is one of the major nutritional problems in Nepal. Malnutrition is affected by individual variations, household variations, variations in community, lack of knowledge related to health and nutrition, economic constraints, malpractices, social and cultural factors, household food insecurity, frequent illness and infections, poor environmental practices, inadequate dietary intake, poor hygiene, eating of fast foods, vaccination status of child, breast feeding as well as maternal factors (Dhungana, 2017).

1.2 Statement of the problem

Children's age under 59 months is the critical period for rapid physical growth as well as overall child development. They suffer from various forms of undernutrition if the nutritional requirement is compromised. Undernutrition among children is a significant contributor to the global disease burden and a leading cause of child mortality worldwide (Black *et al.*, 2008). Malnutrition contributes to 50% of all child deaths and 11% of the total global DALYs worldwide. Geographically, 70–80% of undernourished children worldwide live in lower- and middle-income countries, including Nepal. Undernutrition accounts for 45% of deaths of children younger than 5 years, and contributes to more than three million deaths

every year. In Nepal, around half of the cases of mortality in children under 5 (54 per 1000 live births) are associated with malnutrition (Pravana *et al.*, 2017).

Under-nutrition is the issue of concern among under-5 children in terms of morbidity and mortality as it is causing as high (175/1000) deaths in low-income countries compared to high income countries (6/1000 deaths). Under nutrition places children at an increased risk of impaired physical and mental growth, poor socio-emotional development due to deficiencies of micro and macro nutrients like protein, iodine, iron and vitamin A (Gaurav *et al.*, 2014). Malnutrition remains a serious obstacle to child survival, growth and development in Nepal. Protein-energy malnutrition (PEM) and micronutrient deficiency are most common types of malnutrition. Malnutrition is not evenly distributed throughout Nepal; it varies both ecologically and regionally. Stunting, underweight and wasting are more common in mid and far west hills and mountain areas than other part of the country. All three indicators are poor in the central Terai (Acharya *et al.*, 2013).

According to NDHS 2022, 25% of children under 5years of age are stunted (short for their age), 8% are wasted (thin for their height), 19% are underweight (thin for their age), and 1% are overweight (heavy for their height). 55% of children under age 0-23 months were breastfed within 1 hour of birth, and 56% of children under 6 months were exclusively breastfeed. 78% of children age 6-23 months received meals with minimum recommended diversity (at least 5 out of 8 defined food groups) (MoHP *et al.*, 2022).

Pathari Sanichare municipality has diverse group of population in terms of ethnicity, culture, education and economic status. There was very few research conducted among under 5 children before in this area. It is crucial to find out the most vulnerable group according to different causable factors for improvement of health and nutritional status of people and overall development of Pathari Sanichare. Therefore, present study is designed to assess the association between mother's nutritional knowledge on childcare practices and nutritional status of children aged 6-59 months, which can be used as a reference in priority setting and designing effective nutritional programs at Pathari, Sanischare municipality.

1.3 Objective of the study

1.3.1 General objective

The general objective of this survey is to assess the association between mother's nutritional knowledge on childcare practices and nutritional status of 6-59 months of children of Pathari Sanischare, municipality.

1.3.2 Specific objectives

a) To determine the nutritional status of 6-59 months of children in this study area.

b) To assess the nutritional knowledge of mother and childcare practices followed by them.

c) To assess the association between mother's nutritional knowledge and nutritional status of children.

d) To find out factors associated with malnutrition in children.

1.4 Research questions

a) What is the current nutritional status of 6-59 months of children of Pathari Sanischare municipality?

b) What are the factors associated with nutritional status of 6-59 months of children of Pathari Sanischare municipality?

c) What is the level of mother's knowledge regarding childcare practices?

d) Is there any association between mother's knowledge and nutritional status of children?

1.5 Significance of the study

a) Provide information about nutritional status of 6-59 months of children and identify those who are malnourished or at risk of being malnourished.

b) Identify childcare practices, food habit, food beliefs and taboos that affect nutritional status of child directly or indirectly.

c) Provide knowledge about childcare practices among the mother of the study area.

d) Serve as helpful guide to make a program related to nutrition for this area.

e) Provide information to Government, other private sector and voluntary institution like NGOs, INGOs about nutritional status of 6-59 months of children of that community.

1.6 Limitations of the study

a. Seasonal variation may be there as this is cross sectional study done for specific period of time.
b. The study was conducted with limited resources due to which other important assessments like biochemical, dietary survey and clinical assessment could not be done.

Part II

Literature review

2.1 Nutritional status

Nutrition is defined as a science concerned with the role of food and nutrients in the maintenance of health. Nutrition as defined by Robinson (1982) is “the science of foods and nutrients, 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 of their end product” (John *et al.*, 2004).

Nutrition is concerned primarily with the parts played by nutrients in body growth, development and maintenance. Adequate nutrition helps to attain normal physical growth and is a fundamental right for every human being. If people fail to consume sufficient quality and quantity of nutrients, they will suffer from hunger or malnutrition. The common types of malnutrition in Nepal are: protein energy malnutrition, iodine deficiency disorder, iron deficiency anemia and vitamin A deficiency (Joshi, 2012).

Nutritional status refers to the condition of health of the individual as influenced by the utilization of the nutrients. It can be determined only by the correlation of information obtained through a careful medical and dietary history, through physical examination and appropriate laboratory investigation (Srilakshmi, 2014). Optimal nutrition in infancy and early childhood is essential to meet the demands of rapid growth and development. Under-nutrition reduces immunological capacity to defend against diseases, and recurrent infections, in turn reduce and deprive the body from essential nutrients (De and Chattopadhyay, 2019). Adequate nutrition is essential to ensure healthy growth, proper organ formation and function, a strong immune system, and neurological and cognitive development (WHO, 2012).

2.2 Malnutrition in children

Malnutrition literally means "bad nutrition" and technically includes both over- and under-nutrition. The World Food Programme (WFP) defines malnutrition as "a state in which the physical function of an individual is impaired to the point where he or she can no longer maintain adequate bodily performance process such as growth, pregnancy, lactation, physical work and resisting and recovering from disease" (Bain *et al.*, 2013). Malnutrition is an impairment of health either from a deficiency or excess or imbalance of nutrients. Severe

malnutrition in a certain phase of life can do irreparable damage to the body. Physical, mental and intellectual well-being of a person is affected due to malnourishment (Begum, 2008).

Malnutrition in early childhood is associated with significant functional impairment in adult life, reduced work capacity and decreasing economic productivity (Banstola and Acharya, 2015). Malnutrition remains one of the most common causes of morbidity and mortality among under five children throughout the world. Worldwide, over 10 million children under the age of 5 years die every year from preventable and treatable illnesses despite effective health interventions. At least half of these deaths are caused by malnutrition. Factors that are contributing to malnutrition may differ among regions, communities and over time (Mengistu *et al.*, 2013).

About one-third of all children under the age of 5 years in developing countries are stunted, and 20% are underweight. Wasting, which is also known as moderate acute malnutrition (MAM), has a global prevalence of 10% (55 million children affected). Underweight, stunting, and wasting contribute to 19%, 14.5%, and 14.6% of deaths, respectively, among children under the age of 5 years in the developing world (Ahmed *et al.*, 2020). According to UNICEF the main causes of childhood malnutrition can be categorized into three main underlying factors which are; household food insecurity, inadequate care and unhealthy household environment, and lack of health care services (Tette *et al.*, 2015).

2.3 Causes of malnutrition:

2.3.1 Immediate-level causes of malnutrition

The immediate-level causes of malnutrition include inadequate dietary intake and diseases. On an immediate level, malnutrition results from an imbalance between the required amount of nutrients by the body and the actual amount of nutrients introduced or absorbed by the body. Inadequate dietary intake and diseases are caused by food insecurity, inadequate care for women and children, insufficient health services, and unsanitary environments. Reduced dietary intake, reduced absorption of macro- and/or micronutrients, increased losses or altered requirements, and increased energy expenditure (in specific disease processes) can be a cause for immediate malnutrition (Ersado, 2022).

2.3.2 Underlying-level causes of malnutrition

Household food insecurity, poor social and care environment and poor access to health care, and unhealthy environment are included in underlying causes of malnutrition. The underlying issues are caused by conflict, inadequate education, poverty, gender inequality, inadequate infrastructure, and other basic issues (Ersado, 2022).

2.3.3 Basic-level causes of malnutrition

It includes potential resource and resource control, environmental factors, reasonability, system, institutions, and livelihood system (Ersado, 2022).

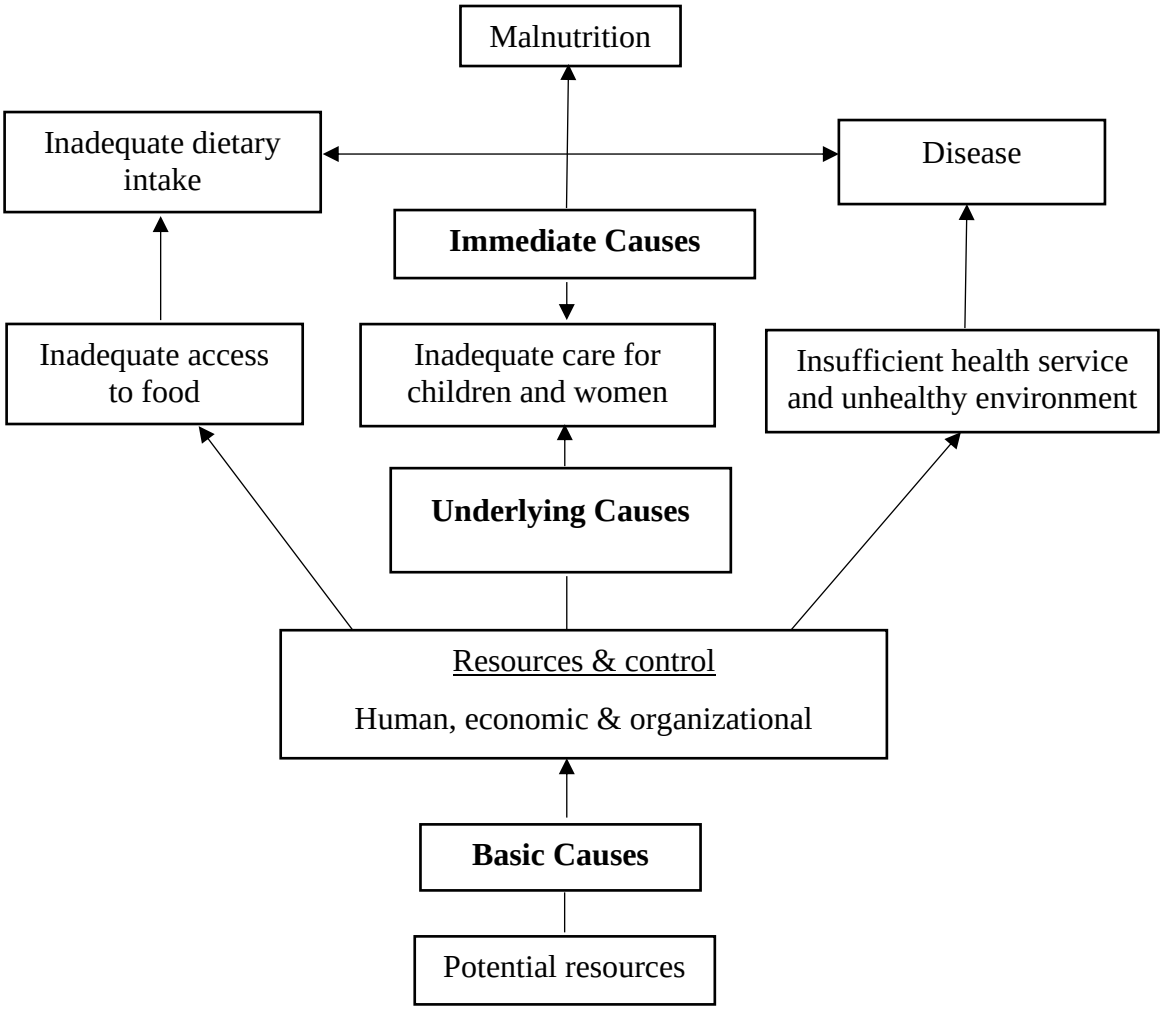

Fig. 2.1 UNICEF Conceptual Framework of Malnutrition (Gross *et al.*, 2000)

2.4 Forms of malnutrition

Four forms of malnutrition are listed below (Srilakshmi, 2006):

a. Undernutrition - the condition which results when insufficient food is eaten over an extended period of time.
b. Over nutrition – the pathological state resulting from the consumption of excessive quantity of food over an extended period of time.
c. Imbalance - the pathological state resulting from a disproportion among essential nutrients with or without the absolute deficiency of any nutrients.
d. Specific deficiency – the pathological state resulting from a relative or absolute lack of an individual nutrient.

2.5 Types of malnutrition

The main types of malnutrition prevailing in humans are protein energy malnutrition (PEM) and micronutrient malnutrition, brief descriptions of which are given in the following sections:

2.5.1 Protein energy malnutrition

It results from a diet lacking in energy and protein because of a deficit in all major macronutrients, such as carbohydrates, fats and proteins. In children, protein–energy malnutrition is defined by measurements that fall below 2 standard deviations under the normal weight-for-age (underweight), height-for-age (stunting) and weight-for-height (wasting). Protein-energy malnutrition usually manifests early, in children between 6 months and 2 years of age and is associated with early weaning, delayed introduction of complementary foods, a low-protein diet and severe or frequent infections (Müller and Krawinkel, 2005).

Classification of PEM is as follows:

2.5.1.1 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 and characterized by emaciation. It usually occurs in the 1st year of life, resulting in wasting & growth retardation (Jee, 2021). It often results when there is a decrease or absence of

breastfeeding, feeding on diluted milk formula, or a delay in introducing solid foods in the diet (Ahmed *et al.*, 2020).

Symptoms of marasmus include (Jee, 2021):

- Severe growth retardation
- Loss of subcutaneous fat
- Severe muscle wasting
- The child looks appallingly thin
- Limbs appear as skin and bone
- Shriveled body
- Wrinkled skin
- Irritability, fretfulness and apathy
- Frequent watery diarrhoea and acid stools
- Mostly hungry but some are anorectic
- Dehydration
- Oedema and fatty infiltration are absent

2.5.1.2 Kwashiorkor

The term kwashiorkor is taken from the Ga language of Ghana and means "the sickness of the weaning". It refers to an inadequate protein intake with reasonable caloric (energy) intake. Kwashiorkor, also called wet protein-energy malnutrition, is a form of PEM characterized primarily by protein deficiency. 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, peeling skin; and hair discoloration (Jee, 2021).

