PREVALENCE AND ITS ASSOCIATED RISK FACTORS OF MALNUTRITION AMONG CHILDREN

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PREVALENCE AND ITS ASSOCIATED RISK FACTORS OF MALNUTRITION AMONG CHILDREN

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CERTIFICATE

This is to certify that the thesis entitled "**Prevalence and its associated risk factors of malnutrition"** submitted to Mizoram University for the award of the degree of Doctor of Philosophy in Nursing by Laltanpuii is a record of original research work carried out during the period of 2020-2024 under our guidance and supervision, it has not been submitted for award of any degree in this or any other University or Institute of learning.

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I, Laltanpuii, hereby declare that the subject matter of this thesis is the record of work done by me, that the contents of this thesis did not form basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that the thesis has not been submitted by me for any research degree in any other University / Institute.

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CHAPTER- I

Introduction

Background of the Study

Malnutrition afflicted people of all ages and in all nations worldwide (Singh, 2020). All forms of malnutrition pose a serious risk to human health. As per the report of World Health Organization (2020), children under five years of age are at higher risk of malnutrition and face many consequences due to malnutrition.

According to World Health Organization (2021), malnutrition refers to deficiencies, excesses or imbalances in a person's intake of energy and /or nutrients.

Govender et al. (2021) stated in their study that insufficient dietary intake in children can cause wasting. It can be cause due to poor access to healthcare, lack of food security, inappropriate feeding practices, and lack of water, sanitation and hygiene services. According to the report of UNICEF (2024) on child wasting, children who experience wasting are more vulnerable to long-term developmental problems, and they have compromised immune systems.

According to World Health Organization (2020), children living in low and middle-income countries are more in danger of inadequate prenatal, infant, and young child nutrition. Reports appearing recently regarding child malnutrition show that the prevalence is rising in India, and it is one of the leading causes of child mortality and morbidity.

There are several factors associated with child malnutrition, one of which is the utilization of prenatal care services of mothers during pregnancy. According to UNICEF (2024), antenatal care is a vital component of preventive health care that aims to monitor the health of pregnant woman and unborn child. World Health Organization Manual (2002) recommends at least four antenatal visits to be done during pregnancy. Toma et al. (2018) study finding shows that antenatal care visits had a significant influence on the nutritional status of the children. Hamel et al. (2015) study identified that mothers who received adequate antenatal care are less likely to have stunted children.

The duration of breastfeeding influences the prevalence of overweight and obesity. Mantzorou et al. (2022) in their study mentioned that reduced risk of obesity and overweight was seen in those children who were breastfed for at least four months. Song et al. (2020) in their study reported that a shorter duration of breastfeeding was associated with an increased risk of overweight/obesity among children. Chen et al. (2019) in the study found that children who had earlier introduction of solid foods as infants, as well as those who were born at a high birth weight and those with parents with obesity were likely to have obesity. Children of today are citizens of tomorrow. Therefore, it becomes crucial to improve children's nutritional status.

World health organization policy (2017) reported the world faces a double burden of malnutrition, which is characterized by the coexistence of undernutrition along with overweight, obesity, or diet-related non communicable diseases.

The nutritional status of children under five years is determined by infant feeding practices. Singh (2004) in national guidelines on feeding of infant and young children mentioned that feeding practices are linked to almost two-thirds of child deaths that occur during the first year of life. Elizabeth (2010) mention in her book as infant and young child feeding is a key area to increase child survival and promote healthy growth and development. UNICEF (2019) also mentioned that for children to grow and develop to the best of their abilities, the proper foods must be consumed at the right times. The 1,000 days between a child's first birthday and their second is the most important time for proper eating as per report of UNICEF (2017).

UNICEF (2018) claimed that one of the most effective strategies for enhancing a child's survival and well-being is breastfeeding, which should begin within the first hour of the child's birth, be sustained exclusively for six months, and be supplemented with safe and appropriate foods for up to two years or beyond. Everyyear, during the first week of August, WHO, UNICEF, Ministries of Health, and civil society partners promote World Breastfeeding Week. Closing the gap: Supporting breastfeeding for everyone is the theme for 2024 (WHO-World Breastfeeding Week, 2024).

The Indian government is firmly dedicated to achieving one of the important developmental goal 'Erase Hunger' which aims to eliminate hunger and all forms of malnutrition by 2030 (United Nations India, 2023). In connection to this, the Central Government launched the Poshan Abhiyaan, a flagship national nutrition mission in 2018 to improve nutrition among children, pregnant women and lactating mothers with a goal to reduce malnutrition (Women and Child Development Department-Poshan Abhiyan).

Nutritional status and infant young feeding practice: Global scenario

One of the biggest but least addressed development concerns in the world today is malnutrition. According to World Health Organization (2024), malnutrition affects every country in the world, and it is the greatest global health challenge. UNICEF Nutrition Strategy (2020) mentioned that the world faces a triple burden of malnutrition and witnessed a continuing burden of undernutrition and micronutrient deficiencies coupled with the rapid increase in childhood overweight and obesity.

World Health Organization(2023) reported that globally 149 million children under 5 years are found to be stunted, 45 millions were wasted, and 37 million were overweight or obese in 2022. According to the World Bank Group (2024) report on nutrition (2024), the region most affected include Sub Saharan Africa and South Asia where two thirds of the 149 million stunted children residing in these two region.

According to WHO- Obesity (2021) reported that in most of the countries, death from obesity and overweight is higher than that from underweight. WHO fact sheet: obesity and overweight (2024) shows that there were 39 million overweight or obese children under the age of five in 2022 and previously thought to be an issue of high-income countries, overweight and obesity are also becoming a problem in low- and middle-income countries. UNICEF/WHO/World Bank, Level and Trends in Child Malnutrition (2021) reported that most children with malnutrition live in Africa and Asia and more than half of all children under five affected by stunting and two-thirds of wasting children in the world lived in Asia.

Breastfeeding is crucial for the health and survival of children. Anything other than breast milk may cause a newborn to miss their first interaction with their

mother and may also make breastfeeding more challenging.According to the report of UNICEF (2023), less than half of all newborns worldwide (46%) are breastfed within an hour of birth and there are significant regional variations in this practice. Compared to South Asia (39%), East Asia and the Pacific (40%), and West and Central Africa (41%), the prevalence of early breastfeeding in Eastern and Southern Africa (69 %) is almost twice as high.

An infant that is not exclusively breastfed could be at a greater risk of death from diarrhoea or pneumonia than one who is exclusively breastfed (World Health Organization- Infant and Young Child Feeding, 2023). Worldwide rates of exclusive breastfeeding during the first six months of life have risen by 10 percentage points in the last ten years, reaching 48% in 2023 near the 50% target set by the World Health Assembly by 2025(UNICEF, WHO & Global Breastfeeding Collective- Global Breastfeeding Scorecard, 2023).

UNICEF (2023) reported regarding breastfeeding that 60% of babies are exclusively breastfed in South Asia, which has the highest incidence of this practice, only 26% of newborns aged 0 to 5 months in Northern America receive exclusive breast milk. Martin et al. (2016) in their article stated that breast milk is a significant source of vital nutrients. However, only 59% of children between the ages of 12 and 23 months benefit from breast milk worldwide (UNICEF- Breastfeeding, 2023).

Nutritional status and infant young feeding practice: India scenario

Malnutrition is a major health problem even in India. Global Hunger Index Report (2024) mentioned that India ranks 105 out of 127 countries, with a Global Hunger Index score of 27.3.Pruthi (2020) in his article mentioned that there is improvement in child malnutrition between NFHS-3 and NFHS-4, but the nation has not improved in terms of malnutrition among children as per the NFHS-5 results in India. Newsreel (2023) reported that prevalence of wasting in India is the highest in the world.

In all states surveyed in India, the percentage of children under five who are stunted (short for their age) based on World Health Organization standards has not significantly decreased since 2015 according to the report of Chakraborty (2021).

According to Ministry of Health & Family Welfare report on NFHS-5, India (2021), thirty six percent of children under five years are stunted, nineteen percent are wasted, and thirty-two percent are underweight. Stunting is the most common form of undernutrition among malnourished children in India.

Twenty nine per cent under five years are stunted in Mizoram. The percentage of children who are stunted increased from 28 per cent to 29 per cent since NFHS-4.Among all the age groups, the highest prevalence rate was recorded among children between the ages of 6-8 months through 6-23 months and it declines thereafter.(International Food Policy Research Institute Report, 2021)

Chakraborty (2021) mentioned that the latest National Family Health Survey (2019-20) results illustrate a drastic increase in obesity among children under five years in the majority of the states, 20 out of the 22 states. Mizoram and Tripura demonstrated a stark rise in the prevalence of overweight. Of all the states surveyed, Mizoram and Jammu & Kashmir recorded the highest rates of obesity in children less than five years of age.

According to Outlook Poshan (2020), out of the 22 States and Union Territories studied, Ladakh had the highest percentage of obese children under five 13.4%, followed by Lakshadweep 10.5%, Mizoram 10%, Jammu & Kashmir (9.6%), and Sikkim 9.6%.

Table 1

Status of Malnutrition of Under Five Children of India

Sl. No	Indicator	NFHS-4 (2015-2016)	NFHS-5 (2019-2020)
1	Children under 5 years who are stunted (height for age)	38.4	35.5
2	Children under 5 years who are wasted(weight for height)	21	18.5
3	Children under 5 years who are severely wasted (weight for height)	7.5	7.7
4	Children under 5 years who are underweight (weight for age)	35.8	32.1
5	Children under 5 years who are overweight (weight for height)	2.1	3.4

Table 1 depicts the nationwide percentage of under five children who were stunted and underweight dropped significantly from NFHS- 4 to NFHS- 5. In India, 38.4% of children were stunted, 35.8% were underweight, 21% were wasted and 7.5% were severely wasted in 2015-2016. In comparison to NFHS- 4, data from NFHS- 4 showed a lower prevalence of undernutrition: 35.5% of the under five children were stunted, 18.5% were wasting and 32.1% were underweight. The proportion of severely wasted children increase from 7.5% to 7.7%. The prevalence of overweight also rose from 2.1% to 3.4%.

Infant Young feeding practice

One of the most important ways to increase child survival and encourage healthy growth and development is through infant and young child nutrition. According to Ministry of Health & family Welfare report on National Family Health Survey-5, India (2021), 41% of the children were breastfed within one hour of birth, and 87% of children were initiated breastfeeding within one day at birth. 16% of children received prelacteal feed. The percentage of children that are initiated breastfeeding within one hour in Jharkhand is 22%. Good-performing states where two-thirds are breastfed within 1 hour of birth are Kerala, Lakshadweep, Meghalaya, and Odisha. Prelacteal feeding was practiced by only three percent in Lakshadweep,

whereas thirty-one percent of the children were given prelacteal feeding in the states of Chandigarh and Nagaland. The median duration of exclusive breastfeeding is 3.9 months, which was improved from the previous report of National Family Health Survey-4.