Symptoms of kwashiorkor include (Jee, 2021):

- Changes in skin pigment.
- Decreased muscle mass
- Diarrhea
- Failure to gain weight and grow
- Fatigue
- Hair changes (change in color or texture)

- Increased and more severe infections due to damaged immune system
- Irritability
- Large belly that sticks out (protrudes)
- Lethargy or apathy
- Loss of muscle mass
- Rash (dermatitis)
- Shock (late stage)
- Swelling (edema)

2.5.1.3 Marasmic- Kwashiorkor

A child with features of both nutritional marasmus and kwashiorkor are diagnosed as having marasmic-kwashiorkor. A child with early kwashiorkor can develop marasmus by severe infective diarrhea and prolonged under feeding. Similarly, an infant with marasmus may develop kwashiorkor if fed on protein deficient carbohydrate rich food along with adequate salt (Müller and Krawinkel, 2005). Characteristically, these children have concurrent gross wasting and edema and frequently are stunted. They usually have mild hair and skin changes and an enlarged palpable fatty liver (Grover and Ee, 2009).

2.5.2 Micronutrient malnutrition

Micronutrient deficiencies, i.e., deficiencies of vitamins and minerals, are significant contributors to the global burden of disease. Micronutrient malnutrition goes largely unrecognized and hence is also referred to as 'hidden hunger', the consequences of which are high morbidity and mortality among young children (Vijayaraghavan, 2018). Micronutrient deficiencies and infectious diseases often coexist and exhibit complex interactions leading to the vicious cycle of malnutrition and infections among underprivileged populations of the developing countries, particularly in preschool children (Bhaskaram, 2002). Micronutrient deficiencies affect at least 2 billion people worldwide (Müller and Krawinkel, 2005).

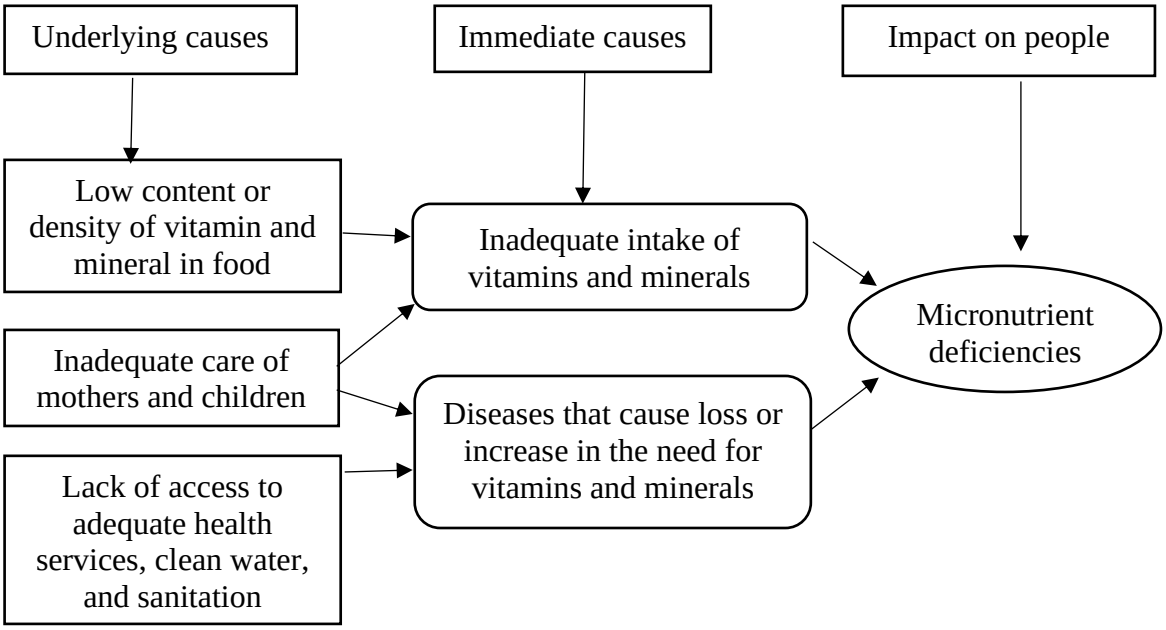

Fig. 2.2: Interlinkage among the causes of MNDs in Nepal (Bhandari and Banjara, 2015)

2.5.3 Vitamin A deficiency (VAD)

Vitamin A is essential in regulating numerous key biologic processes in the body, including those involved in morphogenesis, growth, maturation, vision, reproduction, immunity, and more broadly, cellular differentiation and proliferation throughout life. Thus, it must be provided from the diet in sufficient amounts to meet all physiologic needs (West and Darnton-Hill, 2008). It is the leading cause of preventable blindness in young children in the low-income countries in the world. Children even with milder signs of VAD have higher risk of morbidity and mortality. Inadequate dietary intakes of vitamin A with poor bioavailability associated with frequent infections are the primary contributory factors. Inadequate intakes of vitamin A in women during pregnancy and lactation, increase the chances of VAD in the offspring (Vijayaraghavan, 2018).

Xeropthalmia is the term used to describe the signs and symptoms of vitamin A deficiency (VAD) that are associated with the eyes. It has been associated with anemia, growth retardation, respiratory tract infections, diarrhea, tuberculosis, chicken pox, measles, pertussis, scarlet fever, typhoid, malaria, encephalitis, and urinary tract and other infections (Sommer and West, 1996). A recent study in 2016 revealed that VAD persists in most remote areas in Nepal. The study reported 4% and 3% VAD prevalence in children and women, respectively. This prevalence is partly due to socioeconomic factors such as illiteracy,

limited accessibility to healthcare facilities, and financial constraints as well as nutritionally poor local diets (Thapa *et al.,* 2023).

2.5.4 Iron deficiency anemia (IDA)

Iron deficiency is the most common form of malnutrition in the world, affecting more than 2 billion people globally. Iron deficiency anemia (inadequate amount of red blood cells caused by lack of iron) is highly prevalent in less-developed countries. Iron deficiency is not the only cause of anemia, but where anemia is prevalent, iron deficiency is usually the most common cause (Stoltzfus and Dreyfuss, 1998). It occurs at all stages of the life cycle, but is more prevalent in pregnant women and young children. The main risk factors for IDA include a low intake of iron, poor absorption of iron from diets high in phytate or phenolic compounds, and period of life when iron requirements are especially high (i.e., growth and pregnancy) (WHO, 2008).

IDA is associated with impairment of motor development and cognitive performance, as well as fatigue, sleep disturbance, irritability, and poor memory and school performance. Breast milk contains relatively low levels of iron but it is readily absorbable and sufficient for infants up to six months of age. However, a longer duration of breastfeeding may increase the risk for ID. Extra iron is required from six months of age onward, either from complementary foods or as a supplement (Chandyo *et al.,* 2015). The WHO estimates that worldwide, 42% of pregnant women, 30% of nonpregnant women (aged 15 to 50 years), 47% of preschool children (aged 0 to 5 years), and 12.7% of men older than 15 years are anemic (De Benoist *et al.,* 2008).

2.5.5 Iodine deficiency disorder (IDD)

Iodine is an essential element for thyroid function, which is necessary for the growth, development and function of the brain and body. A diet deficient in iodine is associated with a wide spectrum of illness, collectively known as iodine deficiency disorders (IDD). It is the most common cause of preventable mental retardation and brain damage in the world today (Guttikonda *et al.,* 2003). Iodine deficiency not only causes goiters, but may also result in irreversible brain damage in the fetus and infant and retard psychomotor development in the child. Iodine deficiency is the most common cause of preventable mental retardation; it also affects a child's learning ability (Gelal *et al.,* 2009).

The most important risk factor for iodine deficiency is residing in an area with soil and water poor in iodine; while goitrogens in vegetables may also interfere with iodine metabolism. Nepal recognized iodine deficiency disorder as a serious public health problem by early 1970s and started its first national control program in 1973, with the Goitre Control Project and the Goitre and Cretinism Eradication Project that distributed iodized oil injections and capsules and coordinated salt iodization activities. Salt iodization was continued as the sole strategy from 1998. In 2001, the standard for iodized salt with minimum 50 ppm at the production level and minimum 30 ppm at the retail level was implemented and significant awareness efforts on using the two-child logo refined salt were started, along with observing February as national iodine month for awareness (Lamichhane *et al.*, 2022).

2.5.6 Zinc deficiency

Zinc is an essential micronutrient for humans and is extensively involved in protein, lipid, nucleic acid metabolism, and gene transcription. Zinc deficiency is common worldwide but is seen with greater frequency in developing countries (Maxfield and Crane, 2020). Zinc deficiency could be resulted due to many reasons including poor dietary zinc intake, increased loss, food insecurity, poor household food distribution, presence of fiber and/or phytate in diets, inappropriate food preparation and storage and infection. People who live in low and middle-income countries consume mainly plant-based diets which contain a high amount of phytate (a substance that inhibits the absorption of zinc), and diets based on starchy roots and/or tubers which are known to have low zinc content that can eventually result in zinc deficiency (Berhe *et al.*, 2019).

Zinc deficiency slows physical growth, impairs cognition and learning, delays wound healing, and in many contexts drives diarrhea, infectious disease, and anemia (Bevis *et al.*, 2023). Mild to moderate zinc deficiency is more common throughout the world than severe zinc deficiency. Children are at higher risk of zinc insufficiency, especially those in low-income countries such as Nepal, where poor diets and gastrointestinal infections are prevalent. Globally, zinc deficiency is highly associated with chronic and infectious diseases like cancer, and diabetes, and measles, HIV (Human Immunodeficiency Viruses), tuberculosis, and pneumonia, respectively. The Government of Nepal (GoN) has introduced zinc supplements to manage childhood diarrhoea in 2007 (Mehata *et al.*, 2020) .

2.6 Nutritional requirements

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, 2014).

The recommended daily allowance (RDA) of nutrients for preschool children (1-6 years) is shown in Table 2.1.

Table 2.1 RDA of pre-school children

Nutrients	**(6-12) months**	**(1-3) years**	**(4-6) years**
Energy (Kcal)	680	1110	1360
Protein (g)	10.5	12.5	16.0
Calcium(mg)	300	500	550
Magnesium(mg)	75	90	125
Iron (mg)	3	8	11
Zinc (mg)	2.5	3.3	4.5
Thiamine(mg)	0.4	0.7	0.9
Riboflavin(mg)	0.6	1.1	1.3
Niacin (mg)	5	7	9
Vitamin B6(mg)	0.6	0.9	1.2
Folate (µg)	85	120	135
Vitamin B12(µg)	1.2	1.2	2.2
Vitamin A(µg)	350	390	510

Source: (ICMR, 2020)

2.7 Mother nutrition knowledge

A mother is the principal provider of the primary care that her child needs during the first five years of life. 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. 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 (Kaur *et al.*, 2015).

Women who receive even a minimal education are generally more aware than those who have no education of how to utilize available resources for the improvement of their own nutritional status and that of their families. Education may enable women to make independent decisions, to be accepted by other household members, and to have greater access to household resources that are important to nutritional status (Girma and Genebo, 2002). Nutritional knowledge may be obtained from several sources including formal education, families and friends, mass media and community health services. If correct nutritional knowledge is practiced, it may result in good nutritional status and if incorrect nutritional knowledge is practiced, it may result in poor nutritional status. Whereas nutritional knowledge obtained from formal education and community health services to a large extent may be relied upon to be the right one, the same cannot be said of knowledge about nutrition obtained through friends and families which may be related to the culture, tradition and beliefs in the community (Appoh and Krekling, 2005).

Mothers are particularly important for nutritional outcomes of children and other household members, because in most situations mothers are primarily responsible for dietary choices and food preparation. There are two main pathways how children can be affected by the nutrition knowledge of their mother. First, the quantity, quality, and diversity of the food prepared in the household, as well as the sanitary practices, influence child nutritional outcomes directly. Second, the dietary and sanitary practices observed and experienced during childhood can also have an indirect effect through forming attitudes towards nutrition and health. Household and contextual variables – such as living standard and food environment – can influence maternal nutrition knowledge and also child nutritional outcomes (Debela *et al.*, 2017).

2.8 Exclusive breastfeeding

Exclusive breastfeeding (EBF) has been defined by WHO as the situation where 'the infant has received only breast milk from his/her mother or a wet nurse, or expressed breast milk

and no other liquids, or solids, with the exception of drops or syrups consisting of vitamins, minerals supplements, or medicines. EBF is adequate in quality as well as quantity in terms of energy, protein, nutrients, water etc. for an infant's need under six months of age (Alemayehu *et al.*, 2009).

Breastfeeding has profound benefits for the child, especially in the first hour of life. Colostrum, the first milk produced by a mother, protects an infant's immature immune system against infection and inflammation. Babies who begin breastfeeding in their first hour have a much lower risk of dying, even compared with babies who begin breastfeeding later on in their first day (UNICEF, 2019). Breast milk provides with all the energy and nutrient required by the infants under 6 months of age which is important for physical, neurological and cognitive development as well as protection from infectious diseases and allergies. The World Health Organization recommends that all infants worldwide are exclusively breastfed for the first 6 months of life, with continued breastfeeding up to 2 years of age (De Jager *et al.*, 2013).

Exclusive breastfeeding (EBF) for the first 6 months of life improves the growth, health and survival status of newborns and is one of the most natural and best forms of preventive medicine. EBF plays a pivotal role in determining the optimal health and development of infants, and is associated with a decreased risk for many early-life diseases and conditions, including otitis media, respiratory tract infection, diarrhoea and early childhood obesity. It has been estimated that EBF reduces infant mortality rates by up to 13% in low-income countries (Agho *et al.*, 2011).

Exclusive breastfeeding offers many short and long-term health and nutrition benefits. In the short term, it is the best source of nutrition, and supports optimum growth and development of the infant. In the long term, exclusive breastfeeding is likely to protect from obesity, type-2 diabetes, and is associated with increased intelligence quotient scores. In low- and middle-income countries where supply of clean water is limited and hygiene of the mother and child is poor, substituting breastmilk with other fluids or food is likely to introduce pathogens resulting in infection-related infant mortality and morbidity. Furthermore, the introduction of other fluids and foods reduces the frequency of breastfeeding and contributes to reduced milk production, ultimately affecting milk supply (Khanal *et al.*, 2016).

2.9 Complementary feeding

The WHO has described the complementary feeding period as “the period during which other foods or liquids are provided along with breast milk” and states that “any nutrient-containing foods or liquids other than breast milk given to young children during the period of complementary feeding are defined as complementary foods” The timely introduction of complementary foods during infancy is necessary for both nutritional and developmental reasons, and to enable the transition from milk feeding to family foods. The ability of breast milk to meet requirements for macronutrients and micronutrients becomes limited with increasing age of the infant. Complementary feeding is associated with major changes in both macronutrient and micronutrient intake (Agostoni *et al.*, 2008).

A proper complementary feeding consists of foods that are rich in energy and in micronutrients (especially iron, zinc, calcium, vitamin A, vitamin C and folates), free from contamination (pathogens, toxins or harmful chemicals), without much of salt or spices, easy to eat and easily accepted by the infant, in an appropriate amount, easy to prepare from family foods, and at a cost that is acceptable by most families (Ulak *et al.*, 2020).

Addition of complementary feeds at six months with continued BF till two years which if followed appropriately can decrease infant mortality by 19% and prevent malnutrition. Complementary feeds bridge the energy, vitamin A and iron gaps which arise in breastfed infants at 6 months of age. Early introduction of complementary feeds is associated with increased morbidity due to diarrheal diseases and development of malnutrition in areas with poor food or water hygiene. On the other hand, too long delay in introducing appropriate complementary foods may lead to nutritional deficiencies of iron, zinc, calcium and sometimes vitamin A and riboflavin. Cultural practices; beliefs and knowledge of parents regarding appropriate feeding practices influence CF (Chapagain, 2013).

WHO and UNICEF define complementary feeding as the process of starting solid, semi-solid or other food to the child along with breastfeeding when breast milk alone is no longer sufficient to meet the nutritional requirements of infants. Appropriate complementary feeding is:

- Timely – meaning that foods are introduced when the need for energy and nutrients exceeds what can be provided through exclusive and frequent breastfeeding;

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

2.10 Methods of assessing nutritional status

Nutrition assessment refers to a comprehensive evaluation of nutrition status including medical history, dietary history, physical examination, anthropometric measurements, and laboratory data (Sungurtekin *et al.*, 2008). Assessment of nutritional status is of fundamental importance to investigating whether a child is growing within recommended limits or is falling outside of them due to disease or unfavourable living conditions (Rocha *et al.*, 2006).

The Academy of Nutrition and Dietetics defines nutritional assessment as "a systematic method for obtaining, verifying, and interpreting data needed to identify nutrition related problems, their causes. and their significance". In other words, nutritional assessment is critical to determine whether a person is at nutritional risk, the nutritional problem, and best strategy to monitor responses to nutrition- and lifestyle-based treatment. It involves initial data collection and continuous reassessment and analysis of data, which are compared to certain criteria such as the Dietary Reference Intakes or other nutrient intake recommendations (Nieman and Lee, 2019). The nutritional status can be assessed by two methods:

2.10.1 Direct method

2.10.1.1 Anthropometric method

Anthropometry is the measurement of the physical dimensions and gross composition of the body. Examples of anthropometry include measurements of height, weight, and head circumference and the use of measurements of skinfold thickness, body density (underwater weighing), air-displacement plethysmography, magnetic resonance imaging, and bioelectrical impedance to estimate the percentage of fat and lean tissue in the body. These

results often are compared with standard values obtained from measurements of large numbers of subjects (Nieman and Lee, 2019).

The advantage of anthropometry is that the available methods are simple, inexpensive and non-invasive. Measurements of length or height and weight provide important clues about health and nutritional well-being. Weight and height measurements are important in identifying infants and children who already have or may be at risk of a nutritional problem (Al-Jassir *et al.,* 2002).

The most commonly used anthropometric indexes for assessing child growth are:

a) Weight-for-Height:

The weight-for-height index measures body mass in relation to body height or length and describes current nutritional status. Children whose Z-score is below minus two standard deviations (-2 SD) from the median of the reference population are considered thin (wasted), or acutely undernourished. 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. The term wastin*g* is used for low weight for height (Blossner *et al.*, 2005).

b) Height-for-Age:

Height-for-age is a measure of linear growth retardation and cumulative growth deficits. 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), or chronically undernourished. Children who are below minus three standard deviations (-3 SD) are considered severely stunted (Blossner *et al.*, 2005).

The commonly used term for low height for age is stunting. Stunting suggests that there was inadequate health and or nutrition for a long period of time. There is worldwide variation of low height for age that ranges from 5% to 65% in less developed countries (Chhetri, 2005).

c) Weight-for-Age:

Weight-for-age is a composite index of height-for-age and weight-for-height. It takes into account both acute and 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 (Blossner *et al.*, 2005).

This measurement is used to determine whether the child is normal, overweight or underweight. This basically shows the dimension of the body in relation to the age of a person. It is affected by the height (height for age) and weight (weight for height) of a person. The term 'underweight' is commonly used for low weight for age (Chhetri, 2005).

d) Mid-upper arm circumference (MUAC):

The MUAC is measured on the left arm at the mid-point of elbow and the shoulder. A measuring tape is placed around the relaxed arm. A single cut off value (12.5 or 13.0 cm) can be used for the children less than 5 years of age (Chhetri, 2005).

e) Head circumference:

The measurement of head circumference is a standard procedure to detect pathological condition in children. Head circumference is related mainly to brain size. At birth the circumference of head is greater than that of the chest (John *et al.*, 2004).

f) Chest circumference:

The circumference of the head and the chest are about the same at six months of age. After this the skull grows slowly and the chest more rapidly. Therefore, between the ages of six months and five years the chest / head circumference ratio of less than one may be due to failure to develop or due to wasting of muscle and fat of chest (John *et al.*, 2004).

2.10.1.2 Biochemical method

The biochemical evaluation of nutritional status includes quantitative determinations of nutrients (minerals and vitamins) their products of metabolism in the body and urine. Example: serum albumin, hemoglobin estimation, serum retinol, urinary iodine, etc., (Bauer, 2002).

Biochemical or laboratory methods include measuring a nutrient or its metabolite in blood, feces, or urine or measuring a variety of other components in blood and other tissues that have a relationship to nutritional status. The quantity of albumin and other serum proteins frequently is regarded as an indicator of the body's protein status, and haemoglobin and serum ferritin levels reflect iron status. Serum lipid and lipoprotein levels, which are influenced by diet and other lifestyle factors, reflect coronary heart disease risk (Nieman and Lee, 2019).

2.10.1.3 Clinical assessment

It is defined as assessment of the health of those parts of the body that can be readily observed in a routine physical examination. Clinical examination can be done by observing certain signs and symptoms which are associated with various nutrient deficiencies in various organs of body like skin, hair, mouth, tongue, nails, etc., (Bauer, 2002).

2.10.1.4 Dietary assessment

Dietary methods generally involve surveys measuring the quantity of the individual foods and beverages consumed during the course of one to several days or assessing the pattern of food use during the previous several months. These can provide data on intake of nutrients or specific classes of foods (Nieman and Lee, 2019).

Dietary assessment deals with assessing a person normal food intake and quality of that diet. It consists of (Bauer, 2002):

a) 24-hours dietary recall

b) Food frequency questionnaire

c) Dietary history

d) Food diary technique

e) Observed food consumption

2.10.2 Indirect method

These include three categories (Jelliffe, 1966):

2.10.2.1 Vital health statistics

Vital health statistics like infant mortality rate, under-five mortality rate, nutritionally relevant diseases (for example diarrhea, tropical ulcer, tuberculosis and measles). A variety of vital statistic may be considered as indirect indicators of the nutritional status of the community (Jelliffe, 1966).

2.10.2.2 Ecological variable

Ecological variables include crop production, soil, irrigation, storage, transport and economic level of the population, as well as on such cultural influence as local cooking

practice and food classifications, especially in relation to the distribution or restriction of foods for vulnerable age groups (Jelliffe, 1966).

2.10.3 Socioeconomic factor

Socio-economic factor like per capita income, occupation, prices of food, budgeting, etc., (Jelliffe, 1966).

2.11 Factors associated with nutritional status of children

Study conducted in Ethiopia showed that mother's educational status was significantly associated with stunting ($p<0.05$). Children whose mothers had no education and also whose mothers had primary education were more likely to be stunted as compared to children whose mother had educational status of secondary or above (Dessie *et al.*, 2019). Study conducted in Kenya showed that sex of a child had no association with nutritional status indices while household income was significantly associated with stunting and underweight (Omondi and Kirabira, 2016).

Study conducted in Bhadrapur Municipality of Jhapa district showed that age of children under five years and maternal age was significantly associated with stunting ($p<0.05$) but not with underweight and wasting ($p>0.05$). The children who were weaned after six months were less likely to be underweight than the children who were weaned before six months and was statistically significant ($p<0.05$) (Sangroula and Uprety, 2020).

Study conducted in rural area of Sri Lanka showed that low birth weight, prolonged breastfeeding, lower maternal education level and paternal smoking were significantly associated with both stunting and underweight ($p<0.05$) whereas male sex, low birth weight and paternal smoking were significantly associated with wasting ($p<0.05$) in children aged 6-59 months (Samarasekara *et al.*, 2019).

Study conducted in Baglung district showed that no significance association between mothers age and underweight ($p>0.05$). However, colostrum milk and the duration of exclusive breastfeeding was significantly associated with underweight ($p<0.05$) (Shah *et al.*, 2021). Study conducted in Kathmandu valley showed that underweight and stunting were significantly associated with socioeconomic status of the family and ethnicity ($p<0.05$). Underweight was found significantly associated with the age of child ($p<0.05$) and stunting was found significantly associated with the educational status of the mother and the age of child ($p<0.05$) (Bucha *et al.*, 2023).

Part III

Materials and methods

3.1 Research design

A community based cross-sectional study was conducted in Pathari Sanischare municipality, Morang to assess the association between mother's nutritional knowledge in childcare practices and nutritional status among children aged 6-59 months. It consisted of;

a) Anthropometric measurement of children under five years of age.
b) Household survey with the help of questionnaires.

3.2 Research materials

Instruments and equipment used during the survey were:

- Digital weighing machine: Child weighing machine made by Micro Life Pvt. Ltd. having capacity of 150 kg (1 piece). The minimum capacity of weighing machine was 0.1 kg.
- 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).
- Mid Upper Arm Circumference (MUAC) tape: MUAC tape was used to measure the MUAC reading. The tape was flexible, non-stretchable and used to measure to the nearest 0.1 cm.
- Questionnaire: A well designed and pretested set of questionnaires was used to collect information on household characteristics, maternal characteristics, child caring practices, hygiene and environmental characteristics, etc

3.3 Study site

The study was conducted in Pathari Sanischare municipality, Morang district of Koshi Province.

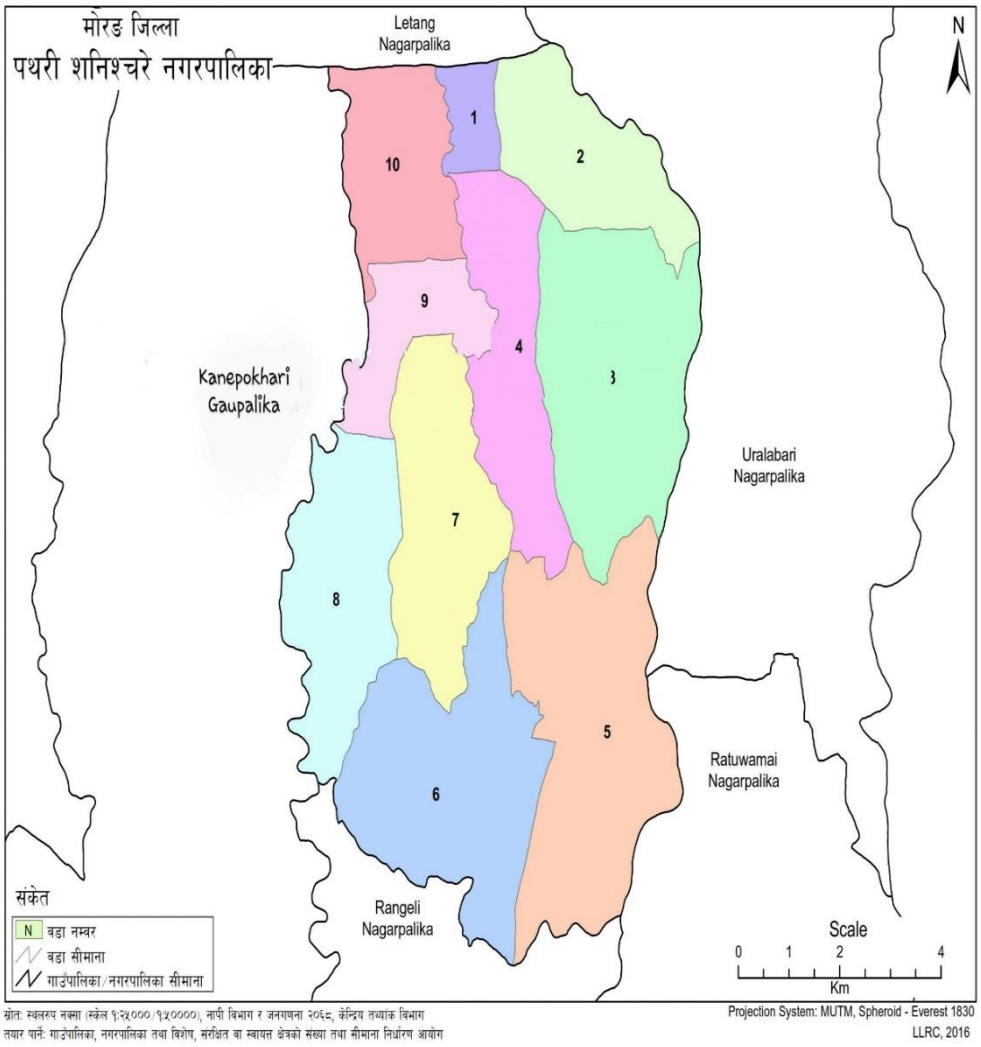

Fig. 3.1: Map of Pathari Sanaischare Municipality

3.4 Target population

The target population of the study was 6-59 months children of Pathari Sanischare municipality, Morang and interview was taken from mothers.

Inclusion and exclusion criteria:

a) **Inclusion criteria:** The children of 6-59 months were selected for survey and the mothers of respective children were also selected for questionnaire.

b) **Exclusion criteria:** The study participants who were seriously ill or whose mothers were not available at household during the time of survey.

3.5 Sampling technique

A cross – sectional study was conducted in ward no.6 of Pathari Sanischare municipality. Pathari Sanischare municipality was selected by purposive sampling method and simple random sampling was used to select ward no.6 from Pathari Sanischare municipality. Children from households were selected by simple random sampling. The basic criterion for the selection of household sample was that the household with at least one child of 6-59 months of age was included in the sample. In households with more than one child of age between 6-59 months, one child was chosen by lottery method.

3.6 Sample size

The sample size was determined by using a single proportional formula assuming the prevalence rate of malnutrition to be 50% in the survey area, 95% confidence interval (CI), 8% margin of error (d) and 10% non-response rate was added to the total calculated sample size.

Calculation of sample size for infinite population: -

Sample size (n0) = $Z^2 \times p \times (1-p)/d^2$

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

P= estimated prevalence of malnutrition (50%)

d= margin of error (8%)

Now, N= $(1.96)^2 \times 0.5 \times (1-0.5) / (0.08)^2$

= 150.0625

≈ 150

According to the information collected from Pathari Sanischare 6 health post, the total numbers of 6 -59 months aged children were 583. Thus, we apply finite population sample formula to obtain new sample size to conduct the survey.

Therefore, New SS = $n_0 / [1+ \{(n_0-1) / POP)]$

Where, New SS = 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 6-59 months age children in Pathari Sanischare, 6).

New sample size obtained as: $n_0 / [1+ \{(n_0-1) / POP\}]$

$= 150 / [1+ ((150-1) / 583)]$

$= 119.46$

Thus, calculated sample size is adjusted for non-response. So, considering non-response rate as 10%, the adjusted sample size is calculated to be 131.41 i.e., 131.