Table 2

Scenario of Infant Young Feeding practice of Children of India

Sl. No	Indicator	NFHS-4 (2015-2016)	NFHS-5 (2019-2020)
1	Initiation of breastfeeding within 1 hour	41.8	41.6
2	Exclusively breastfeed for 6 months	54.9	63.7
3	Started weaning at 6-8 months	42.7	45.9

Based on data from the Ministry of Health and Family Welfare report of NFHS-4 and NFHS-5 result, Table 2 compares the percentage of infant and young feeding practices among children in India. The percentage of women who exclusively breastfed improved from 54.9% (NFHS-4) to 63.9% (NFHS-5) and the start of weaning in India increased from 42.7% to 45.9%. However, the percentage of women who started breastfeeding within an hour decreased slightly from 41.8% to 41.6%.

Nutritional status and feeding practice: North east scenario

Most of the north east states are experiencing hike burden of malnutrition. Suri (2023) reported that stunting is highest in Meghalaya state 46.8%, followed by Nagaland 32.7%, Tripura 32.3%, and Mizoram 28.9%, whereas Assam, Manipur, and Sikkim have shown a decrease in stunting status. Sikkim has the lowest prevalence of stunting. The prevalence of stunting, wasting, and underweight or overweight is increased in Mizoram, Nagaland, and Tripura. All Northeast states have shown an increase in overweight, which shows the double burden of malnutrition.

Chakraborty (2021) reported that there is deterioration of infant and young child feeding indicators in northeastern states. Nagaland, Mizoram, and Assam saw a decrease in the proportion of children receiving adequate diets.

Suri (2023) reported that the percentage of children receiving early initiation of breastfeeding is on the decline in most of the Northeast states. Sikkim, Tripura, and Manipur have shown a reduction in the practice of exclusive breast feeding. The percentage of exclusive breastfeeding practice in Sikkim is lowest (28.3%). Tripura demonstrated a significant improvement in the timely introduction of semisolid food (13.6% to 53.1%), whereas Meghalaya, Mizoram, Nagaland, Sikkim, and Arunachal Pradesh have shown a decrease.

Nutritional status and feeding practice: Mizoram scenario

According to the Ministry of Health & family Welfare report on NFHS-5, Mizoram twenty-nine percent under five years are stunted, ten percent are wasted, and thirteen percent are underweight in Mizoram.

The National Family Health Survey -5 (2019-20) conducted in Mizoram state revealed increase in proportions of all the indicators of malnutritional status of under five children from the previous report. The percentage of stunted children increase from 28.1% to 28.9%, proportion of wasted children increase from 6.1% to 9.8%, increase of 2.3% to 4.9% wasted children, percentage of underweight children grew from 12% to 12.7% and there is significant increase of overweight children from 4.2% to 10% (Table 3). Therefore, increasing stunting under five years of age children continue to be a major nutritional problems in Mizoram and it is the most common form of undernutrition. Increasing in any form of undernutrition under five years of age children indicates undernutriton is a significant problem in Mizoram.

International Food Policy Research Institute report mentioned that among the eight districts of Mizoram, Aizawl district is the highest burden district of children in stunting, wasting, and underweight.

Table 3

Status of Malnutrition of Under Five Children of Mizoram

Sl. No	Indicator	NFHS-4 (2015-2016)	NFHS-5 (2019-2020)
1	Stunting	28.1	28.9
2	Wasting	6.1	9.8
3	Severely wasting	2.3	4.9
4	Underweight	12	12.7
5	Overweight	4.2	10

National Family Health Survey-5 report mentioned that breastfeeding is universal practice in Mizoram by most of the mothers, but only 68% of children were exclusively breastfed. While exclusive breastfeeding practice shows an improvement since NFHS-4, many infants are still not receiving the first breast milk at the right time. 94 percent of the children were given breastfeeding within the first day of birth, whereas only 63 percent of the children were provided breastfeeding within 1 hour of birth. There was a decline in the percentage of practice of initiation of breastfeeding within one hour. Weaning was practiced as per recommendation by only 57 percent of children in Mizoram

Table 4

Child Feeding Practice of Children of Mizoram

Sl. No	Indicator	NFHS-4 (2015-2016)	NFHS-5 (2019-2020)
1	Initiation of breastfeeding within 1 hour	70	63
2	Exclusively breastfeed for 6 months	61	68
3	Started weaning at 6-8 months	68	57

Data in table 4 shows the comparison of status of child feeding practice in Mizoram based on the report of Ministry of Health and Family Welfare on National Family Health Survey reports. There was decline in the practice of initiation of breastfeeding within one hour from 70% (NFHS-4) to 63% (NFHS-5). The

percentage of practice of exclusive breastfeeding improve from 61% to 68 %. There was also a decline in the practice of starting weaning at the right time from 68% to 57%.

Anthropometric measurement

Anthropometric measurements are the single most portable, widely applicable, and noninvasive quantitative measurements of the body. According to the Center for Disease Control and Prevention (CDC), anthropometric measurement provides a valuable assessment of nutritional status in children (Fryar et al., 2016). It reflects the growth and development of the children.

The following measurements are commonly used in assessing the nutritional status of children:

- **Weight for age**: The low weight-for-age index identifies the condition of being underweight or overweight for a specific age.
- **Height/length for age**: Low height for age index identifies past undernutrition or chronic malnutrition. For children below 2 years of age, length is measured in a recumbent/lying position; the index is referred to as length-for-age. For children above 2 years of age, length is measured in standing position; the index is referred to as height-for-age. Deficits in length for age or height for age are referred to as stunting.
- **Weight-for-length or Weight-for-height**: Weight-for-height helps to identify children suffering from current undernutrition or wasting. It is appropriate for short term effects of malnutrition.

The five indices are used to identify the different nutritional conditions: underweight, stunting, wasting, and overweight and obesity based on Food and Technical Assistance (2016).

Underweight: It is calculated based on weight for age. The weight of a child is two standard deviations below the WHO's recommended growth rate for that age group. In other words, if a child's z-scores for a specific weight for age are less than -2 SD from the WHO/NCHS kid Growth Standards or References median, the child is

considered underweight. It reflects both past (chronic) under nutrition and present (acute) under nutrition.

Overweight: The weight of a child is two standard deviations higher than the WHO growth standards for that age group. In other words, if a child's z-score for a specific weight for age deviates more than two standard deviations from the WHO/NCHS kid Growth Standards or References median, the child is considered overweight.

Obesity: The weight of a child exceeds the WHO growth criteria for that age by three standard deviations. In other words, if a child's z-score for a specific weight for age deviates more than three standard deviations from the WHO/NCHS Child Growth Standards or References median, the child is considered obese.

Stunting: Height below the WHO child growth standards median by less than two standard deviations. In other words, if a child's z-scores for a specific height for age are less than -2 SD from the WHO Child Growth Standards median, the child is considered stunted. It reflects past or chronic undernutrition; it cannot measure short-term changes in undernutrition (World Health Organization, 2020).

Wasting: It refers to less of body weight in reference to height. In other words, for a given height and weight, a child's z-score is fewer than two standard deviations from the WHO/NCHS Child Growth Standards or References median. It identifies current (acute) under nutrition.

Determinants of Maternal and Child Nutrition

Various factors may influence a child's nutritional status. Factors can be broadly classified into three categories: immediate determinants, such as diets and care that will impact a child's lifelong outcomes; underlying determinants, including food, practices, and services; and enabling determinants, which include governance, resources, and norms (UNICEF Conceptual Framework, 2020).

1) **Diets**: Sufficient foods, proper feeding techniques, and dietary habits are the foundation of a healthy diet. Insufficient food consumption can lead to health problems.

2) **Care**: Sufficient services to support women's and children's healthy nutrition are the foundation of effective care.
3) **Food**: This includes age-appropriate nutrient rich food with safe and palatable drinking water and household food security in the first two years of life.
4) **Practices**: This comprises age-appropriate feeding and dietary practices - with adequate food preparation, food consumption and hygiene practices.

The ability of the caregiver to feed the children appropriately for their age has a significant impact on children. Nutritional status of children is influence by the parents' cooking practice and the family's eating habits and hygiene.

5) **Services**: It includes social protection services, proper nutrition, health, sanitation, and education, as well as hygienic food and living conditions that prevent sickness and encourage good eating habits and physical exercise for all women and children.
6) **Governance**: The protection of individual rights and the enforcement of women's and children's right to nutrition are made possible by good governance.
7) **Resources**: Sufficient resources including environmental, financial, and social and human resources also have a profound effect on the nutrition status of the children. The environment in which a child lives has influence on the children. Human well-being is diminishing by poor sanitation and shortage of clean drinking water, which are connecting to numerous diseases. Poverty increases food insecurity and hidden hunger which contribute to the problem of malnutrition. There can be fewer resources available for physical health in low-income households.
8) **Norms**: The right to nutrition for women and children must be supported by positive gender, societal, and cultural norms and behaviours.

Need for the study

Malnutrition is a universal problem, and it can severely affect vulnerable children, especially those under five years of age. Singh (2020) mentioned that

children of today are our future citizens and improving children's nutritional status becomes crucial. Park (2019) reported that a young child under 5 years is most vulnerable to the vicious cycles of malnutrition, infection, and disability, all of which influence the present condition of a child and the future human resource development of the nation as a whole. Hence the assessment of the ground reality on prevalence and associated risk factors of children becomes very significant.

Saigal and Shrivasta (2023) stated that Meghalaya, Mizoram, Nagaland, and Tripura saw an increase in stunting among children in north east of India. The National Family Health Survey-5 also reported the prevalence of undernutrition in Mizoram is also increasing.

According to the United Nations International Children's Emergency Fund (2020), every child has the right to nutrition. Since the early years are so important for optimum growth and development, the nutritional status of infants and children is particularly concerning. For children to grow and develop to the best of their abilities, the right foods must be consumed at the right times. The most important period for healthy eating is from pregnancy until a child's second birthday.

World Health Organization (2023) also mentioned that children are at particular higher risk of malnutrition. Datta (2018) mentioned that malnutrition affect vast majority numbers of populations and 55% of childhood death is due to malnutrition and they are regarded as leading causes of death and important causes of childhood morbidity.

Narayan et al. (2019) stated that maternal, infant, and child nutrition play significant roles in the proper growth and development of the child. World Health Organization newsletter (2018) mentioned that when children are undernourished over an extended period of time, there are various outcomes such as delayed mental development and reduced intellectual capacity; it may also result in heightened severity and susceptibility to infections and elevated mortality risk.

World Health Organization (2024) reported obese children are more likely to grow up to be obese adults and are also more likely to have non-communicable diseases as adults.

The Government of India has committed to the success of one of the important developmental goals, 'Erase Hunger,' which aims to end hunger and all forms of malnutrition by 2030 (United Nations India, 2023).

It is very essential to know the existing status of malnutrition and identify the associated factors that lead to malnutrition so that appropriate intervention and prevention of the problem can be implemented, which will improve the nutritional status of the target population. The present study strives to identify the prevalence of malnutrition among children in Mizoram and the possible risk factors of stunting, wasting, underweight, overweight, and obesity. It also tries to explore the existence of associations between malnutrition and different factors to fill these research gaps so that the research will contribute to this unexplored field.

PROBLEM STATEMENT

Prevalence and its associated risk factors of malnutrition among children.

Objectives

The objectives of this study are:

- To identify the prevalence of malnutrition among children.
- To find out association between prevalence of malnutrition(nutritional status) and child characteristics.
- To find out association between prevalence of malnutrition (nutritional status) and maternal characteristics.
- To find out association between malnutrition(nutritional status) and feeding practices of the children
- To identify the associated risk factors of malnutrition among children.