3.7 Pre testing

This study was pre-tested among few 6-59 months children before final survey. Pre-testing helps to establish accuracy and clarity of questionnaire and to check the consistency in interpretation of questions by respondents and to identify ambiguous items. After pre-testing, all the ambiguous, misleading and wrongly interpreted questions were omitted and questionnaire was revised in accordance with the findings of pre-testing.

3.8 Validity and reliability of the research

To ascertain the degree to which the data collection instruments measures what they purposed to measure, the instruments was validated by comparing with standard known weights (for weighing balance). Reliability refers to quality control measure of data collected. Questionnaire was checked for completeness, consistency and clarity. Validity and reliability of the study was ensured by pre-testing of the tools, using standardized instruments. Instruments was set at 0 reading before taking measurements with standardized reference one. Close supervision was done in the field.

3.9 Data Collection Techniques:

Data was collected using semi structured questionnaires and anthropometric measurements. Face to face interview was conducted with mother of child to fill the questionnaire. The relevant data recorded were as follows:

- **Date of birth**: The date of birth for each child was inquired from the caretaker/mother and recorded in months.
- **Length/height**: For children below 24 months of age recumbent length was taken and for children above 24 months standing length was taken with the help of stadiometer. Child height was measured to the nearest one decimal place. Children

were made to stand bare foot on height board, with feet parallel and joined together, with heels and buttocks touching the wall. It was made sure that that the head was erect and hands were hung closely at the sides.

- **Weight**: Weight was measured by digital weighing scale and read to the nearest 0.1 kg with minimum/lightly/clothing and no shoes. Those who were unable to stand alone, their weights were obtained from the difference between weight of mother (carrying the child) and the weight of mother alone.
- **MUAC**: MUAC tape was used and was taken on the left hand midway between the elbow and shoulder. Care was taken to make sure that the hands were relaxed and hanging by the side.
- **Edema**: Firm pressure for three seconds with one digit on the lower portion of the median surface of the tibia was applied. The sign was taken as positive if there was a visible and palpable pit that persists after the pressure is removed and recorded only if present bilaterally.

3.10 Data analysis:

Data was checked for 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 and into WHO Anthro 3.2.2. The collected data was analyzed by using both descriptive and interferential analysis. Descriptive analysis was done to describe the percentage and number distribution of respondents 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 units (z scores) based on the WHO criteria. The chi-square test was applied to test the association between nutritional status and its associated factors.

3.11 Ethical considerations

Permission to conduct study was received from Nutrition and dietetics department, Central Campus of Technology. An informed written and verbal consent was obtained from all the participants. The objectives of the research were explained in simple language. Privacy and confidentiality of collected data was ensured.

Part IV

Results and discussion

The survey was conducted in ward no.6 of Pathari Sanischare Municipality to find the association between mother's nutritional knowledge in childcare practices and nutritional status of 6-59 months of children. Among 131 respondents, all the respondents responded to the study with 100% response rate. The results and findings of the study are expressed into several following headings.

4.1 Socio-economic and demographic characteristics

As shown in table 4.1, among 131 households, 10.7% were Brahmin, 29.8% were Chhetri, 32.1% were Adivasi/Janjati, 22.9% were Dalit and 4.6% were from other ethnicity. Majority of the households (82.4%) were headed by male while only few (17.6%) of them were headed by female. Similarly, there were 62.6% nuclear family and 37.4% joint family.

The major occupation of fathers was foreign employment (27.5%) followed by labor (24.4%), agriculture (23.7%), job (13.7%), business (3.8%) and other types of occupations (6.9%). From the study population, 11.5% of father had achieved primary level education, 56.5% had achieved secondary level education, 15.3% were intermediate, 3.1% had bachelors and above education and 13.7% of them were illiterate.

Most of the family (46.6%) had their annual income between (1-3) lakhs whereas 30.5% of the families had their annual income below 1 lakh and 22.9% of the families had annual income above 3 lakhs. Regarding the type of house, 50.4% had concrete house whereas 49.6% had house made up of mud.

Table 4.1 Socioeconomic and Demographic Characteristics

Variables	Frequency	Percent
Ethnicity		
Brahmin	14	10.7
Chhetri	39	29.8
Adivasi/Janjati	42	32.1
Dalit	30	22.9
Other	6	4.6
Head of the Household		
Male	108	82.4
Female	23	17.6
Family type		
Nuclear	82	62.6
Joint	49	37.4
Father's Occupation		
Agriculture	31	23.7
Business	5	3.8
Job	18	13.7
Foreign Employment	36	27.5
Labor	32	24.4
Other	9	6.9
Father's Education		
Primary	15	11.5
Secondary	74	56.5
Intermediate	20	15.3
Bachelor and above	4	3.1
None	18	13.7
Annual income		
< 1 lakh	40	30.5
1 lakh to 3 lakh	61	46.6
> 3 lakhs	30	22.9
House structure		
Cemented	66	50.4
Mud	65	49.6

4.2 Maternal characteristics

Table 4.2 shows that 81.7% of mother's were between 20-30 years, 13.7% were above 30 years and only 4.6% of mothers were below 20 years of age. Similarly, 50.4% of mothers under the survey were housewife, 35.9% were involved in agriculture, 9.2% were doing different types of job and 4.6% of mothers were labor.

Table 4.2 Maternal characteristics of survey population

Variables	Frequency	Percent
Mother's age		
<20 years	6	4.6
20-30 years	107	81.7
>30 years	18	13.7
Mother's occupation		
Housewife	66	50.4
Agriculture	47	35.9
Job	12	9.2
Labor	6	4.6
Mother's Education		
Primary	21	16
Secondary	72	55
Intermediate	15	11.5
Bachelor and above	4	3.1
None	19	14.5
Age at marriage		
< 15	10	7.6
15-20	80	61.1
>20	41	31.3
Age at first pregnancy		
15-20	50	38.2
>20	81	61.8
Iron folate		
Yes	127	96.9
No	4	3.1
Vaccination		
Yes	126	96.2
No	5	3.8

Majority of the mother (55%) had secondary level education followed by primary level education (16%), intermediate level education (11.5%) and bachelors and above education (3.1%). About 14.5% of mothers were illiterate. Maximum mothers (61.1%) were married in the age group between 15 and 20 years whereas 31.3% were married above 20 years and 7.6% were married below 15 years.

Table 4.2 shows that maximum mothers (61.8%) were above 20 years during their first pregnancy while 38.2% were between 15 to 20 years. A higher percentage of mothers

(96.9%) had consumed iron and folic acid tablets and had taken vaccination during pregnancy (96.2%).

4.3 Child characteristics

Table 4.3 shows that, out of 131 children, 55% were males and 45% were females. The highest (26.7%) number of children were between the age group of 48-59 months followed by 12-23 months (20.6%), 24-35 months (19.8%), 36-47 months (17.6%) and 6-11 months (15.3%).

Table 4.3 Child characteristics of surveyed children

Variables	Frequency	Percent
Gender		
Male	72	55.0
Female	59	45.0
Age		
6-11 months	20	15.3
12-23 months	27	20.6
24-35 months	26	19.8
36-47 months	23	17.6
48-59 months	35	26.7
Birth weight		
<2.5kg	20	15.3
≥2.5kg	100	76.3
No idea	11	8.4
Recent disease		
Common cold	19	14.5
Fever	20	15.3
Jaundice	1	0.8
Pneumonia	4	3.1
No	87	66.4

The birth weight of 15.3% of children was less than 2.5kg whereas the birth weight of 76.3% of the children was greater than and equal to 2.5 kg. About 8.4% of mothers had no idea about the birth weight of their children. Common cold (14.5%), fever (15.3%)**,** jaundice (0.8%), pneumonia (3.1%) were the diseases that child had recently suffered during the survey period (Table 4.3).

4.4 Child care practices (a)

Majority of children (73.3%) were breastfed within 1 hour of birth. Similarly, 16.8% and 9.2% of them were breastfed within 24 hours and after 24 hours of birth respectively while 0.8% of children were not breastfed at all. Table 4.4 shows that colostrum was given to 92.4% of children and pre-lacteal feeds was given to 16% of the children.

Table 4.4 Child care practices (a)

Variables	Frequency	Percent
Initiation of breastfeeding		
Within 1hour	96	73.3
Within 24hours	22	16.8
After 24hours	12	9.2
Not breastfed	1	0.8
Colostrum Feeding		
Yes	121	92.4
No	10	7.6
Pre-lacteal feeding		
Yes	21	16
No	110	84
Duration of Breastfeeding		
<2 years	5	3.8
≥2 years	51	38.9
Still feeding	74	56.5
Not fed	1	0.8
Suffered from diarrhea		
Yes	60	45.8
No	71	54.2
Vitamin A capsule intake		
Yes	117	89.3
No	14	10.7
Deworming Tablet intake		
Yes	99	75.6
No	32	24.4
Immunization		
Yes	129	98.5
No	2	1.5

During the survey period, 3.8% of the children were breastfed below 2 years of age and 38.9% were breastfed above and equal to 2 years of age. Majority of the children (56.5%) were still breastfeeding while 0.8% of the children were not breastfed at all. Among the

surveyed children, 45.8% of them had suffered from diarrhea while 54.2% of them had never suffered from diarrhea.

Table 4.4 shows that 89.3% of children had received vitamin A supplementation and 98.5% of children had received all the immunization according to their age. About 24.4% of children had not received deworming tablets. Among them 15.3% were below 1 year of age, so there were 9.1% children above 1 year of age who had not received deworming tablets.

4.5 Child care practices (b)

Table 4.5 shows that 61.1% of children were exclusively breastfed. The initiation of complementary feeding of 62.6% of children was done at the age of 5-6 months followed by 20.6% at the age of less than 4 months and 8.4% at the age of 4-5 months and above 6 months. Among them, maximum children (83.2%) were given same food as other family members whereas 6.9% were given lito, 4.6% were given gilo rice and 5.3% were given other types of food. Nearly half (51.9%) of the surveyed children were given cow milk.

The consumption of fruits of maximum children (47.3%) was once a week while that of 19.1% and 13% children was twice a week and thrice a week and above respectively. About 20.6% of children were not given fruits in a week. Similarly, 48.1% of children had green leafy vegetables twice a week followed by once a week (19.1%) and thrice a week and above (29.8%). Consumption of given green leafy vegetables by 3.1% of children was not even a once in a week. Similarly, 3.8% of children were not given meat/fish in a week while 35.9% were given once a week, 40.5% were given twice a week and 19.8% were given thrice a week and above.

Table 4.5 Child care characteristics (b)

Variables	Frequency	Percent
Exclusive breastfeeding		
Yes	80	61.1
No	51	38.9
Initiation of complementary food		
< 4 months	27	20.6
4-5 months	11	8.4
5-6 months	82	62.6
>6 months	11	8.4
Types of food given		
Lito	9	6.9
Gilo rice	6	4.6
Family food	109	83.2
Others	7	5.3
Cow milk feeding		
Yes	63	48.1
No	68	51.9
Fruits (per week)		
Never	27	20.6
Once	62	47.3
Twice	25	19.1
Thrice and above	17	13.0
Green leafy vegetables (per week)		
Never	4	3.1
Once	25	19.1
Twice	63	48.1
Thrice and above	39	29.8
Meat/Fish (per week)		
Never	5	3.8
Once	47	35.9
Twice	53	40.5
Thrice and above	26	19.8

4.6 Household characteristics

All the surveyed houses used iodized salt. In 46.6% of houses maad was not extracted due to the use of pressure cooker/rice cooker while in 53.4% of houses it was discarded. The main source of drinking water was from tube well. There was only 26% of houses that used filtered water while majority of them (74%) used it directly from source.

Among the surveyed population, maximum houses had toilet facility (93.9%) but still in 6.1% of houses there was no toilet facilities. Table 4.6 shows that 71% of families had kitchen garden in their house and 90.1% of the families had domesticated animals like cow, buffalo, ox, goat, pig, duck, chicken etc.

Table 4.6 Household characteristics

Variables	Frequency	Percent
Type of salt		
Iodized salt	131	100
Use of maad		
Do not extract	61	46.6
Discard	70	53.4
Source of water		
Tube well	131	100
Drinking water		
By filter	34	26
Direct use from source	97	74
Toilet in home		
Yes	123	93.9
No	8	6.1
Kitchen garden		
Yes	93	71
No	38	29
Livestock ownership		
Yes	118	90.1
No	13	9.9

4.7 Mother's knowledge on breastfeeding practices

Table 4.7 shows that 74% of mother knew that breastfeeding should be initiated within 1 hour of child birth while 26% of mother had no idea about the time of initiation of breastfeeding. Survey shows that 45.8% of mothers were aware about the importance of colostrum feeding for the child health while 54.2% of mothers were unaware about the

importance of colostrum feeding. Also, most of the mothers (84%) had knowledge about exclusively breastfeeding until six months of age.

Table 4.7 Mother's knowledge on breastfeeding practices

Variables	Frequency	Percent
Knowledge on initiation of breastfeeding		
Within 1 hour	97	74
No idea	34	26
Knowledge on importance of colostrum feeding		
Good for child health	60	45.8
Don't know	71	54.2
Knowledge on exclusive breastfeeding		
Yes	110	84
No	21	16
Knowledge on duration of breastfeeding		
2 years	17	13
>2 years	107	81.7
Don't know	7	5.3

According to 81.7% of mother's, the duration of breastfeeding of the child is above 2 years of age i.e., till 3,4 or 5 years whereas according to 13% of mothers breastfeeding till 2 years of age is sufficient while 5.3% of mother were unaware about the duration of breastfeeding (Table 4.7).

4.8 Mother's knowledge on childcare practices

Most of the mothers (85.5%) said that the correct time for initiating complementary feeding for the child is in the age of 5-6 months while some said that complementary feeding should be started at the age of <4 months (3.1%), 4-5 months (2.3%) and above 6 months (2.3%). Also, 6.9% of mother had no idea about the appropriate age for the initiation of complementary feeding. All mother said that feeding of child should be done 3 or more times in a day.

As shown in Table 4.8, 51.9% of mothers had known about sarbottam pitho while 48.1% of mothers were unaware of it. About 60.3% of mothers had knowledge about malnutrition

and regarding the cause of malnutrition, 46.6% of them were right, 3.1% of them were wrong while maximum (50.4%) of them had no idea about the cause of malnutrition.

Table 4.8 Mother's knowledge on child care practices (a)

Variables	Frequency	Percent
Initiation of complementary feeding?		
< 4 months	4	3.1
4-5 months	3	2.3
5-6 months	112	85.5
>6 months	3	2.3
No idea	9	6.9
Frequency of complementary feeding?		
3 or more times	131	100
Knowledge about sarbottam pitho		
Yes	68	51.9
No	63	48.1
Knowledge about malnutrition		
Yes	79	60.3
No	52	39.7
Reason for malnutrition		
Right	61	46.6
Wrong	4	3.1
Don't know	66	50.4
Knowledge about diarrhoea		
Yes	128	97.7
No	3	2.3
Reason for diarrhea		
Right	113	86.3
Wrong	5	3.8
Don't know	13	9.9
Knowledge on ORS preparation		
Yes	90	68.7
No	41	31.3
Foods during diarrhea?		
Soup	109	83.2
As usual	10	7.6
Others	5	3.8
Don't know	7	5.3

Almost all mothers (97.7%) had knowledge about diarrhoea but only 86.3% of them were right about the cause of diarrhoea while 3.8% of them were wrong and 9.9% of them were

unaware about the cause of diarrhoea. 68.7% of mother knew the process of making ORS at home while 31.3% did not knew about it. About the types of food that should be given during diarrhoea, 83.2% of mothers said soup should be given, 7.6% said same as usual, 3.8% said others type of food and 5.3% of mother did not knew the types of food that should be given during diarrhoea (Table 4.8).