Operational definition

- **Prevalence**: In this study, prevalence refers to the number of children with malnutrition as evident from anthropometric measurements of the child, which are deviated from the normal range.

- **Risk factor:** In this study, risk factors refer to factors that increase the children's chances of developing malnutrition, as evident from the identified risk factors at the child, mother, and household level.
- **Malnutrition**: In this study, it refers to deviation of growth of the child as evident from anthropometry which will be based on WHO growth standards. It refers both under nutrition and over nutrition.
- **Children**: In this study, children refer to a child in the age group of 6 months – 59 months.
- **Immunization status:** (12 and 23 months of children)

  Full immunisation: Those who received all vaccines recommended as per National Immunization Schedule.

  No immunization: Individuals who have not been vaccinated

  Partially immunisation: Individuals who received some vaccines recommended in National Immunization Schedule.
- **Meals:** An occasion when family sit together to eat food**.**
- **Weaning:** Introduction of solid food to the infant.
- **Inadequate iron supplementation:** It refers to supplementation of less than 100 Iron tablets during pregnancy.
- **Inadequate antenatal check up:** It refers to number of antenatal check up less than 4 times during pregnancy.

Research Hypothesis

On the basis of the objectives of the study, the hypotheses are formulated

- **H_1** There is a significant association between malnutrition and child characteristics.
- **H_2** There is a significant association between malnutrition and maternal characteristics.
- **H_3**There is a significant association between malnutrition and feeding practices of children.

Assumption

The assumption of the study are

- Undernutrition may be more prevalent among children from lower socio economic condition
- Nutritional status of the children may be influenced by proper maintenance of health of the mother during pregnancy.

Delimitation

The study is delimited to

- Selected community of Aizawl North and Aizawl East main centre only.

Conceptual Framework

Conceptual framework adopted for the present study is based on UNICEF conceptual framework.

The **enabling determinants** are the political, financial, social, cultural and environmental conditions that enable good nutrition for children and women.

The **underlying determinants** are the food, practices and services available to children and women in their households, communities and environments.

The **immediate determinants** of maternal and child nutrition are diets and care, which influence each other.

The **outcome** resulting from improved nutrition for children and women.

In this present study, the investigator assesses the different determinants which could influence the nutritional status of mother and children.

The **enabling factors** determined in the study are the demographic data of the participants–age, gender, birth weight, birth order, birth interval, antenatal check up and iron supplementation during pregnancy, socio economic condition of the family and family size.

The **underlying factors** are observing age appropriate feeding practice, practice of breastfeeding and weaning, practice of frequency of meal of the child,

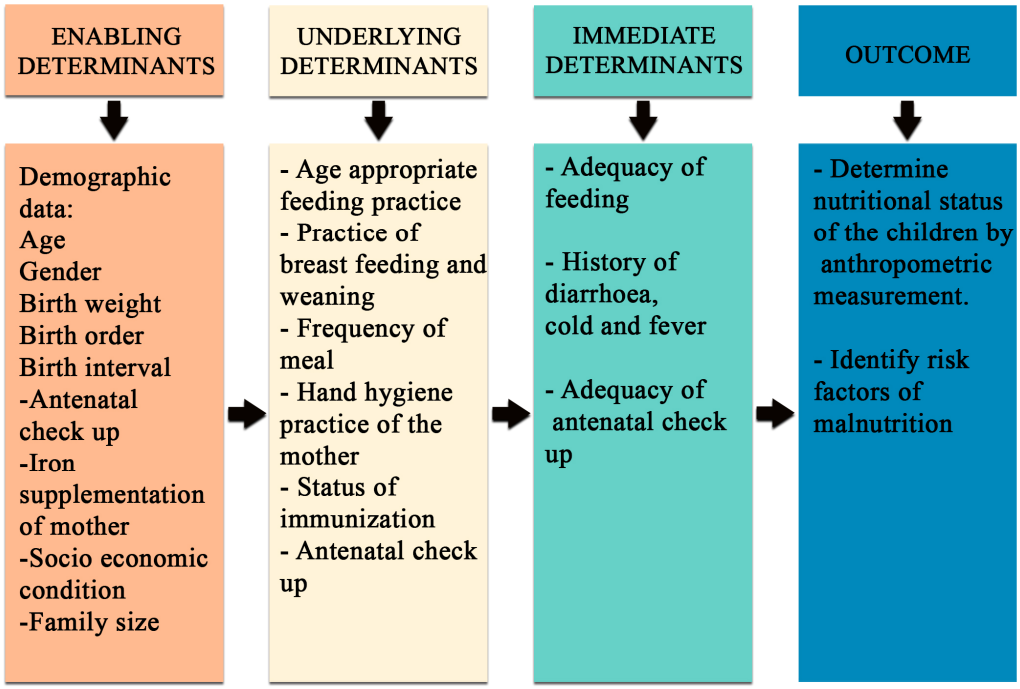
identifying immunization status of the child and adequacy of antenatal check up of the mother during pregnancy.

The **immediate determinants** of the present study are evaluation of feed adequacy, the assessment of fever, cold and diarrhoea during the previous two weeks and the adequacy of antenatal checkup.

The **outcome** is the evaluation of the nutritional status of the child and identifies the associated risk factors of malnutrition.

Fig. 1

Conceptual Framework Based on UNICEF Conceptual on Maternal and Child Nutrition (2020)



CHAPTER II

Review of Literature

This chapter deals with a review of related literature. Conducting a literature review allows the researcher to have an understanding of the kinds of prior studies that have been done. It provides the researcher with knowledge and direction regarding the necessary course of action. The literature review gives the researcher a conceptual framework, methods, techniques, data sources, instrument development, and statistical procedures.

Malnutrition is a global issue. Every country is affected. It impacts people from all age groups, all geographic locations, all socioeconomic classes, and both sexes.

A supportive environment, sufficient health care, and a healthy diet all help children grow and develop to the fullest extent possible. This is particularly crucial during the 1,000 days that pass between the start of the mother's pregnancy and the child's second birthday because that is the time when children grow and develop the fastest. To support this growth, young children have relatively high nutritional needs and are more vulnerable to malnutrition and its consequences than other age groups (Food and Nutrition Technical Assistance (FANTA) - Anthropometric Basics, 2016).

Early childhood constitutes the most crucial period of life, when the foundations are laid for cognitive, social, and emotional language, physical and motor development, and cumulative lifelong learning (Singh, 2020).

Malnutrition is a global issue that has been the subject of several research studies, with very few of them being done in Mizoram. This chapter is organized under the following headings to present the observations and conclusions of different researchers.

For the purpose of logical sequence, the chapter is organized under different sections.

Section I: Studies related to prevalence of malnutrition

Section II: Studies related to associated risk factors of malnutrition. It contains the following sub sections in line with

- Risk factor of under nutrition at the child level
- Risk factor of under nutrition at the maternal level
- Risk factor of under nutrition at the household level
- Risk factor of over nutrition

Section I: Studies related to prevalence of malnutrition

Saloi et al. (2017) carried out a study on nutritional status in the Ulubari Slum area, Urban Health Training Centre, Assam, among 380 children aged 1-5 years of age during 15th August 2016-15th January 2017. The prevalence of underweight was 32%, wasting 25%, and stunting 18%. There was a significant association between nutritional status of children and socioeconomic status, but there was no significant association between nutritional status and education of the mother. Compared to firstborn children, children with higher birth orders (2nd and ≥3rd) had a higher likelihood of malnutrition (underweight, stunted/wasted), although the distribution was not determined to be statistically significant (p>0.05).

Vasudevan and Udayanshankar (2019) executed a community-based study in the rural field practice area of Pondicherry to assess the nutritional status of 224 children under 5 years old. The prevalence of underweight, stunting, and wasting was 18.3%, 31.6%, and 20.1%, respectively. In the age category of 11- 23 months, the proportion of moderate and severe underweight and wasting was highest, whereas in the 48-59 month age group, the proportion of moderate and severe stunting was highest. The study concluded that improving awareness among mothers about feeding practices and early identification and intervention is necessary for malnourished children.

Chaudhary and Agrawal (2019) conducted a cross-sectional study to identify nutritional status among 2007 children aged 6–59 months in a slum area of Jaipur city, Rajasthan, in the years 2016-2017. The prevalence of stunting, underweight, and wasting was 43%, 35.7%, and 10.5%, respectively. While wasting was not related to birth order, underweight and stunting were substantially correlated with the child's age, the number of siblings, birth order, birth weight, and parents' educational attainment. Gender, religion, family type, and size of the household did not significantly correlate. Growth monitoring and immunization status were statistically significantly correlated in children with all three forms of malnutrition. It was discovered that children who were not immunized and who did not receive routine growth monitoring had far greater rates of malnutrition. The study concluded that in order to stop stunting and wasting, it is necessary to enhance the Anganwadi service delivery, improve the nutrition teaching session, and counsel the mothers on optimal utilization.

Sinha et al. (2019) analyzed the nutritional status of 140 under-five children in village Dimrapal, Bringpal, and Pandripani catchment areas of Rural Health Training Centre Tokapal, Chhatisgarh, by door-to-door survey in the month of July-September 2017. Out of the total children, 40.7% were stunted, 29.3% were wasted, and 44.3% were underweight. The study concluded that the degree of undernutrition among children living in tribal rural parts of the Bastar Region has remained high despite multiple nutrition programs. The low socioeconomic situation and issues with feeding practices are the root causes of undernutrition among the tribal population. As a result, a multifaceted approach is required to solve the issue.

Hazarika and Ojah (2020) analyzed the nutritional status of 344 children aged 0-5 years in the slums of Guwahati city. The prevalence of malnutrition was considerably high, at 38.66%. The prevalence of underweight was 27.91%, stunting was 31.40%, and wasting was 21.22%. The prevalence was higher in male children (51.88%). A significant association exists between malnutrition and male child. The study came to the conclusion that the prevalence of malnutrition was slightly higher than the national average.

Mishra and Chaurasia (2020) undertook a study to explore the magnitude of the nutritional status and disparities among children in various regions of Uttar Pradesh. Fourth rounds of the National Family Health Survey (2015-16) data were used. The study result shows that the southern part of Uttar Pradesh has the highest rate of wasting and underweight children, the eastern part has the highest prevalence of stunting, and the rural areas have the highest rates of underweight among those with lower incomes. The study identified that over half of the children (46.3%) whose mothers do not have formal education are underweight, 55% are stunted, and 18% are wasted, suggesting that child malnutrition is primarily a problem for the poor. The study concluded that deducing geographical variations and the socioeconomic imbalance in child health and malnutrition may be achieved through effective regional health planning for child health and nutritional development.

Biswal and Biswal (2021) executed a community-based cross-sectional study from January 2019-February 2020 on the prevalence of malnutrition among 200 children below 5 years and their mothers. Analysis was done based on WHO standards. The prevalence of underweight, stunting, and wasting was found to be 34.3%, 41.5%, and 18.9% respectively and the prevalence of overweight and obesity was 7.4% and 3.1% respectively. The study concluded that the studied population has a significant prevalence of malnutrition when compared to national and state data. Among the participants, it is also discovered that the prevalence of all types of malnutrition rises with age.

Section II: Studies related to associated risk factors of malnutrition

A number of possible risk factors have been linked to malnutrition; there seem to be variations of results in different research studies. Commonly identified risk factors are gender, infant and young feeding practice, low maternal education, birth weight, socioeconomic status, history of diarrhoea, parity, and spacing of children.

Abera et al. (2017) examined the prevalence of malnutrition and associated factors among 398 children aged 6-59 months among rural dwellers in Damot Gale District, South Ethiopia. Children with a birth interval less than 24 months and a

history of sickness in the past 2 weeks have a higher chance of being underweight. Occupation of the mother and presence of diarrhoea were associated with wasting status. Mothers who attend antenatal clinics during pregnancy have less chance of being underweight and wasting the children. The study came to the conclusion that stakeholders and health extension agents should take promotion in the community seriously.

Haradanhalli et al. (2017) conducted an in-depth investigation to find out the infant feeding practice and association with the nutritional status of 216 children in the age group of 1-5 years in an urban poor locality, which was under the field practice area of KIMS, Bangalore. 95.1% of the participants were given colostrums, 49.5% were exclusively breastfed, and 49.1% started weaning at 6 months. The prevalence of underweight, stunting, and wasting was 31.1%, 3.7%, and 16.6%, respectively. There was a significant association between underweight and pre-lactation feeds, colostrums, exclusive breastfeeding, weaning, and giving all food items at the age of 1 year. Stunting was significantly associated with colostrums, exclusive breast feeding, weaning, and giving all food items at the age of 1 year. Wasting was associated with pre-lacteal feeds, initiation of breastfeeding within 1 hour after delivery of colostrums, exclusive breastfeeding, and giving all food items at the age of 1 year. The study concluded that undernutrition remains a serious health issue and is closely linked to inappropriate eating practices. Therefore, in order to encourage improved newborn feeding practices, mothers must receive health education beginning in the prenatal period.

Sethy et al. (2017) examined the prevalence of malnutrition among 300 mothers of children aged below five years of age in the urban slums of Berhampur, Odisha. 55.3% of the children were underweight, wasting (75%), and stunting (42%). Maximum number of underweight children belongs to age group 37-60 months. There was a significant association between malnutrition and maternal education, hygiene practices, and feeding practices. The current investigation came to the conclusion that the study population has a higher prevalence of malnutrition than the state and national rates.

Ali et al. (2018) undertook a study to identify the prevalence and associated risk factors among 318 children under 5 years of age in the Takht Bhai community, Pakistan. The overall prevalence of malnutrition is 26.7%. The study identified a higher prevalence of malnutrition among female children (42%), than male children (28%). Factors significantly associated with malnutrition are a mother's working status and a low birth weight. It was determined that children under five did not have an adequate nutritional level.

Talukder et al. (2018) investigated the risk factors associated with stunting among children under five years of age in Bangladesh. The mother's education level, BMI, income index, and the child's age were significantly (p<0.01) correlated with the mother's stunting status. Stunting status in children was also found to be connected with the child's birth interval (p<0.05) and prenatal care services received throughout pregnancy (p<0.1).Therefore, when developing child nutrition programs and intervention initiatives, officials should take into account factors linked to stunting.

Henghono et al. (2019) studied factors associated with malnutrition among 42 mothers and children under the age of five years in Katutura Health Center, Windhoek. The study identified younger mothers, single parenting, and duration of breastfeeding, inadequate feeding, and early introduction of complementary feeding as important factors contributing to malnutrition. It was concluded that malnutrition was more prevalent among male children. To enhance children's nutritional status, research on prevention and intervention is advised.

Girma et al. (2019) did a community-based study to know the prevalence and risk factors of malnutrition among 416 children aged 24-59 months in Aykel Town. The prevalence of stunting, wasting, and underweight was 28.4%, 10%, and 13.5%, respectively. The findings of the study show that a higher risk of stunting was observed among children of low birth order, from large families, and who had a meal frequency of <3/day. Mother’s poor handwashing practice and children who had not fed on cow’s milk had a higher risk of being wasted. Children who were breastfed for less than 24 hours, who had not fed on cow milk, consumed foods from less than four food groups, and were from mothers who had poor hand washing practices had a

higher risk of being underweight. Improving children's nutritional status can be achieved by teaching caregivers the benefits of feeding their children properly and the importance of maintaining hygienic habits.

Gebre et al. (2019) studied the prevalence and associated factors of malnutrition among 840 under five children in pastoral communities of Afar Regional State, North East Ethiopia. The prevalence of wasting, stunting, and underweight was 16.2%, 43.1% and 24.8% respectively. Factors contributing to wasting are family size of five and above, practice of prelacteal feeding, and diarrhoea in the past two weeks. The positive predictors of stunting are male children, the increasing age of the child, and incomplete immunization. Factors contributing to underweight were maternal illiteracy, male childhood, prelacteal feeding and incomplete immunization. To enhance children's nutritional status, it is essential to promote family planning, avoid diarrheal illnesses, vaccinate children, and provide access to nutrition education.

Jude et al. (2019) investigated a study to identify the prevalence of malnutrition among under-five children in Enugu Metrolis, Nigeria. The prevalence of stunting, wasting, overweight, and obesity was 3.5%, 2.4%, 1.5%, and 1.5% respectively. Undernutrition was found to be associated with maternal education and low socioeconomic class, where risk factors for overnutrition were upper socioeconomic class. The study area has a low rate of malnutrition. Nonetheless, persistent efforts are needed to stop the disease of malnutrition from spreading and even to eradicate it.

Modjadji and Mashishi (2019) carried out a study to determine the prevalence of malnutrition and associated factors among 415 children under five years of age with their mother in selected healthcare facilities in Limpopo Province, South Africa. Stunting (45.3%) is the most prevalent form of undernutrition. Among the participants, boys (51.7%) are more affected than girls (38.8%), and children aged 12-23 months are more affected than children aged <11 months old (40.1%). The late introduction of complementary foods and low birth weight has increased the odds of stunting and underweight. Based on the study's findings, mothers' educational

attainment has an impact on their children's nutritional status, and national nutrition programs should be improved to better introduce supplementary meals.

Devi and Kaurs (2019) did a study among 200 under-five children and their mothers in rural areas of district Sirmaur, Himachal Pradesh. The study results show that the prevalence of stunting was 40% and wasting was 19.5%. Malnutrition was found to be associated with fewer antenatal visits, inadequate breastfeeding practices, unsafe drinking water, a lack of transport facilities, a lack of awareness regarding educational programs, and inadequate dietary practices. Programs for health education and awareness will increase mothers' understanding of risk factors that contribute to malnutrition and may also help to reduce its issues.

Khobragade and Yadav (2020) executed a study on the nutritional status of 354 under-five children in a rural area of Central India. The prevalence of stunting, underweight, and wasting is 35%, 15.5%, and 6.4% respectively. Malnutrition was significantly associated with socio-economic status, maternal literacy, and exclusive breastfeeding.

Chawla et al. (2020) conducted a community-based cross-sectional study on undernutrition and associated factors among 600 children in 30 Anganwadi centers in block LakhanMajra, Rohtak, Haryana. The prevalence of undernutrition was 18.4% wasting, 38.3% underweight, and 41.3% stunting. Mothers who had the recommended antenatal visits and received the recommended iron supplementation had a lower prevalence of undernourished children. The study identified that undernutrition was significantly associated with prelactational feeding in children who did not receive exclusive breastfeeding and had an early introduction of complementary feeding.

Kumar et al. (2020) explored the magnitude and the factors affecting malnutrition across 629 tribal and nontribal children in southern Rajasthan. 32.63% of the participants are moderately underweight, and 7.49% are severely underweight among tribal children and among non-tribal children; 24.4% are moderately underweight, and 4.41% are severely underweight. With regard to stunting, 64.37%

in tribal children and 73.22% were found normal in non-tribal children. Malnutrition was significantly associated with household income and a mother's literacy.

Rana et al. (2020) studied among 400 children under two years of age in Narmada district, Gujarat district. The prevalence of stunting, wasting, and underweight was 34.5%, 32.2%, and 39.7%, respectively. Wasting was associated with household income, low maternal stature, and child age 0–6 months, while household income, livestock ownership and child age 7-23 months were associated with stunting. Low maternal stature was significantly associated with being underweight. Children under two years old are most susceptible to undernutrition. Enhancing the nutritional health of teenage girls and mothers, improving the current program, and promoting hygiene awareness are all important ways to make things better.

Bishwajit and Yaya (2020) executed a study regarding overweight and obesity among under-five children in South Asia. The overall prevalence of overweight was 1.91% and obesity (0.89%). It was found that childhood overweight or obesity was significantly associated with a child's dietary diversity, maternal BMI, education, and household wealth status. Children from homes with higher wealth quintiles were also more likely to be overweight or obese. Among South Asian nations, the prevalence of overweight and obesity among children under five is comparatively low. In this community, socio cultural factors have an impact on the epidemiology.

Murarkar (2020) conducted a community-based cross-sectional study among 3671 children in an urban slum and a rural area in Maharashtra. The prevalence of stunting, wasting, and underweight was 45.9%, 17.1%, and 35.4% respectively. The prevalence of undernutrition was more prevalent in urban slums than in rural areas. In the rural slums, wasting was associated with exclusive breast feeding and acute diarrhoea; children with birth order 2 or more were associated with stunting; and exclusive breast feeding and low maternal education were associated with underweight. In the urban slums, exclusive breast feeding was associated with wasting, the sex of the child and type of family were associated with stunting, and the low income of the family was associated with underweight. The child's

nutritional health will improve with increased maternal education. To raise the community's economic condition, strategies are required.

Elnadif (2020) analyzed the prevalence and related factors of malnutrition among 825 Al-Nohoud children between 6 and 59 months of age in Zahedan, Iran. The prevalence of underweight, stunting, and wasting was 16.7%, 13.5%, and 17.6% respectively. Among the participants, female children were underweight than male children. The prevalence of undernutrition is higher in the age group of 24 months (67%). Age of the child, mother's education, and family income were found to be associated with malnutrition.

Chataut and Jonchhe (2020) studied a cross-sectional study to identify the prevalence and associated factors of malnutrition among 302 rural children in the age group of 12 to 59 months in Nepal. The prevalence of underweight, stunting, and wasting was 36.8%, 7.5%, and 14.6% respectively. The lower age group among the participants has an increased chance of all forms of undernutrition. Stunting was significantly associated with a lower level of a mother's education and illness in the past month. Underweight was associated with children of large family sizes, a lower level of mother's education, and illness in the past month. According to the current study, malnutrition among children under five years old in Nepal remains a significant issue. The results of this study should be taken into account when creating plans to enhance the nutritional status of under five children in Nepal.

Hall et al. (2020) executed a study on factors influencing undernutrition among under-5s from 2348 households in three regions of Bougainville. The study identified that stunting and underweight were significantly increased in households with unimproved toilet facilities. Underweight was also increased among children from households without access to clean drinking water, increasing the birth order of the child. Stunting was significantly associated with short maternal stature. Children aged 6-59 months had higher odds of being stunted. The study concluded that a multidisciplinary approach is required to solve the issue.