Table 4.9 Mother's knowledge on child care practices (b)

Variables	Frequency	Percent
Knowledge about nutrients in maad		
Yes	69	52.7
No	62	47.3
Knowledge about baal-vita		
Yes	92	70.2
No	39	29.8
Baal-vita given to baby?		
Yes	52	39.7
No	79	60.3
Knowledge about Growth Monitoring Card		
Yes	109	83.2
No	22	16.8
Note details in GM card?		
Yes	82	62.6
No	49	37.4

About 52.7% of mothers had known that maad contain nutrients while 47.3% of mothers were unaware about it. Among the surveyed populations, 70.2% of mothers had known about baal-vita but only 39.7% of them had given to their child while maximum of them (60.3%) had not given. Maximum mothers (83.2%) knew about growth monitoring (GM) card. Among them 62.6% of them had noted the details in GM card while 37.4% of them had not noted the details as some of them had lost GM card and some of them forget to note details (Table 4.9).

4.9 Mother's knowledge level score

The mother's knowledge level score was done as described by (Shettigar *et al.*, 2013). The scores found for mothers of the study area are shown in Table 4.10. The score was ranges from minimum 6 to maximum 19. Table shows that 29 (22.1%) of them had poor knowledge, 71 (54.2%) of them had average knowledge and 31 (23.7%) of them had good knowledge

regarding the childcare practices. It can be concluded that higher percent of mothers had average knowledge regarding child care practices.

Table 4.10 Mother's knowledge level score (n=131)

Level of knowledge	Scores	Mothers (n=131) (%)
Poor	0-10	29 (22.1)
Average	11-16	71 (54.2)
Good	17-20	31 (23.7)

4.10 Nutritional status of children

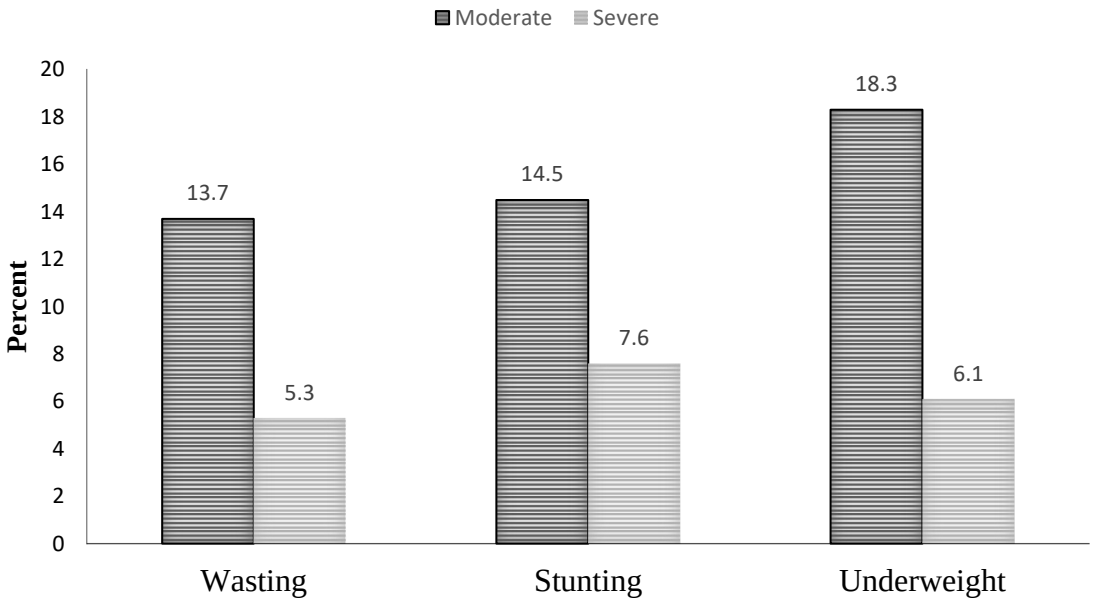

Fig. 4.1 Prevalence of malnutrition among surveyed children

Out of 131 children, 72 were males and 59 were females. Among these children 19% were found to be wasted with 5.3% severely wasted. Similarly, 22.1% of the children were stunted with 7.6% severely stunted. The prevalence of underweight was found among 24.4% of children and among them 6.1% were severely underweight as shown in Fig. 4.1. According to the report of NDHS 2022, 19% of under five children are underweight, 8% are wasted and 25% are stunted (MoHP *et al.*, 2022). The result of this study showed that the prevalence of stunting was lower but the prevalence of wasting and underweight was higher than that of NDHS result.

4.11 Distribution of malnutrition according to age group

From the Table 4.11, it is observed that the prevalence of both severe and moderate wasting was high among 36-47 months of children with 13% severe wasting and 30.4% moderate wasting. The prevalence of severe wasting was nil and moderate wasting was 10% among 6-11 months of child which was lowest compared to other age groups.

The prevalence of moderate stunting was high among 24-35 months of children (34.6%) followed by age groups 48-59 months (25.7%), 12-23 months (22.2%), 36-47 months (17.4%) and lowest in 6-11 months (5%). The prevalence of severe stunting was high among 48-59 months (11.4%) and 12-23 months (11.1%) of children and was nil among 6-11 months of children.

Highest prevalence of moderate underweight was seen among the children of age group 48-59 months (34.6%) and severe underweight was seen among 36-47 months (8.7%) and 48-59 months (8.6%) children. Severe underweight was nil and moderate underweight was lowest among 6-11 months of children (10%).

Table 4.11 Age distribution of malnutrition

Age (months)	N	WHZ (%)		HAZ (%)		WAZ (%)	
		Wasting		Stunting		Underweight	
		<-3SD	<-2SD	<-3SD	<-2SD	<-3SD	<-2SD
6-11	20	Nil	10	Nil	5	Nil	10
12-23	27	7.4	18.5	11.1	22.2	3.7	25.9
24-35	26	3.8	15.4	3.8	34.6	7.7	19.2
36-47	23	13	30.4	8.7	17.4	8.7	26.1
48-59	35	2.9	20	11.4	25.7	8.6	34.3

4.12 Nutritional situation according to gender

From table below, it is seen that 5.6% of male children and 5.1% of female children were found to be severely wasted. Similarly, 12.5% of male children and 15.3% of female children were moderately wasted. The result showed that 9.7% of male children and 5.1% of female children were found to be severely stunted whereas 16.7% of male children and 11.9% of female children were moderately stunted. In case of underweight, 6.9% of male children and 5.1% of female children were severely underweight whereas 12.5% of male children and

25.4% of female children were moderately underweight. The result showed that wasting and underweight was found to be higher in female child whereas stunting was higher in male child.

Table 4.12 Distribution of nutritional situation according to gender

	<-3 Z-score	<-2 Z-score	>-2 Z-score
Wasting			
Male	4 (5.6%)	9 (12.5%)	59 (81.9%)
Female	3 (5.1%)	9 (15.3%)	47 (79.7%)
Stunting			
Male	7 (9.7%)	12 (16.7%)	53 (73.6%)
Female	3 (5.1%)	7 (11.9%)	49 (83.1%)
Underweight			
Male	5 (6.9%)	9 (12.5%)	58 (80.6%)
Female	3 (5.1%)	15 (25.4%)	41 (69.5%)

4.13 Distribution of malnutrition according to MUAC measurement

On the basis of Mid-Upper Arm Circumference (MUAC) 0.8% of children were found to be severely malnourished, 9.2% of children were found to be moderately malnourished and 90.1% of children were found to be normal (Table 4.13).

Table 4.13 Distribution of malnutrition according to MUAC measurement

MUAC range	**Frequency**	**Percent**
Severe (<11.5)	1	0.8
Moderate (11.5-12.5)	12	9.2
Normal (>12.5)	118	90.1

4.14 Weight for Height curve

The median weight-for-height z-score of survey children was found to be -1.03. This is why curve is slightly skewed to the left side of the WHO standard curve showing the prevalence of wasting among the study population as shown in the Fig. 4.2.

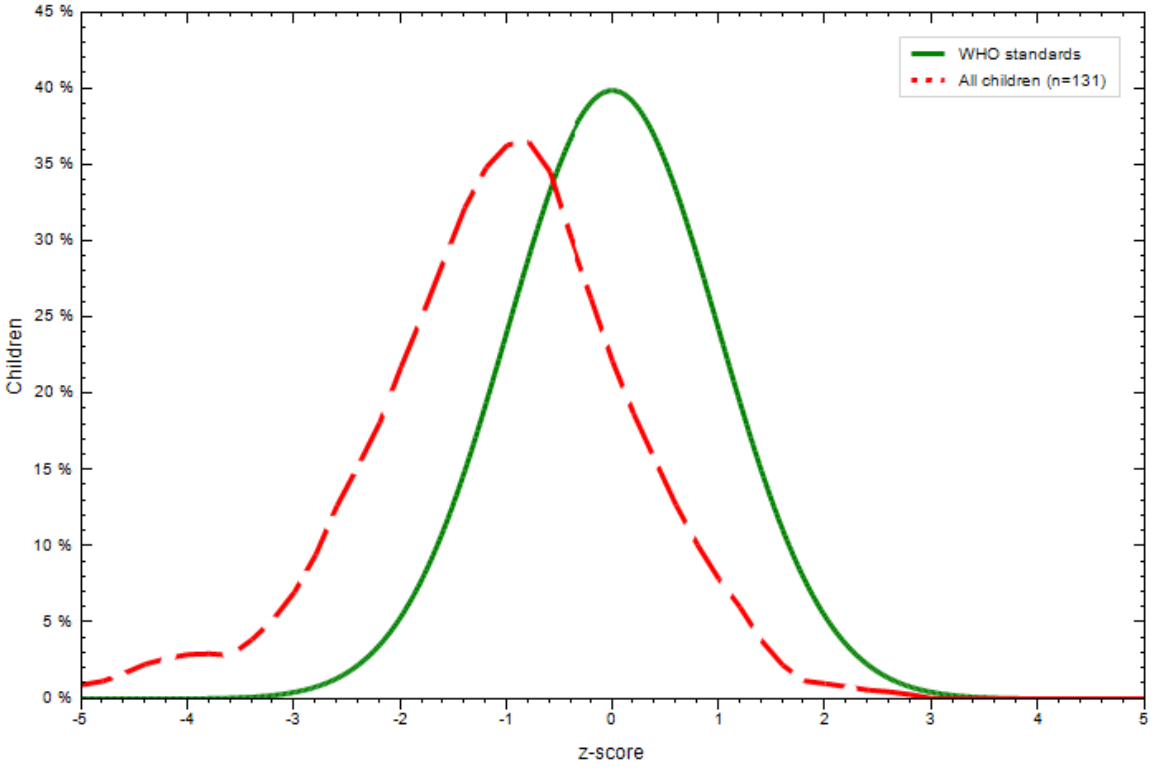

Fig. 4.2 Weight for Height curve with reference to WHO standard

4.15 Factors associated with wasting

The Chi- square test revealed that there was significant association of wasting with family type (P=0.004), toilet facility in house (P=0.008), kitchen garden (P=0.000). There was no significant association of wasting with birth weight of child, father's occupation and mother's education.

Children from nuclear family were more wasted compared to children from joint family. This may be due to the reason that children in the joint family are nutritionally better cared as there is tendency to share the food with the children by all the family members (Joshi *et al.*, 2011). Similarly, study conducted among dalit children of Morang district showed significant association of wasting with family type. Wasting was high among the children of nuclear family (Gachhadar *et al.*, 2021).

Children from houses with no toilet facility were more wasted. Open defecation increases the risk of absorption of fecal pathogens that leads to intestinal worms, diarrhoea and environmental enteric malfunction. This leads to loss of appetite, lessening the immunity of the body, and disturbing the absorption of nutrients, and which eventually lead to

malnutrition (Rahman *et al.*, 2020). Similarly, study conducted in Ethiopia showed that the open defecation was associated with increased prevalence of child wasting (Lee *et al.*, 2022).

Table 4.14 Result of Chi-square test for factors associated with wasting (n=131)

Variables	**WFH**		**χ^2 value**	**P-value**
	Normal	**Wasted**		
Family type				
Nuclear	60 (73.2%)	22 (26.8%)	10.679	0.004*
Joint	46 (93.9%)	3 (6.1%)		
Father's Occupation				
Agriculture	28 (90.3%)	3 (9.7%)	9.104	0.434
Business	5 (100%)	Nil		
Job	14 (77.8%)	4 (22.3%)		
Foreign Employment	29 (80.6%)	7 (19.5%)		
Labor	21 (65.6%)	11 (34.4%)		
Other	9 (100%)	Nil		
Mother's Education				
Primary	17 (81%)	4 (19%)	11.760	0.093
Secondary	61 (84.7%)	11 (15.3%)		
Intermediate	13 (86.7%)	2 (13.3%)		
Bachelor and above	3 (75%)	1 (25%)		
None	12 (63.2%)	7 (36.9%)		
Toilet in home				
Yes	101 (82.1%)	22 (17.9%)	9.797	0.008*
No	5 (62.5%)	3 (37.5%)		
Kitchen garden				
Yes	83 (89.2%)	10 (10.8%)	15.876	0.000*
No	23 (60.5%)	15 (39.5%)		

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

Wasting was high among the children from houses with no kitchen garden. Kitchen gardening contributes to household food security by providing direct access to food in an affordable way (Kiige, 2004). This study is supported by the study conducted in Kenya

which showed that the children whose families had an easily accessible kitchen garden were less likely to be wasted (Bloss *et al.*, 2004).

4.16 Weight for age curve

The median weight for age z-score of survey children was found to be -1.41. This causes the curve slightly skewed to the left side of WHO standard curve showing the prevalence of underweight among study population as shown in Fig. 4.3.