Bagchi et al. (2021) studied to assess the association between feeding practice and nutritional status of children at Baghbazar Slum area in Kolkata among 76

under-five children. 21.1% received breastfeeding within the first hour after birth, 71.2% were exclusively breastfed, 23.7% received prenatal feeding and 93.4% received colostrums. 87.9% of the participants started complementary feeding at the right time. There was a significant association between stunting and lower socioeconomic classes; underweight status was associated with low birth weight; and less educated mothers and children who did not receive exclusive breastfeeding and supplementary nutrition from ICDS.

Chandra et al. (2021) looked into the status of undernutrition among 68 under-5 tribal children in West Bengal. Out of the total children, 30.8% were stunted, 30.8% were wasted, and 14.7% were both stunted and wasted. Undernutrition was significantly associated with gender, education of the father, type of family, socioeconomic status and birth order. To enhance the nutritional quality of the children in these tribal regions, a multisectoral strategy is highly suggested. A behavioral change intervention is to be planned for mothers, focusing on nutrition, safe cooking practices, and a balanced diet.

Njigang et al. (2021) conducted a cross-sectional study to identify the prevalence and risk factors of malnutrition among 301 parents and underfive children in Tole. The overall prevalence of malnutrition was 36.5%. The most common form of undernutrition in the present study is stunting (20.9%), which was followed by underweight (8.6%) and wasting (7%). Lack of vaccination, poor feeding habits of the child, and household size are the important factors contributing to malnutrition. Mothers in particular should get nutrition education, and activities should be integrated into all health institutions and communities.

Menalu et al. (2021) investigated undernutrition and factors associated with undernutrition among 385 under five children in Debre Berhan Town. The total prevalence of undernutrition was 61 (15.8%), among which 41% of the samples are stunted, 33% are wasted, and 26% are underweight. Maternal illiteracy, not breastfeeding exclusively, preterm birth, absence of antenatal care, exposure to infectious diseases, and diarrhoea are identified as factors responsible for undernutrition. Educating them about adequate nutrition can help mothers become

more educated. All expectant mothers should receive prenatal care, and programs on child care, infection prevention, and child feeding should be provided.

Rahman et al. (2021) in-depth investigation among 808 under-5 Dayak children in Sarawak, Malaysia. The total prevalence of undernutrition was 39.6%. Parent's occupation and household wealth index were associated with stunting. Low parental education level, poor wealth index, shorter duration of exclusive breastfeeding, and environmental and sanitation problems were found to be significantly associated with underweight and wasting. In children under three, stunting was more common and was correlated with the occupation of parents and the family wealth index. The study concluded that to address undernutrition, a multi-sectoral and multi-dimensional approach is necessary. To lower childhood undernutrition, improvements in the socioeconomic status of households, the environment, and sanitation should be prioritized.

Naeem et al. (2021) examined the prevalence and associated factors of malnutrition among 400 children under 5 years of age in Frash Town, Islamabad. 77% of the participants are found to be malnourished. Malnutrition was significantly associated with socioeconomic status and parent's education. Planning composite interventions is necessary to identify the risk factors for malnutrition in children.

Das et al. (2022) conducted a study among 135 children aged 0-23 months to identify the prevalence and risk factors of undernutrition in a tertiary health center in West Bengal. The prevalence of stunting was 14.1%, wasting was 18.5%, and underweight was 9.7%. The study result shows that children of working mothers with birth spacing of <3 years, LBW, and delayed initiation of breastfeeding (>1 hour) have a higher chance of stunting and being underweight. Children who had initiated complementary feeding at the incorrect age had a higher risk of wasting. The study concluded that undernutrition is more prevalent among young children. The present study confirms the existence of this public health problem, which can be eradicated by short-term and long-term corrective measures.

Kayastha et al. (2022) carried out a cross-sectional study of malnutrition among 60 under-five children and their mothers in Kamal Gaupalika, Jhapa. The

total prevalence of malnutrition was 41.67%. The present study showed that underweight 31.7% was the most common form of undernutrition, wasting was 25%, and stunting was 20%. Family income was significantly associated with malnutrition. It was concluded that malnutrition is prevalent among under five children in the community. To enhance children's nutritional status, community-based nutrition awareness and education programs are therefore essential.

Jubayer et al. (2022) looked to determine the prevalence and associated factors of malnutrition among 256 children aged under five in St Martin's Island, Bangladesh. The prevalence of stunting, wasting, underweight, and overweight was 34.4%, 17.6%, 18.9%, and 6.9% respectively. The prevalence of undernutrition was higher among the poorer sections of the participants. An increase in child's age decreases their risk of being stunted. Males were more likely to be wasted than female. Household food insecurity and parental occupation affect all forms of malnutrition. The study concluded that there is high prevalence of malnutrition among the study population. To combat the malnutrition problem, cooperation between the government, non-governmental organizations, and the community is required.

Haghighi et al. (2022) investigated the prevalence and associated factors of malnutrition among 825 mother-child pairs in comprehensive Zahedan community urban health centers, The prevalence of stunting, underweight, and wasting was 20.6%, 7.6%, and 5.8%, respectively. Underweight was associated with a mother's education, low birth weight, birth interval, nutrition style, and age of introduction of complementary feeding. Stunting is predicted by sex, age, maternal age, father's education, family size, LBW, birth order, and nutrition style. The predictors for wasting are sex, age, mother's education, LBW and nutrition style. The study concluded that parent's educational status, low birth weight, birth order, birth interval, and nutritional practice are factors contributing to malnutrition among children.

Zhang et al. (2022) conducted a study to assess the prevalence and associated factors of malnutrition of 3431 children aged 6-24 months in Shaaxi Province, China. The prevalence of stunting was highest among 12 - 18 months, prevalence of

underweight (0.5%) and wasting (1.5%) were highest among 18-24 months, and prevalence of overweight (9%) was highest among 6-12 months. Malnutrition was significantly associated with mothers with parity >3. Children with higher educated father, correct supplementary food time and separate supplementary food preparation were significantly associated with lower risk of malnutrition. The present study concluded that while childhood obesity is becoming a bigger issue, China's impoverished regions still need to address stunting. It is important to provide parents of children who are at high risk of malnutrition with information on proper feeding practices.

Singh et al. (2023) examined the prevalence and associated risk factors of malnutrition in Maheshbathna, Bihar, among 300 children aged under 5 years. The prevalence of stunting, underweight, and wasting was 45%, 32%, and 22% respectively. The study result shows that malnutrition was significantly associated with maternal education, family income, and limited access to clean water, inadequate sanitation facilities, and suboptimal feeding practices. Malnutrition was more common in children whose mothers had less education (40.7%). The present study finding shows the disturbing prevalence of child malnutrition in Maheshbathna, Bihar and identifies the associated risk factors of malnutrition. Countering child malnutrition in the region requires interventions that focus on enhancing maternal education, decreasing poverty, guaranteeing access to clean water, and encouraging optimum feeding practices.

- **Risk factor of under nutrition at the child level**

Shukla et al. (2018) undertook a study of malnutrition and associated risk factors among 517 children of age 6-59 months in a rural area of Jabalpur district, Madhya Pradesh. The prevalence of stunting, underweight, and wasting was found to be 41.4%, 35.8% and 19.7% respectively whereas the prevalence of overweight and obesity was 5.6% and 2.7% respectively. The study found that malnutrition was associated with low birth weight, having a higher birth order, a larger number of siblings, incomplete immunization, and inappropriate feeding practices. The study concluded that malnutrition is still a major health problem and the present study

exhibit the multiple risk factors requiring multisectoral approach to fight this problem.

Kumar (2018) investigated the nutritional status among 400 children of 1-5 years of age in the urban area of Rohtak district. The prevalence of stunting, wasting, and underweight was 33.8%, 21.5%, and 34.5%, respectively. There was a significant association between undernutrition and illiteracy among mothers and children belonging to the schedule caste category, and children of lower socioeconomic classes. The study concluded that the prevalence of undernutrition is very high among under five children of Rohtak city. Effort should be made to eradicate the undernutrition in children through multisectoral approach.

Saimin et al. (2019) conducted a study to assess the prevalence of malnutrition among 64 children of low birth weight among children under five years old in coastal areas. The study result shows that the prevalence of malnutrition was more common among the age group of 12-36 months, and the risk of malnutrition in childhood was five times higher in infants with LBW. The study concluded that to improve the state of public health, understanding about low birth weight and malnutrition is necessary.

Palupi et al. (2019) carried out a study on the relationship between feeding practice and nutritional status of children among 185 children aged 7-59 months in Slement District, Yogyakarta. The prevalence of stunting, underweight, and wasting was 39.5%, 12.5%, and 5.4%, respectively. Most subjects had good feeding practices in terms of breastfeeding 95.7%, complementary feeding 70.8%, and feeding frequency at least twice daily; the majority of subjects had good feeding practices. However, half of the subjects 54.1% had started complementary feeding before the age of six months, which indicates an early end to exclusive breastfeeding. The study concluded that feeding practices did not have an association with the nutritional status of the children.

Ntenda (2019) conducted a cross-sectional study from the Malawi Demographic and Health Survey 2015-16 to find out the relationship of low birth weight with undernutrition in 4047 preschool-aged children in Malawi. The

prevalence of stunting is 39%, underweight (11.2%), and wasting 10%. In contrast to children of normal birth weight, children of low birth weight had a significantly higher risk of being stunted, underweight, and wasted. The study concluded that the prevalence of undernutrition remains high in Malawi. There was a clear correlation between low birth weight newborns and a higher risk of undernutrition. Preschoolers' growth and development should be improved from the very beginning in utero to prevent intrauterine growth retardation, which lowers birth weight.

Ghosh and Varerkar (2019) executed a survey among the 375 tribal households with children aged 1-6 years in Palghar district, Maharastra. The prevalence of stunting, wasting, and underweight was 59%, 20%, and 53%, respectively. With the late introduction of complementary foods (at 10 months or more), children from large families have a greater chance of having any form of undernutrition. The present study confirms that the degree of undernutrition in tribal rural areas of Palghar district, Maharashtra, has remained incredibly high despite multiple nutrition programs. This could be because the ICDS budgetary allocation has decreased in recent years. It is also essential to improve the socioeconomic conditions of the tribal population, and the methods for feeding and caring for children need to be improved. In order to solve this, mothers should be educated on infant care and feeding procedures as soon as they get pregnant.

Sari et al. (2020) did a study to find out the association between low birth weight and underweight among 114 children between the ages of 6 and 59 months in the Seberang Ulu subdistrict of Palembang, Indonesia. Low-birth-weight children have a higher risk of being underweight. The study identified that a mother's handwashing practice, the availability of latrine, and household monthly income had an influence on the underweight of the children. It was concluded that low birth weight increases the likelihood that a child will be underweight during the first five years of their life. Additionally, a mother's personal cleanliness might possibly be improved in order to prevent it.

Tiwari et al. (2020) conducted a study to find out the association between planning of birth and childhood undernutrition by analyzing data from the Nepal Demographic and Health Survey 2016. The study result shows that higher prevalence

of stunting and underweight were seen among children of birth order > 3 and interval of < 2 years between birth and subsequent birth. It was also found that there was a significant association of prevalence of undernutrition with mother's age at marriage, parent's education, underweight mother, children's age, and place of residence. The study concluded that planning of birth has a significant association with childhood undernutrition, and delaying childbearing until 12 to 24 months after marriage lowers the likelihood of childhood stunting. The government must encourage delayed childbearing after marriage, improve household economic standing, and increase mass media coverage and use in order to reduce childhood undernutrition.