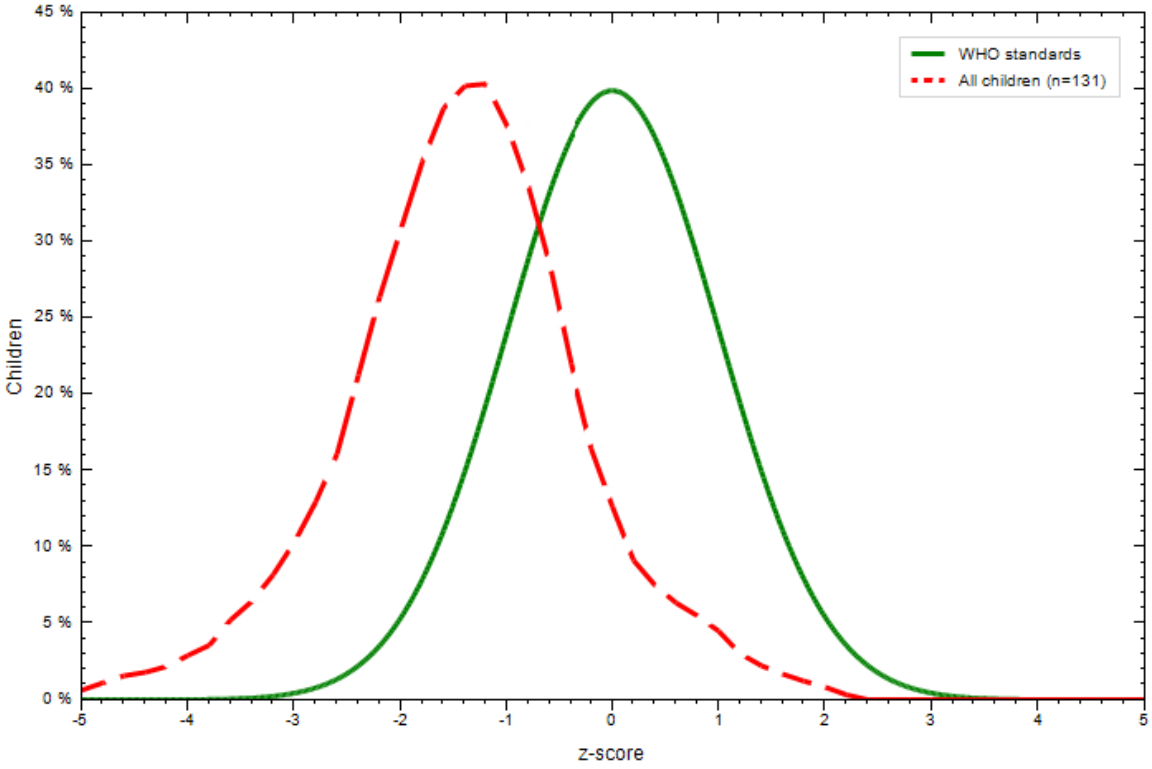

Fig 4.3 Weight for Age curve with reference to WHO standard

4.17 Factors associated with underweight

In this study, there was significant association of underweight with family type (P=0.011), house structure (P=0.009), kitchen garden (P=0.005). There was no association of underweight with mother's occupation and duration of breastfeeding.

Children living in nuclear family were more underweight compared to those living in joint family. This is supported by the study conducted in Bharatpur, Chitwan which showed the significant association between family type and underweight. This study showed children from nuclear family were more vulnerable to underweight (Sigdel *et al.*, 2021). Similarly, study conducted in Lamjung, Gorkha and Tanahun Districts of Nepal showed children from larger family size were less likely to be malnourished and this could be because in Nepal,

children from larger family size receive care from several family members (Dhungana, 2017).

Children living in mud house were more underweight compared to those living in cemented house. Study conducted among under five years old Nepalese children showed that children living in households with poorer main floor material were more underweight than others living in not poor condition (Osguei and Mascie-Taylor, 2019).

Table 4.15 Result of Chi-square test for factors associated with underweight (n=131)

Variables	**WFA**		**χ^2 value**	**P-value**
	Normal	**Underweight**		
Family type				
Nuclear	55 (67.1%)	27 (32.9%)	8.979	0.011
Joint	44 (89.8%)	5 (10.2%)		
Mother's occupation				
Housewife	47 (71.2%)	19 (28.8%)	3.462	0.728*
Agriculture	38 (80.9%)	9 (19.2%)		
Job	10 (83.3%)	2 (16.7%)		
Labor	4 (66.7%)	2 (33.4%)		
House structure				
Cemented	57 (86.4%)	9 (13.6%)	9.278	0.009
Mud	42 (64.6%)	23 (35.4%)		
Duration of Breastfeeding				
<2 years	4 (80%)	1 (20%)	3.374	0.970*
≥2 years	37 (72.5%)	14 (27.5%)		
Still feeding	57 (77%)	17 (23%)		
Not fed	1 (100%)	Nil		
Kitchen garden				
Yes	76 (81.7%)	17 (18.3%)	10.661	0.005
No	23 (60.5%)	15 (39.5%)		

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

Underweight was seen more in children of household with no kitchen garden. Kitchen gardens affect nutrition through changes in household food production and consumption,

maternal and child intake of target foods and micronutrients, and increase overall dietary diversity of rural low-income households (Ruel and Alderman, 2013).

4.18 Height for age curve

The median height for age z-score of survey children was found to be -1.32. This is why the curve is slightly skewed to the left side of WHO standard curve showing the prevalence of stunting among study population as shown in Fig. 4.4.

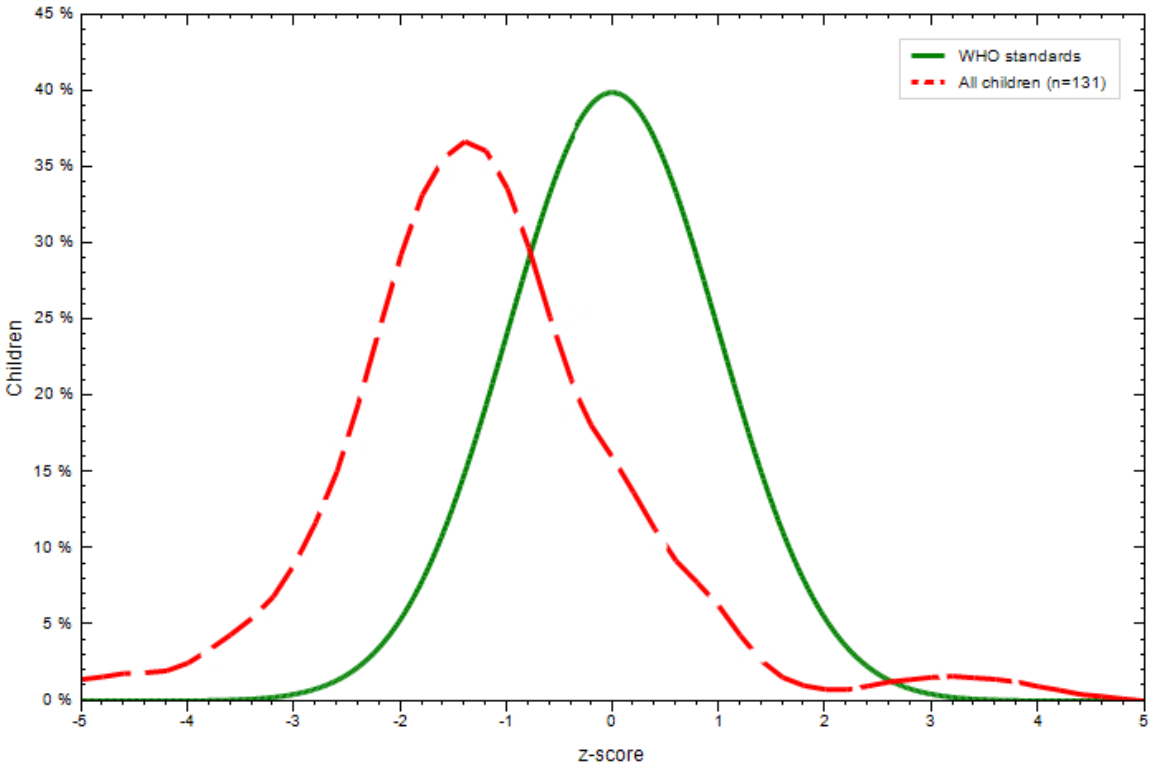

Fig. 4.4 Height for age curve with reference to WHO standard

4.19 Factors associated with stunting

There was significant association of stunting with ethnicity (P=0.017), birth weight of child (P=0.026), house structure (P=0.000), use of maad (P=0.011), drinking water (P=0.023).

Table below shows stunting was significantly associated with ethnicity. Adhavasi/janjati children were at high risk of stunting followed by dalit, brahmin and chhetri children.

Stunting was seen more in children whose mother had no idea about the birth weight of their child. A community based cross-sectional study conducted in China showed significant association of child birth weight with stunting. Low birth weight children were more vulnerable to stunting compared to normal or high birth weight children (Li *et al.*, 2022).

Table 4.16 Result of Chi-square test for factors associated with stunting (n=131)

Variables	HFA		χ^2 value	P-value
	Normal	Stunting		
Ethnicity				
Brahmin	12 (85.7%)	2 (14.3%)	16.327	0.017
Chhetri	36 (92.3%)	3 (7.7%)		
Adhavasi/Janjati	26 (61.9%)	16 (38.1%)		
Dalit	22 (73.3%)	8 (26.6%)		
Others	6 (100%)	Nil		
Birth weight				
<2.5 kg	14 (70%)	6 (30%)		
≥2.5 kg	83 (83%)	17 (17%)	10.243	0.021
No idea	5 (45.5%)	6 (54.6%)		
House structure				
Cemented	61 (92.4%)	5 (7.5%)	17.357	0.000
Mud	41 (63.1%)	24 (37%)		
Use of maad				
Do not extract	54 (88.5%)	7 (11.5%)	9.072	0.011
Discard	48 (68.6%)	22 (31.5%)		
Drinking water				
By filter	32 (94.1%)	2 (5.8%)	7.113	0.023
Direct use from source	70 (72.2%)	27 (27.9%)		

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

Children living in mud house were more vulnerable to stunting compared to those living in cemented house. Study conducted in Dhaka showed that the stunting was more common in children having houses with mud floor than those having houses with cement. This could be due to the growth of pathogenic organism on the mud floor, which makes children sick and undernourished (Yeasmin and Islam, 2016).

Children from houses which extracted and discarded maad were found to be more vulnerable to stunting. The study conducted in Dhanusha district, Nepal showed that the children from families where rice scum is extracted and discarded were more likely to be stunted than children from families who do not discard. This may be due to the reason that

most of the nutritious elements such as protein, fat and minerals are lost through the rice scum (Sah, 2004).

Children from houses using water directly from source were more vulnerable to stunting compared to those using filtered water. Study conducted in Bhutan showed that the stunting was lower in children of households practicing water treatment (Kang *et al.*, 2018).

4.20 Association between mother's knowledge score and malnutrition

No association was seen between the total knowledge scoring of mothers and the nutritional status of the children. However, the prevalence of wasting, stunting and underweight was seen higher among the children of mothers with poor knowledge on child care practices.

Table 4.17 Association between mother's knowledge score and malnutrition (n=131)

	WFH		χ^2 value	P-value
	Normal	Wasted		
Poor	23 (79.3%)	6 (20.7%)	6.270	0.146
Average	58 (81.7%)	13 (18.3%)		
Good	25 (80.6%)	6 (19.4%)		
	HFA			
	Normal	Stunted		
Poor	20 (69%)	9 (31%)	7.303	0.103
Average	53 (74.6%)	18 (15.3%)		
Good	29 (93.5%)	2 (6.4%)		
	WFA			
	Normal	Underweight		
Poor	21 (72.4%)	8 (27.5%)	1.852	0.791
Average	55 (77.5%)	16 (22.5%)		
Good	23 (74.2%)	8 (25.8%)		

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

Part V

Conclusion and Recommendation

5.1 Conclusion

This study has generally assessed the mothers' nutritional knowledge in childcare practices and nutritional status of 6-59 months of children residing in ward no. 6 of Pathari Sanischare Municipality. The following conclusions were made from the study:

a) The prevalence of wasting, stunting and underweight in 6-59 months aged children of Pathari Sanischare Municipality was 19%, 22.1% and 24.4% respectively. Among them severe wasting, severe stunting and severe underweight was found to be 5.3%, 7.6% and 6.1% respectively. Based on MUAC measurement, severe wasting and moderate wasting were found to be 0.8% and 9.2% respectively.
b) Wasting and underweight was found to be higher in female child whereas stunting was higher in male child.
c) Prevalence of underweight was high among the children of age group 48-59 months (42.9%), stunting was high among 24-35 months of children (38.4%) and the prevalence of wasting was high among 36-47 months of children (43.4%).
d) Majority of mothers (54.2%) had average knowledge regarding child care whereas rest of the mothers managed to score good (23.7%) and average (22.1%).
e) Mother's nutritional knowledge score was not significantly associated with any forms of malnutrition in this study but children's of mother with poor knowledge level were found to be more wasted, stunted and underweight.
f) Family type, toilet facility in house and kitchen garden were significantly associated with wasting.
g) Family type, house structure and kitchen garden were significantly associated with underweight.
h) Similarly, ethnicity, birth weight of child, house structure, use of maad in household and drinking water were significantly associated with stunting.

5.2 Recommendations

On the basis of the results obtained from the study following recommendation could be made in order to improve the nutritional status of the survey area in future:

a) There is the need for intervening nutritional and health education as educated mother is most likely to provide better care in terms of good nutrition and better hygiene which in turn improve the nutritional status.
b) Promotion of locally available nutritious food and practice of kitchen garden at home should be encouraged to the mothers.
c) Similar cross-sectional descriptive or longitudinal survey can be conducted to determine the magnitude and distribution of malnutrition and other probable causes of malnutrition.
d) 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, wasting and underweight among children remains a major public health problem in Nepal. A cross-sectional study was conducted to assess the association between mothers' nutritional knowledge in childcare practices and nutrition status of 6-59 months of children residing in ward no.6 of Pathari Sanischare Municipality, Morang.

The study included 131 children selected using simple random sampling technique. Anthropometric measurements (like height, weight, MUAC) were performed and edema was checked to assess the nutritional status of children, and a structured questionnaire was asked to their mothers to examine knowledge level in child care practices. Data collected from the survey was analyzed using WHO Anthro version 3.2.2 and SPSS version 25. Chi-square test and Fischer exact test were used to analyse the factors associated with nutritional status.

Out of 131 children, 72 of them were males and 59 of them were females. The prevalence of wasting, stunting and underweight was 19%, 22.1% and 24.4% respectively. Wasting and underweight was found to be higher in female child whereas stunting was higher in male child. Prevalence of underweight was high among the children of age group 48-59 months (42.9%), stunting was high among 24-35 months of children (38.4%) and the prevalence of wasting was high among 36-47 months of children (43.4%).

Majority of households (82.4%) were headed by male. Around 62.6% of families were from nuclear family whereas 37.4% were from joint families. Maximum family (46.6%) had annual income of 1 lakh to 3 lakhs while 30.5% of them had below 1 lakh and only 22.9% of them had above 3 lakhs.

Majority of father (56.5%) and mother (55%) had achieved secondary level education. Majority of father (27.5%) had gone for foreign employment while most of the mother (50.4%) were housewife. Similarly, 61.6% of mothers were married at the age of 15-20 years and 61.8% of mothers were above 20 years during their first pregnancy. Majority (73.3%) of children were breastfed within 1 hour of birth and 92.4% of children were given colostrum milk after the birth.

22.1% of mothers had poor knowledge, 54.2% had average knowledge and 23.7% had good knowledge regarding the childcare practices. Mother's nutritional knowledge score was not significantly associated with any forms of malnutrition in this study.

Family type, toilet facility in house and kitchen garden were significantly associated with wasting. Family type, house structure and kitchen garden were significantly associated with underweight. Similarly, ethnicity, birth weight of child, house structure, use of maad in household and drinking water were significantly associated with stunting.

To reduce the burden of malnutrition among these children, a combined effort by the government, nongovernmental organizations and the community is essential to improve the nutritional status of children. Effective, efficient and equitable program should be designed to reduce child malnutrition. A healthy mother can give birth to a healthy child, thus the intervention programs for improving the nutritional status of children must focus not only on children but also on their mothers. 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

Consent letter

मनजुरि नामा पत्र

नमस्कार,

म रोशनी थापा, केन्द्रिय प्रविधि क्याम्पस धरानमा पोषण तथा आहार विज्ञान चौथो वर्षमा अध्ययनरत बिद्यार्थी हु। यस संकायको चौथो वर्षको पाठ्यक्रम अन्तर्गत म सोधपत्र गरिरहेको छु | मेरो सोधकार्यको विषय " पथरी सनिस्चरे ६ मा रहेका ६-५९ महिनाका बालबालिकाहरुको पोषणस्थिती र उनीहरुको आमाको बालबालिकाहरुको पोषण स्याहार सम्बन्धी ज्ञान को अध्ययन" रहेको छ ।यो अध्ययन को उदेश्य यस क्षेत्रका बालबालिकाहरुको पोषणस्थितीको बारे जानकारी संकलन गर्नु रहेको छ | यस अनुसन्धानमा सोधिएका कुराहरु गोपनीय राखिनेछ | यस अध्ययनका लागि तपाइको छोरा / छोरीलाई सहभागी गराउन हामी तपाइलाई यस सर्वेक्षणका केही प्रश्नहरु गर्नेछौ साथै तपाइको बच्चा को केही नाप लिनेछौं र तपाइको ३० मिनेटको समय लागने छ | यो सर्वेक्षणले तपाइको बच्चाको पोषण स्तिथि बारे थाहा हुन्छ र बच्चालाई पोषण सम्बन्धि विशेस हेरचाह आवश्यक पर्ने वा नपर्ने पनि थाहा पाउन सक्नुहुनेछ । यदि तपाइलाई कुनै पनि प्रश्न व्यक्तिगत लागेमा उत्तर नदिन पनि सक्नुहुन्छ । सोधकार्यमा सहभागी भइ, अभियानको दौरानमा सोधिने प्रश्नहरुको जवाफ दिन तपाई तयार हुनुहुन्छ भने यस अनुसन्धानमा सहभागी हुन सक्नुहुनेछ ।

म यस अध्ययनमा सहभागीहुन इच्छुक छु र यस अध्ययनका लागि आवश्यक पर्ने मेरो बच्चाको नाप तौल लिन अनुमति दिन्छु ।

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शहवागीको हस्ताक्षर

Appendix B

Questionnaire for mother's

A. General Information

Code No.	**Ward No.**
Child's Name **Date of Birth**	Age Gender: Male / Female
Mother's Name	Age

B. Child's Description

Anthropometric measurement of children

Height (cm)	**Weight (kg)**	**MUAC (cm)**	**Oedema (Yes / No)**

1) Weight of a newly born child? ≥ 2.5kg/ <2.5kg/ no idea
2) Did your child is affected by any disease recently? …….

C. Family member's description

1) Head of the household. (male/female)
2) Family type. Nuclear/joint
3) Ethnicity: Brahmin/ Chhetri/ Adhavasi/ Janjati/ Dalit/ Others
4) What is your husband's occupation?
   Agriculture / Business / Employment / Foreign employment / Labor / other
5) What is your occupation?
   Housewife/Agriculture / Business / Employment / Labor / other
6) Father's education level? Primary Level (1-5) / Secondary Level (6-10) / Intermediate / None
7) Mother's education level? Primary Level (1-5) / Secondary Level (6-10) / Intermediate / None
8) Family's annual Income?.....
9) House structure? Cemented / Mud

D. Mother's health description

1) Age of marriage? 15 or less / 15-20 / >20 years
2) Age at first pregnancy? 15 or less / 15-20 / >20 years

3) Did you take iron and folic acid tablet during your pregnancy? Yes/ No
4) Vaccinations during pregnancy? Yes / No

E. Child care practices

1) When did you first initiate breast feeding? Within 1hr of birth/ within 24hrs/ after 24hrs/ not breastfed
2) Did you feed colostrum to your child? Yes / No
3) Before giving colostrum to the baby did you fed any other thing? Yes / No
4) If yes, then what?
   i. Honey, water and ghee ii. Cow's milk iii. Alcohol iv. Others
5) What was your child's age up to which you breast-fed? ……
6) Had your child suffered from diarrhea? Yes / No
7) Did you give Vitamin A capsule and de-worming tablet supplementation to your child? Yes / No
8) Did you give de-worming tablet supplementation to your child? Yes / No
9) Has your child received all the immunization (खोप) according to the age? Yes/No
10) If no then, why not?
    i. Was not aware about immunization ii. Forgot iii. Sick during immunization time iv. Too busy v. Others
11) Do you feed cow milk to your child? Yes / No
12) Did you feed anything except mother's milk to your child during the first 6 months? Yes/No
13) At what age did you start feeding other foods to the child? 4/5/6/7 months
14) How many times per week your child is fed fruits?
    Never/ Once/ Twice/ Thrice and above
15) How many days per week your child is fed green leafy vegetables?
    Never/ Once/ Twice/ Thrice and above
16) How many days per week your child is fed meat or fish items?
    Never/ Once/ Twice/ Thrice and above
17) What food items do you fed to your child?
    i. Lito ii. Gilo rice iii. sarbottam pitho
    iv. Same as other family membes v. Others

F. Mother Nutritional Knowledge

1) At what time is it suitable to initiate breastfeeding?
   Within 1 hour/ within 24 hours / after 24 hours/ no idea
2) Why colostrum feeding is important to the child?
   don't know/ good for child health
3) Do you know about exclusively breastfeeding? Yes / No
4) How long a child should be breastfed?
   <2 years / 2 years/ >2 years / don't know
5) At what age to start feeding other foods to the child? ……..
6) How many times per day child should be fed food?
   3 or less / 3 / 4 / 4 and more
7) What kinds of salt are good to use at home?
   Iodized salt/ non-iodized salt / both (iodized, non-iodized)
8) Do you know about sarbottam pitho? Yes/ No
9) Do you have knowledge about malnutrition? Yes/ No
10) If you know about malnutrition, what may be the cause of it?
    i. Poor hygiene ii. Superstition iii. Dirty water iv. Lack of diet
    v. Poor sanitation vi. God's curse vii. Don't know
11) Do you have knowledge about diarrhea? Yes / No
12) If you know about diarrhea, what may be the cause of it?
    i. Poor hygiene ii. Superstition iii. Dirty water iv. Lack of diet
    v. Poor sanitation vi. God's curse vii. Don't know
13) Do you know the process of preparing Oral Rehydration Solution (ORS) at home?
    Yes/ No
14) What kinds of food should be given to the children during diarrhea?
    i. Soup ii. Same as usual iii. No idea
15) What would you do with the maad?
    i. Mix on curry ii. Mix on animal's feed iii. Do not extract iv. Discard
16) Do you know extracted maad also have nutrients? Yes/ No
17) Do you know about Baal-Vita? Yes/No
18) Have you given it to your baby? Yes/No
19) Do you know about Growth Monitoring Card (बाल स्वास्थ्य कार्ड)? Yes/No

20) If yes, do you note the details about your child in GM (Growth Monitoring) card? Yes/No

21) If no then, why?

i. Forgot to write ii. Lost GM card iii. Not available

iv. Ht/Wt not monitored v. Others

G. Additional knowledge

1) What is your source of water for general household purposes?

i. Tube well ii. River iii. Tap v. Others

2) How do you prepare drinking water?

i. By filter ii. Boiling iii. Direct use from source v. Others

3) Do you have toilet in your home? Yes /No

4) Do you have kitchen garden at your home? Yes/ No

5) Which pets do you owe, if any? Buffalo/Goat /Cow / Ox /Duck / Chicken /Pig/ Other ……

Appendix-C Photo Gallery

Fig. A Height measurement of a child

Fig. B Measuring MUAC

Fig. C Filling up survey form by asking questionnaire to the mother.

Appendix-D Relationship of study variables with malnutrition

Factors Associated with Wasting:

Variables		WFH		χ^2 value	P-value
		Normal	Wasted		
Age category	6-11 months	18 (90%)	2 (10%)	5.134	0.760
	12-23 months	22 (81.5%)	5 (18.5%)		
	24-35 months	22 (84.6%)	4 (15.3%)		
	36-47 months	16 (69.6%)	7 (30.4%)		
	48-60 months	28 (80%)	7 (20%)		
Gender	Male	59 (81.9%)	13 (18.1%)	0.311	0.940
	Female	47 (79.7%)	12 (20.4%)		
Birth weight	< 2.5 kg	16 (80%)	4 (20%)	2.920	0.527
	≥ 2.5 kg	82 (82%)	18 (18%)		
	No idea	8 (72.7%)	3 (27.3%)		
Family type	Nuclear	60 (73.2%)	22 (26.8%)	10.679	0.004*
	Joint	46 (93.9%)	3 (6.1%)		
Recent disease	Common cold	16 (84.2%)	3 (15.8%)	6.874	0.587
	Fever	16 (80%)	4 (20%)		
	Jaund*ice	1 (100%)	Nil		
	Pneumonia	4 (100%)	Nil		
	No	69 (79.3%)	18 (20.6%)		
Household head	Male	87 (80.6%)	21 (19.5%)	1.355	0.540
	Female	19 (82.6%)	4 (17.4%)		
Father's	Agriculture	28 (90.3%)	3 (9.7%)	9.104	0.434
Occupation	Business	5 (100%)	Nil		
	Job	14 (77.8%)	4 (22.3%)		
	Foreign Employment	29 (80.6%)	7 (19.5%)		
	Labor	21 (65.6%)	11 (34.4%)		
	Other	9 (100%)	Nil		
Mother's	Housewife	52 (78.8%)	14 (21.3%)	10.781	0.056
occupation	Agriculture	41 (87.2%)	6 (12.7%)		
	Job	11 (91.7%)	1 (8.3%)		

	Labor	2 (33.3%)	4 (66.6%)		
Father's Education	Primary	13 (86.7%)	2 (13.4%)	12.008	0.083
	Secondary	62 (83.8%)	12 (16.3%)		
	Intermediate	17 (85%)	3 (15%)		
	Bachelor and above	3 (75%)	1 (25%)		
	None	11 (61.1%)	7 (38.9%)		
Mother's	Primary	17 (81%)	4 (19%)	11.760	0.093
Education	Secondary	61 (84.7%)	11 (15.3%)		
	Intermediate	13 (86.7%)	2 (13.3%)		
	Bachelor and above	3 (75%)	1 (25%)		
	None	12 (63.2%)	7 (36.9%)		
Annual income	<1 lakh	29 (72.5%)	11 (27.5%)	5.730	0.192
	1-3 lakhs	54 (88.5%)	7 (11.5%)		
	>3 lakhs	23 (76.7%)	7 (23.3%)		
House structure	Cemented	58 (87.9%)	8 (12.1%)	5.219	0.064
	Mud	48 (73.8%)	17 (26.1%)		
Age at marriage	<15	7 (70%)	3 (30%)	2.676	0.581
	15-20	67 (83.8%)	13 (16.3%)		
	>20	32 (78%)	9 (22%)		
Age at first	15-20	38 (76%)	12 (24%)	1.727	0.435
pregnancy	>20	68 (84%)	13 (16%)		
Iron/Folate intake	Yes	104 (81.9%)	23 (18.1%)	4.372	0.092
	No	2 (50%)	2 (50%)		
Vaccination	Yes	103 (81.7%)	23 (18.3%)	3.319	0.143
	No	3 (60%)	2 (40%)		
Initiation of	Within 1 hour	80 (83.3%)	16 (16.7%)	6.542	0.394
breastfeeding	Within 24 hours	16 (72.7%)	6 (27.2%)		
	After 24 hours	9 (75%)	3 (25%)		
	Not breastfed	1 (100%)	Nil		
Colostrum feeding	Yes	99 (81.8%)	22 (18.2%)	2.353	0.223
	No	7 (70%)	3 (30%)		
Pre-lacteal feeding	Yes	17 (81%)	4 (19.1%)	0.184	1.000
	No	89 (80.9%)	21 (19.1%)		

Duration of breastfeeding	< 2 years	5 (100%)	Nil	3.360	0.837
	≥ 2 years	40 (78.4%)	11 (21.5%)		
	Still feeding	60 (81.1%)	14 (19%)		
	Not fed	1 (100%)	Nil		
Suffered from diarrhea	Yes	51 (85%)	9 (15%)	2.943	0.213
	No	55 (77.5%)	16 (22.5%)		
Vitamin A capsule	Yes	95 (81.2%)	22 (18.8%)	0.612	0.862
	No	11 (78.6%)	3 (21.4%)		
Deworming tablet	Yes	78 (78.8%)	21 (21.3%)	0.881	0.659
	No	28 (87.5%)	4 (12.5%)		
Immunization	Yes	105 (81.4%)	24 (18.6%)	3.086	0.346
	No	1 (50%)	1 (50%)		
Exclusive breastfeeding	Yes	64 (80%)	16 (20.1%)	0.327	0.939
	No	42 (82.4%)	9 (17.6%)		
Initiation of complementary feeding	< 4 months	22 (81.5%)	5 (18.5%)	4.583	0.544
	4-5 months	9 (81.8%)	2 (18.2%)		
	5-6 months	67 (81.7%)	15 (18.3%)		
	>6 months	8 (72.7%)	3 (27.3%)		
Fruits (per week)	Never	20 (74.1%)	7 (25.9%)	5.712	0.416
	Once	50 (80.6%)	12 (19.4%)		
	Twice	21 (84%)	4 (16%)		
	Thrice and above	15 (88.2%)	2 (11.8%)		
Green leafy vegetables (per week)	Never	4 (100%)	Nil	4.301	0.615
	Once	21 (84%)	4 (16%)		
	Twice	53 (84.1%)	10 (15.8%)		
	Thrice and above	28 (71.8%)	11 (28.2%)		
Meat (per week)	Never	5 (100%)	Nil	8.140	0.177
	Once	40 (85.1%)	7 (14.9%)		
	Twice	45 (84.9%)	8 (15.1%)		
	Thrice and above	16 (61.5%)	10 (38.4%)		
Cow milk feeding	Yes	56 (88.9%)	7 (11.1%)	5.519	0.056
	No	50 (73.5%)	18 (26.4%)		