Yaseen et al. (2020) conducted a cross-sectional study among 339 children of 0-5 years to assess nutritional status in relation to their birth space in Shirqat City. The study result shows that children with a birth interval of fewer than 24 months had the highest frequency of stunting (14.5%) and wasting (6.8%) compared to those with a birth interval of 24-59 months. The study concluded that there is a significant link between birth spacing and child nutritional status. To improve birth spacing and promote postpartum birth control use, birth spacing education programs centered on communities and health facilities are necessary.

Chungkhama et al. (2020) did a study to identify the relationship between birth interval and childhood undernutrition by analyzing data from four rounds of the National Family Health Survey. 699686 women in the eligible age group were given interviews. The study result shows that among children born with a birth interval of less than 24 months, there is a 28% increase in stunting and a 26% increase in underweight. Males are more malnourished than females, and malnutrition is higher in the birth order of 2-3 and less than 24 months birth interval. The study concluded that even when biological, behavioral, and social factors are taken into consideration, children born with short birth intervals are more likely to suffer from stunting and underweight.

Banerjee et al. (2021) conducted a study to investigate the nutritional and immunization status of under five children of India and Bangladesh by using National family Health survey data 2015-2016 India and Bangladesh Demographic Health Survey data, 2017-2018. The study result shows that prevalence of stunting

and underweight of under-five children in India are more than Bangladesh children and the immunization status is better in Bangladesh. Mother's educational status and wealth index have an influence on immunization status in both countries. The study concluded that there are significant number of children has under nutrition in both the countries, the nutritional and immunization status of Bangladeshi children is better than Indian children.

Aboagye et al. (2022) conducted a study to identify the association between birth weight and nutritional status of 110,497 children under five in sub-Saharan Africa by analyzing data from the Demographic and Health Survey Report of 2010 to 2019. The study result shows that low birth weight children were more likely to be stunted, underweight, and wasted. The study identified that low birth weight is an important factor that can influence undernutrition among children under five in sub-Saharan Africa. Policymakers in sub-Saharan Africa must focus especially on enhancing the nutritional status of children under five.

Samuel et al. (2022) conducted a cross-sectional study to investigate gender differences in nutritional status and determinants among 2036 infants (6-11 months) in two regions in Ethiopia. The prevalence of stunting and wasting is significantly higher among boys compared to girls. Inadequate breastfeeding practice and low maternal education are factors influencing stunting in boys. Inappropriate introduction to complementary food and low consumption of legumes and nuts are significant factors of stunting in both the sexes. The study concluded that boys are more malnourished; stunting in both boys and girls is mostly determined by exclusive breastfeeding and an adequate variety of complementary foods, but there is no clear gender interaction for the main determinants of stunting and wasting.

Ntambara et al. (2023) conducted a meta-analysis to identify the relationship between different birth interval groups and child nutrition outcomes by analyzing forty-six studies of 898.860 children. The result shows that a birth interval of 24 months was associated with decreased risk of stunting and wasting in contrast to a birth interval of <24 months. The study concludes that a longer birth interval (24 months) is linked to a considerably lower incidence of undernutrition in children, and a 36-48 month optimal birth interval may be suitable to lower the prevalence of

children with poor nutritional outcomes. Government policymakers and development partners in mother and child health initiatives, particularly those working in family planning and childhood nutrition programs, might find this material helpful.

Khan et al. (2024) conducted a study to identify the effects of short birth intervals on child malnutrition in the Asia-Pacific region by studying evidence from a systematic review and meta-analysis. 48 research studies were included in the study. The research study result shows that the prevalence of malnutrition was slightly higher among children in short birth intervals, and there were significant effects of short birth intervals on child malnutrition status among studies from the national level and studies with large sample sizes. In order to lessen this burden and eventually lower child malnutrition, it is essential to implement efficient policies and initiatives.

- **Risk factor of under nutrition at the maternal level**

Iftikhar et al. (2017) conducted a case control study at the OPD of Children Hospital Lahore among 340 children aged six months to five years to identify the impact of maternal education, employment, and family size on the nutritional status of children. The study results show that the nutritional status of children was significantly correlated with maternal education, whereas children's nutritional status is not significantly correlated with the mother's employment position or the size of the family. The study concluded that it is very essential to launch sustainable programs to boost women's educational status to solve the increasing burden of malnutrition.

Ali et al. (2017) investigated the effect of maternal and child factors among preschool children in Northern Ghana among 425 mother-child pairs. The study result shows increased stunting among male children, maternal height between 155 and 159 cm, and an age group of 12-23 months. The prevalence of wasting was high among male children, consumption of less than four food groups, and children of underweight mothers. Wasting was higher among male children and those with low birth weight. The present study concluded that factors affecting wasting and stunting are not always the same thing, and consumption of dietary groups such as eggs,

legumes, basics, and animal-source foods was linked to a higher chance of a higher weight but a shorter height in infants.

Sinha et al. (2017) conducted a cross-sectional study to investigate the different maternal factors influencing the nutritional status of 381 underfive children of urban slums in Dehradun. The study result shows that prevalence of malnutrition was increased among mother's ages less than 18 years. The prevalence of undernutrition was associated with maternal age, literacy, maternal nutritional intake, and anemia during the antenatal period. Mothers with higher levels of education are more conscious of the health resources that are accessible to them, and they also feel more comfortable using them. By teaching mothers how to take care of their children and by offering meals that match their diet, strengthening Anganwadis and Balwadis can usher in a new era of healthy childhood and improve the nutritional status of the children.

Wemakor et al. (2018) conducted a case control study to compare the nutritional status of children under 5 years of teenage and adult mothers in Tamale Metropolis, Ghana, among 300 mother-child pairs. The study result shows that children of teenage mothers were 8 times more likely to be stunted, 3 times more likely to be wasted, and 13 times more likely to be underweight. The study concluded that younger mothers experience higher rates of malnutrition in their children. To avoid undernutrition, nutrition counseling and nutrition programs for teenage mothers and their children are necessary.

Toma et al. (2018) attempt to study the association between antenatal care service and child malnutrition in Bangladesh by analyzing the data from the Bangladesh Demographic and Health Survey (BDHS) 2014 among 6.965 married women who were 15 to 49 years of age. The risk of malnutrition status was lower in mothers who got prenatal care from qualified prenatal care providers. The study concludes that an antenatal care visit is significantly linked with child malnutrition.

Shyam et al. (2020) conducted a cross-sectional study using data from India's National Family Health Survey (2005-2006) to investigate the association between antenatal care attendance and child undernutrition in Madhya Pradesh, India. The

study result shows that antenatal care was not associated with the body weight status of the infant. Increased child age and belonging to a schedule tribe, schedule caste, or other backward caste increased the risk of child undernutrition. Children who have a normal weight at birth have a lower risk of being underweight. Mothers who had a normal BMI or were overweight were less likely to have underweight children. The study concluded that attendance at prenatal care did not correlate with body weight status. The likelihood of a child being undernourished is linked with increasing age, low birth weight, inadequate nourishment from the mother, and among SC, ST, and OBC groups.

Nisar et al. (2020) attempt a study to assess the effect of WHO-recommended antenatal iron and folic acid supplements on smaller than average birth size and stunting in 96,512 South Asian children less than 2 years old by analyzing data from nationally representative surveys between 2005 and 2016. According to the study, taking enough iron and folic acid supplements during pregnancy lowered the chance of stunting by 8%, severely stunting by 9%, and smaller-than-average birth size by 14%. Length at birth was higher in children whose mothers had recommended IFA supplements. Use of IFA in the first 4 months and receiving 120 or more supplements during pregnancy was associated with a significantly reduced risk of stunting. The study concluded that the early and sustained use of antenatal IFA is associated with better child growth among the study population.

Das et al. (2020) studied the nutritional status of 225 Rabha tribal children of Udalguri District of Assam, India. The study results show that 93 (41.33%) were stunted, 62 (27.56%) were wasted, and 68 (30.22%) were underweight. The prevalence was found to be higher in girls. There was an inverse relationship between the education of the mothers and the nutritional status of the children. The study concluded that to improve their children's nutritional status, parents must receive education.

Saha et al. (2022) undertook a study to assess the nutritional status of 1301 children under two years of age in Devbhumi Dwarka District of Gujarat, India. The prevalence of stunting, underweight, wasting, and overweight was 32%, 17%, 14%, and 20%, respectively. There was a significant association of undernutrition with

parity and spacing of children. The study concluded that the findings of the present study are lower than the state and national prevalence of malnutrition. An interdisciplinary and convergent strategy is required to address the threat of undernourishment in children.

Wells et al. (2022) conducted a study to explore the contributions of age at marriage and age at pregnancy and its association with infant undernutrition in children among 3002 first-time mothers of low-land rural Nepal. A decrease in body length was likely to occur in neonates born to mothers under the age of 18. Lower head circumference and an underweight newborn were common in mothers who were pregnant while less than 19 years old. Neonatal stunting was likely to occur in early pregnancies between the ages of 10 and 13. The study concluded that poorer growth was found to be connected with early marriage and pregnancy.

Traore et al. (2023) investigate the relationship between iron supplementation and/or deworming and stunting, anemia, and low birth weight in infants under two years of age in sub-Saharan Africa by examining data from Demographic and Health Surveys between 2014 and 2020. The study result shows that deworming during pregnancy was linked to a significantly lower incidence of stunting, low birth weight, and childhood anemia, while iron supplementation during pregnancy was linked to a considerable reduction in childhood anemia. The study concluded that prenatal deworming improves the outcome of the infant and antenatal iron supplementation was useful to improve childhood anemia.

Prasetyol et al. (2023) conducted a systematic review to investigate the effect of mothers's nutritional education and knowledge on children's nutritional status**.** The study result shows that nutrition education impacted knowledge, attitudes, and skills of the mothers (p<0.001). There was improvement in birth weight seen among mothers who were given nutrition education. The study concluded that nutritional education had an influence on maternal knowledge and children's nutritional status.

Razaeizadeh (2024) conducted a systematic review and meta-analysis to identify the influence of maternal education levels on child growth from birth to two years old. Data from Pubmed, Scopus, EMBASE, Web of Science, ERIC, and

Google Scholar from January 1990–2024 were used. The study concluded population-based cohort studies of healthy children aged under two years and their mothers. The study result shows that among middle-income countries, children's weight is positively correlated with maternal education. The study result also shows that among the low-educated population, high maternal education is associated with increased weight and height in the children. In a high-income and highly educated population, there is no association of maternal education with the nutritional status of the children. The study concluded that maternal education's association varies based on country income and education levels.

Khaliq et al. (2024) investigate the relationship between maternal stature and malnutrition from the Demographic & Health Surveys data (2012-2013 & 2017-2018) of Pakistan among 6194 mother-child pairs. The study result shows that three out of four households had a malnourished mother, child, or both. The study identified that short maternal stature increased the risk of undernutrition by two-folds, but there was no significant association with wasting, overweight, or obesity. There is a need to further identify the relationship between maternal health and infant feeding and child undernutrition, along with coexisting forms of undernutrition.

- **Risk factor of under nutrition at the household level**

Mokalla and Mendu (2019) did a study to identify the risk factors and socioeconomic inequalities among 209,377 children aged 0-59 months by using data from the National Family Health Survey (NFHS-4). The findings of the study indicate a substantial relationship between the nutritional status of the kid and the mother's nutritional status as well as the caste type, wealth index, birth order, and size of the child at birth. In lower-income households, the factors are noticeably higher. The study concluded that more specific nutrition programs are necessary to improve the nutritional status of India.

Ahmad et al. (2020) investigated a study to find out the effect of socioeconomic factors on malnutrition among 2497 under-5 year old children in Multan district of Punjab province, Pakistan, by analyzing information obtained from the Multiple Integrated Cluster Survey 2018. The study result shows that wasting

was the most common form of undernutrition (28.53%), which was followed by underweight (19.54%) and stunting (18.58%). The prevalence of all forms of undernutrition was higher among male children and in rural areas of the study district. Stunting was significantly associated with children of some month, family size and maternal education, wealth quintile, and sanitation facility. Wasting status was correlated with children of urban areas and food shortages. Underweight status was closely related to incomplete immunization and treated water access. The study concluded that a higher level of malnutrition was linked to lower socioeconomic status among the study population.

George and Murthy (2021) carried out a study in Anganwadi Centers in Urban Mysuru among 365 children in the age group of 3-6 years. The prevalence of underweight, stunting, and wasting was 25.4%, 23.5%, and 10.2% respectively. 0.3% of the children were severely malnourished. The study found that undernutrition is largely caused by low socioeconomic status and a lack of knowledge about affordable nutritious foods.

Shahid et al. (2022) conducted a study to assess the nutritional status of preschool children and its relationship with household deprivation status among 384 households in Punjab, Pakistan. According to the study's findings, the most disadvantaged areas of the population- highly deprivation districts 1 and 2have the highest rates of malnutrition and the worst conditions. According to the study's findings, socioeconomic hardship and the prevalence of malnutrition are associated. The study concluded that malnutrition is a result of deprivation in marginalized districts, which might be eliminated with fair opportunities for human development and more funding for disadvantaged populations.

Chen (2023) conducted a study to identify the association between parental education and malnutrition (overnutrition or undernutrition) at the household level among 423340 mother-and-child pairs and 56720 father-child pairs from low and middle-income countries by analyzing International Development Demographic and Health Surveys from January 2020-December 2021. The study observed that 49% experienced both undernutrition and overnutrition in the household. Higher maternal malnutrition was associated with a lower risk of both mothers and children being

undernourished but a higher risk of overnutrition. 26.5% of the father-child pairs had a double burden of malnutrition; those with higher paternal education are more likely to have paternal overnutrition and children undernutrition. The study concluded that maternal and paternal education have associations with the nutritional status of the children.

- **Risk factor of over nutrition**

Similar to undernutrition, there are diverse identified risk factors associated with overnutrition. Factors that have been shown to be associated with overweight and obesity in children under five are the socioeconomic status, occupation of the mother, and maternal overweight.

Jones et al. (2017) investigate data of WHO European Region Member States on overweight and obesity in children under 5 years from 1998 to 2015 among 35 member states. The study findings show that the prevalence of overweight and obesity in the study population is from 1 to 28.6%. Although it is widely acknowledged that monitoring children's growth is important, most WHO European Member States lack regular and representative measures of the prevalence of overweight and obesity. Understanding the development of childhood obesity can also be enhanced by more extensive and methodical direct assessment of kid growth and weight trajectories at younger ages.

Ra and Yun (2020) conducted a descriptive cross-sectional study among 507 mothers with their children aged 3-5 years to identify the associated risk factors of overweight and obesity in daycare centers in South Korea. Among the study population, 11.4% were overweight and 8.1% were obese. There was a significant association between overweight and obesity, the introduction of solid foods before 4 months of age, and a nonresponsive feeding style. The study concluded the need for a parenting education program regarding the timely introduction of solid food and awareness of hunger and fullness cues in infants.

Soliman et al. (2021) investigate the environmental and socioeconomic factors that appeared to influence the environmental and socioeconomic factors by examining literature from Pubmed, Google Scholar, and Cochrane Library for the

past 20 years. The study result shows that factors influencing obesity in young children are overfeeding of preterm and small for gestational age using artificial milk and early introduction of complementary feeding. The study also identified that childhood obesity appears to be initiated and progressed by a number of factors, including education, income, urbanization, food environments, increased energy intake from eating fatty foods and a high-sugar diet, and parental feeding practices to their children. Important risk factors among poor populations include limited access to physical activity, inadequate health care, and a lack of health education for parents and children. It is crucial to comprehend the contributing elements in order to manage and prevent early childhood obesity in an effective and timely manner.

Gebremichael et al. (2022) conducted a community-based cross-sectional study to identify the prevalence and associated risk factors among 5164 under-5 children in Ethiopia by analyzing data from the Ethiopia Mini Demographic and Health Survey 2019. The study result shows that prevalence of overweight/obesity was low; it was seen more in the children aged 6-24 months who were delivered by caesarian section, maternal age of 40-49 years, using traditional contraceptive methods, and households headed by males. The study concluded that the prevalence of overweight/obesity among children below five years was low in Ethiopia. The study came to the conclusion that a number of factors, including child age, mother age, delivery mode, head of household sex, usage of contraception, and home location, influence childhood overweight and obesity. Therefore, a wide range of known contributing factors should be taken into account in attempts to lower pediatric obesity and overweight.

Saha et al. (2022) conducted a study to investigate the prevalence and associated risk factors of overweight/obesity among 176,255 children aged 0-59 months using data from the National Family Health Survey-4. The study identified that the prevalence of overweight or obesity was 2.6%. Male children, aged 0-11 months, which belong to a schedule tribe family, whose mothers married after 18 years of age and who consumed 7-9 food items were at higher risk of being overweight and obese. According to the study, there is a higher chance of being overweight or obese in male children between the ages of 0 and 11 months who have

a low birth rank, children whose mothers married after the age of 18, children who are members of a scheduled tribe family, and children who consume 7-9 food items. Adequate health initiatives, clinical monitoring, and education regarding sedentary habits might mitigate the dangers associated with childhood overweight and obesity.

Choi et al. (2022) conducted a study to identify the risk factors of obesity among 26,047 five-year-old children using a database of the Korean National Health Insurance Service. The study identified females who have a birth weight of more than 4 kg, whose mothers are obese, and who were from middle-level income as associated high-risk factors for obesity among children aged 3-5 years. A strong appetite, a lot of milk, a lot of sweets when the child was three years old, eating quickly, eating irregularly, and not exercising were all seen as important risk factors. The study concluded that modifiable behavior factors and other obesity risk factors identified in this study could be used to target high-risk children.

There is some research gaps found from the review of literature. There have been very few studies on malnutrition of under five children, and very few topics were taken up in research to study the associated factors of malnutrition in Mizoram. Although several recent studies have studied the problem of malnutrition under five children in the world and different parts of India, there is scanty information regarding malnutrition among children of Mizoram. Most of the research studies focus mainly on undernutrition, but the prevalence of obesity is increasing in recent years, which requires an important health concern.

CHAPTER III

Research Methodology

This chapter deals with the methodology adopted for prevalence and associated risk factors of malnutrition among under five-year-old children. It includes the research approach, research design, variables under study, the setting, population, the sample and sampling technique, development and description of tools, data collection procedure, description of the treatment, pilot study, and plan for data analysis for the present study.

The present study is a cross sectional study carried out to identify the prevalence and associated risk factors of malnutrition among under five years of children in Mizoram.

Research Approach

To accomplish the objectives of the study, **quantitative approach** was considered the most effective.

Research Design

The research design selected for the present study was community based cross sectional design.

The setting: Profile of the Study Area

The present study was conducted in randomly selected one district (Aizawl district) of the eight districts of Mizoram (Aizawl, Lunglei, Champhai, Mamit, Kolasib, Siaha, Serchhip, Lawngtlai), which are located in the north-eastern part of India. Aizawl is the capital of Mizoram, located in the northern part of Mizoram at an altitude of 1132 meters above sea level, north of the Tropic of Cancer. To the west and east of the city are the Tuirial and Tlawng river valleys. 20 to 30 degrees Celsius are typical summer temperatures, whereas 11 to 21 degrees Celsius are typical winter temperatures. According to the statistical handbook of Mizoram 2018, Aizawl district has a population of 293,416, which constitutes 144,913 males and 148,503 females, and there are 523,57 children under 6 years of age (Census of India 2011). Data collection was done in the areas of Aizawl East Main Center and Aizawl North

Main Center, which are under the administration of the Chief Medical Officer of Aizawl East District with a population of 96290, among which 13,676 are children under 5 years of age (Fig. 2). The rationales for choosing the setting are:

- Aizawl district is the highest burden district of children in stunting, wasting and underweight
- Being acquainted with the environment
- The subjects' accessibility
- The feasibility of carrying out the research
- Expectation of cooperation for the study
- Accessible
- Administrative consent and expectation of cooperation from various personnel for the project

Fig. 2

Map showing location of Mizoram

Fig. 3

Study Location

Population

The present study population comprises of children and their mothers residing in Mizoram.

Target Population: Children between the age group of 6-59 months and their mothers residing in Mizoram

Accessible Population: The accessible population are children between the age group of 6-59 months and their mothers residing in Aizawl East Main Centre and Aizawl North Main Centre.

Sample and Sampling Technique

Sample: The sample consists of children 6-59 months of age and their mothers in a selected community of Mizoram, namely, Aizawl North Main Centre and Aizawl East Main Centre. 233 children under 5 years and their mothers were selected.

Sample Size: Sample size was determined by considering the following assumptions: estimated proportion (P) of underweight (13%), wasting (9.8%), and stunting (28.9%) taken from the previous National Family Health Survey-5 (2019-2020) report for Mizoram at 6% level of significance and an absolute precision of 4%, which was estimated using Cochran's formula:

$$N=4PQ/d^2$$

Where P= prevalence of previous studies (28.9%)

Q= 100-P (100-28.9= 71.1)

D=allowable error (6%)

Accordingly, the calculated sample size for prevalence of stunting was relatively largest (n=228) and 233 was taken as the sample size for this study.

Sample selection

The criteria for selection of sample subjects were

Inclusion criteria

- ✓ Children who are in the age group of 6 -59 months of age.
- ✓ Children who are enrolled in ICDS Centre.
- ✓ Children whose mothers are available during data collection.

Exclusion criteria

- ✓ Children with musculoskeletal conditions (such as bony deformities, spasticity, casts, or splints) limit standard nutritional measurements.

- ✓ Children with known debilitating illnesses that can affect growth, such as sickle cell anemia, chronic kidney disease, or congenital heart defect.

Sampling Technique: In the present study, children in the age group of 6-59 months and their mothers were considered for the study. A multistage cluster sampling technique has been used to select the required sample size. Aizawl District is broadly divided into Aizawl East and Aizawl West District. Aizawl East District is divided again into different eight divisions. The study was done in the divisions of Aizawl East Main Center and Aizawl North Main Center, which are under the administrative control of the Chief Medical Officer, Aizawl East District. The above mentioned two areas cover 47 local council areas; 9 local council areas were selected by random sampling. Each local council area is regarded as cluster. Samples are selected randomly by simple random sampling based on population proportionate to size sampling technique.