Foods during diarrhea	Soup	89 (81.7%)	20 (18.4%)	6.092	0.281
	As usual	8 (80%)	2 (20%)		
	Other's	5 (71.4%)	2 (28.6%)		
	Don't know	4 (80%)	1 (20%)		
Baal-vita given to baby	Yes	38 (73.1%)	14 (27%)	4.122	0.120
	No	68 (86.1%)	11 (14%)		
Growth monitoring	Yes	68 (82.9%)	14 (17%)	3.490	0.157
	No	38 (77.6%)	11 (22.4%)		
Drinking water	By filter	30 (88.2%)	4 (11.8%)	2.499	0.278
	Direct from source	76 (78.4%)	21 (21.6%)		
Toilet in home	Yes	101 (82.1%)	22 (17.9%)	9.797	0.008*
	No	5 (62.5%)	3 (37.5%)		
Kitchen garden	Yes	83 (89.2%)	10 (10.8%)	15.876	0.000*
	No	23 (60.5%)	15 (39.5%)		
Livestock	Yes	98 (83.1%)	20 (17%)	4.141	0.105
	No	8 (61.5%)	5 (38.5%)		

*Statistically significant with wasting (P<0.05)

Factors Associated with Stunting:

Variables		**HFA**		χ^2 **value**	**P-value**
		Normal	**Stunting**		
Ethnicity	Brahmin	12 (85.7%)	2 (14.3%)	16.327	0.017*
	Chhetri	36 (92.3%)	3 (7.7%)		
	Adhavasi/Janjati	26 (61.9%)	16 (38.1%)		
	Dalit	22 (73.3%)	8 (26.6%)		
	Others	6 (100%)	Nil		
Age category	6-11 months	19 (95%)	1 (5%)	9.687	0.245
	12-23 months	21 (77.8%)	6 (22.2%)		
	24-35 months	17 (65.4%)	9 (34.6%)		
	36-47 months	19 (82.6%)	4 (17.4%)		
	48-60 months	26 (74.3%)	9 (25.7%)		
Gender	Male	53 (73.6%)	19 (26.4%)	1.800	0.407
	Female	49 (83.1%)	10 (17%)		

Birth weight	<2.5 kg	14 (70%)	6 (30%)	10.243	0.021*
	≥ 2.5 kg	83 (83%)	17 (17%)		
	No idea	5 (45.5%)	6 (54.6%)		
Family type	Nuclear	63 (76.8%)	19 (23.1%)	0.267	0.875
	Joint	39 (79.6%)	10 (20.4%)		
Recent disease	Common cold	16 (84.2%)	3 (15.8%)	7.789	0.451
	Fever	16 (80%)	4 (20%)		
	Jaundice	Nil	1 (100%)		
	Pneumonia	4 (100%)	Nil		
	No	66 (75.9%)	18 (24.1%)		
Household	Male	84 (77.8%)	24 (22.2%)	0.483	0.842
head	Female	18 (78.3%)	5 (21.7%)		
Father's	Agriculture	25 (80.6%)	6 (19.4%)	5.611	0.841
Occupation	Business	5 (100%)	Nil		
	Job	14 (77.8%)	4 (22.2%)		
	Foreign Employment	30 (83.3%)	6 (16.7%)		
	Labor	22 (68.8%)	10 (31.3%)		
	Other	6 (66.7%)	3 (33.3%)		
Mother's	Housewife	48 (72.7%)	18 (27.3%)	4.484	0.547
occupation	Agriculture	36 (76.6%)	11 (23.4%)		
	Job	12 (100%)	Nil		
	Labor	6 (100%)	Nil		
Father's	Primary	8 (53.3%)	7 (46.7%)	12.619	0.069
Education	Secondary	58 (78.4%)	16 (21.7%)		
	Intermediate	16 (80%)	4 (20%)		
	Bachelor and above	4 (100%)	Nil		
	None	16 (88.9%)	2 (11.1%)		
Mother's	Primary	15 (71.4%)	6 (28.6%)	4.337	0.820
Education	Secondary	55 (76.4%)	17 (23.6%)		
	Intermediate	14 (93.3%)	1 (6.7%)		
	Bachelor and above	4 (100%)	Nil		
	None	14 (73.7%)	5 (26.3%)		

Annual income	<1 lakh	29 (72.5%)	11 (27.5%)	4.785	0.309
	1-3 lakhs	47 (77%)	14 (22.9%)		
	>3 lakhs	26 (86.7%)	4 (13.3%)		
House structure	Cemented	61 (92.4%)	5 (7.5%)	17.357	0.000*
	Mud	41 (63.1%)	24 (37%)		
Age at marriage	<15	6 (60%)	4 (40%)	5.461	0.200
	15-20	61 (76.3%)	19 (23.8%)		
	>20	35 (85.4%)	6 (14.6%)		
Age at first pregnancy	15-20	38 (76%)	12 (24%)	1.000	0.606
	>20	64 (79%)	17 (20.9%)		
Iron/Folate intake	Yes	100 (78.7%)	27 (21.3%)	3.332	0.212
	No	2 (50%)	2 (50%)		
Vaccination	Yes	99 (78.6%)	27 (21.4%)	2.358	0.306
	No	3 (60%)	2 (40%)		
Initiation of breastfeeding	Within 1 hour	78 (81.3%)	18 (18.7%)	7.783	0.246
	Within 24 hours	15 (68.2%)	7 (31.8%)		
	After 24 hours	8 (66.7%)	4 (33.3%)		
	Not breastfed	1 (100%)	Nil		
Colostrum feeding	Yes	94 (77.7%)	27 (22.3%)	0.712	0.705
	No	8 (80%)	2 (20%)		
Pre-lacteal feeding	Yes	16 (76.2%)	5 (23.8%)	3.053	0.203
	No	86 (78.2%)	24 (21.8%)		
Duration of breastfeeding	< 2 years	3 (60%)	2 (40%)	4.186	0.684
	≥ 2 years	39 (76.5%)	12 (23.5%)		
	Still feeding	59 (79.7%)	15 (20.3%)		
	Not fed	1 (100%)	Nil		
Suffered from diarrhea	Yes	46 (76.7%)	14 (23.4%)	0.513	0.774
	No	56 (78.9%)	15 (21.2%)		
Vitamin A capsule	Yes	92 (78.6%)	25 (21.4%)	0.972	0.676
	No	10 (71.4%)	4 (28.5%)		
Deworming tablet	Yes	74 (74.7%)	25 (25.3%)	1.947	0.378
	No	28 (87.5%)	4 (12.5%)		
Immunization	Yes	101 (78.3%)	28 (21.8%)	2.683	0.395

	No	1 (50%)	1 (50%)		
Exclusive	Yes	62 (77.5%)	18 (22.5%)	2.080	0.353
breastfeeding	No	40 (78.4%)	11 (21.5%)		
Initiation of	< 4 months	20 (74.1%)	7 (25.9%)	4.869	0.516
complementary	4-5 months	9 (81.8%)	2 (18.2%)		
feeding	5-6 months	66 (80.5%)	16 (19.5%)		
	> 6 months	7 (63.6%)	4 (36.4%)		
Foods during	Soup	86 (78.9%)	23 (21.1%)	9.960	0.066
diarrhea	As usual	4 (40%)	6 (60%)		
	Other's	7 (100%)	Nil		
	Don't know	5 (100%)	Nil		
Baal-vita given	Yes	44 (84.6%)	8 (15.3%)	2.648	0.266
to baby	No	58 (73.4%)	21 (26.6%)		
Growth	Yes	65 (79.3%)	17 (20.7%)	1.095	0.578
monitoring	No	37 (75.5%)	12 (24.5%)		
Drinking water	By filter	32 (94.1%)	2 (5.8%)	7.113	0.023*
	Direct from source	70 (72.2%)	27 (27.9%)		
Toilet in home	Yes	96 (78%)	27 (21.9%)	0.867	0.797
	No	6 (75%)	2 (25%)		
Kitchen garden	Yes	74 (79.6%)	19 (20.4%)	0.691	0.708
	No	28 (73.7%)	10 (26.3%)		
Livestock	Yes	93 (78.8%)	25 (21.2%)	1.300	0.565
	No	9 (69.2%)	4 (30.8%)		

*Statistically significant with stunting (P<0.05)

Factors Associated with Underweight:

Variables		**WFA**		χ^2 **value**	**P-value**
		Normal	**Underweight**		
Ethnicity	Brahmin	12 (85.7%)	2 (14.2%)	9.610	0.225
	Chhetri	32 (82.1%)	7 (17.9%)		
	Adhavasi/Janjati	31 (73.8%)	11 (26.1%)		
	Dalit	18 (60%)	12 (40%)		
	Others	6 (100%)	Nil		

Age category	6-11 months	18 (90%)	2 (10%)	5.722	0.684
	12-23 months	20 (74.1%)	7 (25.9%)		
	24-35 months	21 (80.8%)	5 (19.2%)		
	36-47 months	17 (73.9%)	6 (26.1%)		
	48-60 months	23 (65.7%)	12 (34.3%)		
Gender	Male	58 (80.6%)	14 (19.4%)	3.625	0.162
	Female	41 (69.5%)	18 (30.5%)		
Birth weight	< 2.5 kg	14 (70%)	6 (30%)	4.902	0.231
	≥ 2.5 kg	79 (79%)	21 (21%)		
	No idea	6 (54.5%)	5 (45.5%)		
Family type	Nuclear	55 (67.1%)	27 (32.9%)	8.979	0.011*
	Joint	44 (89.8%)	5 (10.2%)		
Recent disease	Common cold	16 (84.2%)	3 (15.8%)	7.343	0.506
	Fever	15 (75%)	5 (25%)		
	Jaundice	1 (100%)	Nil		
	Pneumonia	4 (100%)	Nil		
	No	63 (72.4%)	24 (27.6%)		
Household	Male	82 (75.9%)	26 (24.1%)	0.370	0.914
head	Female	17 (73.9%)	6 (26%)		
Father's	Agriculture	27 (87.1%)	4 (12.9%)	8.270	0.546
Occupation	Business	5 (100%)	Nil		
	Job	13 (72.2%)	5 (27.8%)		
	Foreign Employment	27 (75%)	9 (25%)		
	Labor	19 (59.4%)	13 (40.6%)		
	Other	8 (88.9%)	1 (11.1%)		
Mother's	Housewife	47 (71.2%)	19 (28.8%)	3.462	0.728
occupation	Agriculture	38 (80.9%)	9 (19.2%)		
	Job	10 (83.3%)	2 (16.7%)		
	Labor	4 (66.7%)	2 (33.4%)		
Father's	Primary	12 (80%)	3 (20%)	8.111	0.337
Education	Secondary	56 (75.7%)	18 (24.4%)		
	Intermediate	17 (85%)	3 (15%)		
	Bachelor and above	2 (50%)	2 (50%)		

	None	12 (66.7%)	6 (33.3%)		
Mother's	Primary	15 (71.4%)	6 (28.5%)	7.905	0.361
Education	Secondary	57 (79.2%)	15 (20.9%)		
	Intermediate	13 (86.7%)	2 (13.3%)		
	Bachelor and above	2 (50%)	2 (50%)		
	None	12 (63.2%)	7 (36.9%)		
Annual income	<1 lakh	26 (65%)	14 (35%)	6.520	0.142
	1-3 lakhs	52 (85.2%)	9 (14.8%)		
	>3 lakhs	21 (70%)	9 (30%)		
House	Cemented	57 (86.4%)	9 (13.6%)	9.278	0.009*
structure	Mud	42 (64.6%)	23 (35.4%)		
Age at	<15	7 (70%)	3 (30%)	1.146	0.907
marriage	15-20	61 (76.3%)	19 (23.8%)		
	>20	31 (75.6%)	10 (24.4%)		
Age at first	15-20	36 (72%)	14 (28%)	0.838	0.689
pregnancy	>20	63 (77.8%)	18 (22.2%)		
Iron/Folate	Yes	97 (76.4%)	30 (23.6%)	3.451	0.136
intake	No	2 (50%)	2 (50%)		
Vaccination	Yes	96 (76.2%)	30 (23.9%)	2.538	0.311
	No	3 (60%)	2 (40%)		
Initiation of	Within 1 hour	74 (77.1%)	22 (23%)	8.999	0.150
breastfeeding	Within 24 hours	16 (72.7%)	6 (27.3%)		
	After 24 hours	8 (66.7%)	4 (33.3%)		
	Not breastfed	1 (100%)	Nil		
Colostrum	Yes	92 (76%)	29 (24%)	1.169	0.464
feeding	No	7 (70%)	3 (30%)		
Pre-lacteal	Yes	16 (76.2%)	5 (23.8%)	0.128	1.000
feeding	No	83 (75.5%)	27 (24.6%)		
Duration of	< 2 years	4 (80%)	1 (20%)	2.727	0.937
breastfeeding	≥ 2 years	37 (72.5%)	14 (27.5%)		
	Still feeding	57 (77%)	17 (23%)		
	Not fed	1 (100%)	Nil		

Suffered from	Yes	46 (76.7%)	14 (23.4%)	0.314	0.904
diarrhea	No	53 (74.6%)	18 (25.3%)		
Vitamin A	Yes	88 (75.2%)	29 (24.8%)	0.393	1.000
capsule	No	11 (78.6%)	3 (21.4%)		
Deworming	Yes	71 (71.7%)	28 (28.3%)	3.263	0.196
tablet	No	28 (87.5%)	4 (12.5%)		
Immunization	Yes	99 (76.7%)	30 (23.3%)	6.600	0.058
	No	Nil	2 (100%)		
Exclusive	Yes	58 (72.5%)	22 (27.5%)	5.805	0.054
breastfeeding	No	41 (80.4%)	10 (19.6%)		
Initiation of	< 4 months	20 (74.1%)	7 (25.9%)	5.968	0.355
complementary	4-5 months	10 (90.9%)	1 (9.1%)		
feeding	5-6 months	62 (75.6%)	20 (24.4%)		
	>6 months	7 (63.6%)	4 (36.4%)		
Foods during	Soup	82 (75.2%)	27 (24.8%)	6.964	0.217
diarrhea	As usual	6 (60%)	4 (40%)		
	Other's	5 (100%)	Nil		
	Don't know	6 (85.7%)	1 (14.3%)		
Baal-vita given	Yes	37 (71.2%)	15 (28.8%)	2.919	0.207
to baby	No	62 (78.5%)	17 (21.5%)		
Growth	Yes	63 (76.8%)	19 (23.2%)	0.232	0.890
monitoring	No	36 (73.5%)	13 (26.5%)		
Drinking water	By filter	30 (88.2%)	4 (11.7%)	3.988	0.136
	Direct from source	69 (71.1%)	28 (28.8%)		
Toilet in home	Yes	94 (76.4%)	29 (23.6%)	4.231	0.112
	No	5 (62.5%)	3 (37.5%)		
Kitchen garden	Yes	76 (81.7%)	17 (18.3%)	10.661	0.005*
	No	23 (60.5%)	15 (39.5%)		
Livestock	Yes	91 (77.1%)	27 (22.8%)	2.163	0.334
	No	8 (61.5%)	5 (38.5%)		

*Statistically significant with underweight (P-value <0.05)