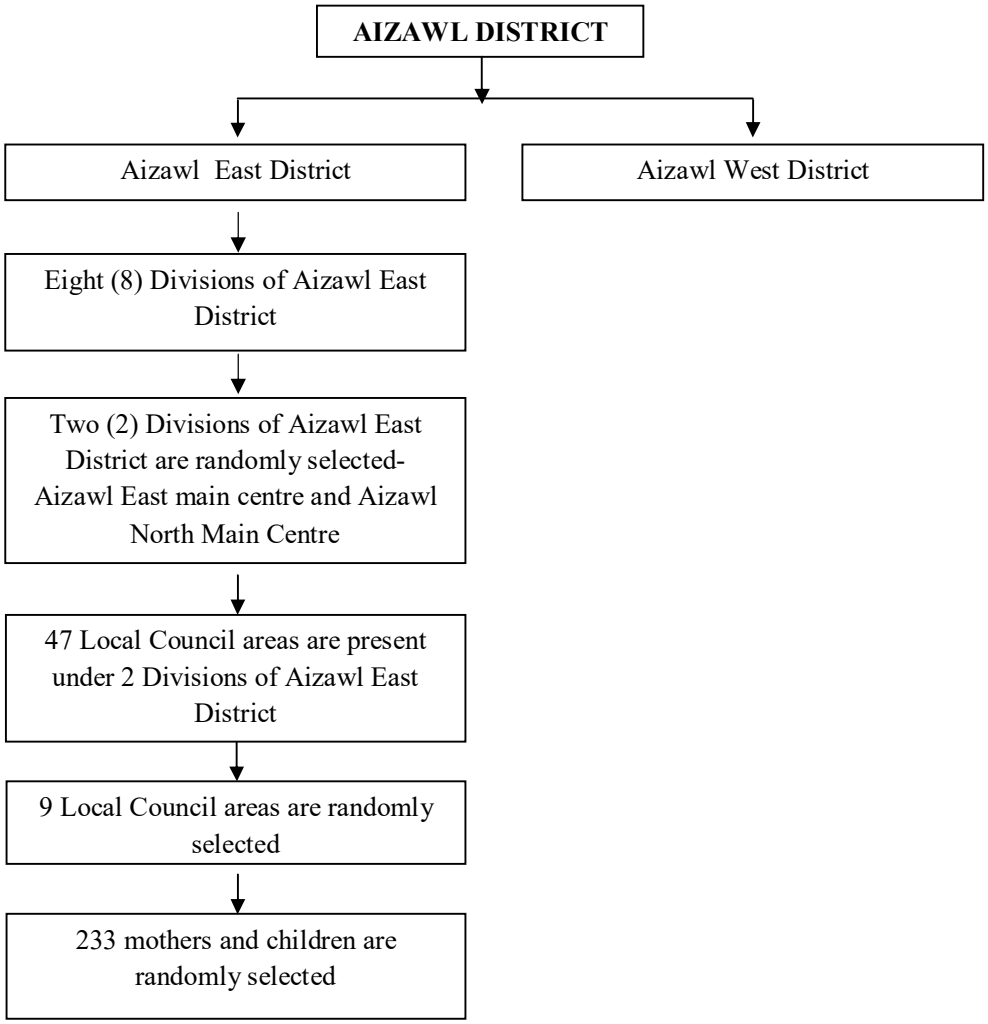


Fig 4: Sampling framework

Sampling frame are prepare from enrollment in the ICDS center. Selected samples are contacted ahead of the data collection. Representation from each cluster was determined using this equation:

$n_h = (Nh/N)x\ n$ where $n_h$is the sample size for stratum h, Nh is the population size for stratum h, N is the total population size and n is total sample size.

Table 5

Number of participants from different Local Council areas

Sl. No	Name of the Area	Total population of under 5children	Proportionate allocation of subjects	Study participants
1	Bethlehem Vengthlang	110	25	25
2	Tuithiang	65	15	15
3	Zemabawk	368	82	82
4	Zuangtui	26	6	6
5	Laipuitlang	65	15	15
6	Thuampui	70	16	16
7	Tuirial Airfield	58	13	13
8	Durtlangleitan	119	27	27
9	Ramhlun S	150	34	34
Total		**1031**	**233**	**233**

Data collection tools and Techniques

A structured interview schedule for the mother was developed in order to generate the demographic data, feeding practice and risk factors of malnutrition. The interview schedule was divided into three parts. The first part of the interview schedule is divided into four sections, where section A contains identification information and section B consists of ten questions regarding the profile of the child and family, which include age and sex of the child, child birth weight, status of immunization, mother's gender at birth and mother's education status, type of family, religion, number of family members, and meal frequency per day in the family. Section C contains information about the socioeconomic status of the family, which was assessed based on Kuppuswamy's Socio-economic Status Scale. Section-D of Part I consists of two parts: the first part consists of mother's practice regarding feeding, where five questions about feeding practice since birth till information about the child's discontinuation of breastfeeding was obtained; the second part of the section contains information about mother's hand hygiene practice.

Part II of the research contains information about the child's nutritional status by anthropometric measurement. Measurement of the child was taken to know

weight and height to know three anthropometric indices (weight-for-age, weight-for-height, and height-for-age). Body weight was measured using a calibrated electronic weighing scale - OMRON HN 289 in light clothing. The height of children between the ages of 24-59 months was measured using a portable Prestige stadiometer with no shoes, whereas for children 6-23 months old, recumbent length was measured with infantometre. Anthropometric measurement was compared with WHO and MGRS (multicentre growth reference standards). Children with height for age, weight for age, and weight for height below -2SD will be considered stunted, wasted, and underweight respectively. Weight-for-height greater than 2 and 3 standard deviations above the WHO Child Growth Standards median to be considered as overweight and obesity. Normal weight is the z-score of weight for height between −2 SD and +2 SD, and underweight is defined as the z-score of weight for height less than−2 SD.

Part III of the research tools contains information about risk factors for malnutrition. It consists of three parts: the first part has thirteen questions, which give information about probable risk factors of undernutrition at the child level; the second part has nine questions, which provide information about probable risk factors of undernutrition at the mother and household level; and the last part of Part III contains seven questions, which are about risk factors of overnutrition.

Content validity of the Tool

The interview schedule was given to five experts for establishing the content validity with the nature of content covered by the statement on malnutrition. Out of the five experts, two were pediatricians, two were from paediatric nursing and one expert is from community medicine. The theoretical and clinical expertise was considered in identifying the experts, who were requested to determine their opinion on the relevance and clarity of each of the interview schedule items. Suggestions given to modify the language of a few items were taken into consideration, and modifications were made according to their suggestions. The content validity was calculated based on the item content validity index, and it was found to be 1, therefore the items of the tools have reached the satisfaction level of content validity.

Pre testing of Interview Schedule

The pre-testing of the tool was done to check the clarity of items and to test the feasibility and practicability of the tool. The interview schedule was administered to 10 mothers of Chanmari Local Council area of Aizawl, Mizoram. The average time taken for the tool was 20 minutes. Items were clear and did not require any modifications.

Pilot study

After obtaining the formal administrative permission from the concerned authorities, a pilot study was conducted in the Chanmari local council area on 21st - 23rd Sept 2022. Children with their mothers who met the inclusion criteria were selected. Twenty three children and their mothers were selected randomly from the list of the ICDS Centre. Participants were contacted ahead for their consent to visiting their house. Information was responded by their mothers. Demographic variables and necessary information were assessed by the structured interview method. Anthropometric measurements of the child were taken, and mother height was taken. It takes about 20 minutes to complete for each participant.

Results of the pilot study

Majority of the participants 16(69.6%) were between the age group of 36-59 months. 13 (56.5%) participants were male and 10(43.5%) were female. Most of the participants 22(95.7%) have a birth weight between 2501-4000gm. All of the participants were born full term. Majority of the participants 22(95.7%) were fully immunized.

Among the mothers, 13 (56.5%) are between the ages of 19 and 34 years, and 10 (43.5%) are above the age of 35 years. Most of the mothers (95.7%) have a height above 145 cm. The majority of the participants, 69.6%, are from nuclear families, and 26.1 % are from joint families. Most of the participants (87%) are from lower socioeconomic conditions. 21 mothers (91.3%) have adequate iron supplementation during pregnancy. Most of the mothers, 95.7%, had antenatal visits four or more

times during pregnancy. 60.5% of the mothers have inadequate hand hygiene practices.

Regarding the feeding practices of the participants, 43.5% of the participants initiated breastfeeding within 1 hour, and 46.5% initiated it within 1-24 hours. Only 3 (13%) participants were given prelacteal feed. Exclusive breastfeeding was given to the majority, 87%, of the participants. Weaning was started at the recommended month by 82.7% of participants. The majority of the participants, 69.6%, continued breastfeeding for 2 years. 1 participant was found to have malnutrition (underweight) during the pilot study. Thus, the pilot study findings showed the practicability and feasibility of conducting the main study.

Learning Incorporated from Pilot Study

From the pilot study, it is learned that the average monthly income of the family was found not to have much significant information for the study because the socioeconomic condition was also assessed by the Kuppuswamy socioeconomic scale. Therefore, it was decided not to include it in the final study.

Data Collection Procedure

Formal administrative approval was obtained from Human ethical Committee, Mizoram University (MZU/HEC/2022/008) and Chief Medical Officer of Aizawl East 1 (No. A. 12031/1/2011/-CMO'E'). The main study was conducted from February 2023 to June 2023.After self-introduction and establishment of rapport, the purpose of the study was explained to the subjects, and confidentiality was assured. Consent was taken from the mother to take part in the study.

The investigator obtained required data from ICDS Centre, where a sampling frame was formulated based on the children enrolled in the centre. Data was collected by a structured interview schedule. Information about the subjects and their mothers was entered into the interview schedule by the investigator. The socioeconomic status of the family was determined based on Kupuswammy Socioeconomic Scale 2022.

The investigator measured and recorded the weight and length/height of the participants by using standard anthropometric measurement guidelines prepared by the Food and Nutrition Technical Assistance project in 2007. A standardized digital weighing scale (OMRON HN 289) in the nearest 0.1 kg was used to measure the weight. Subjects are instructed to stand without shoes. Children who were unable to stand were carried by their mother while measuring their weight. The weight of the mother was measured alone. The difference between the two measurements was taken as the weight of the child. Length was measured to the nearest 0.1 cm using an infantometer for children aged less than 24 months. This scale has a measuring range of 100 cm with a precision of 0.1 cm. Measurements of height were made to the closest0.1 cm using a Stadiometer (Prestige Height measuring scale) for children aged 24-59 months. Participants stand barefooted, head placed in the Frankfort plane, and their height was taken.

Ethical Consideration

Ethical approval was obtained from the Human Ethical Committee of Mizoram University(Appendix A_1). Approval was obtained from the Chief Medical Officer, Aizawl East 1 before commencement of the study (Appendix A_2). Written consent was taken from the mothers before data collection (Appendix C).

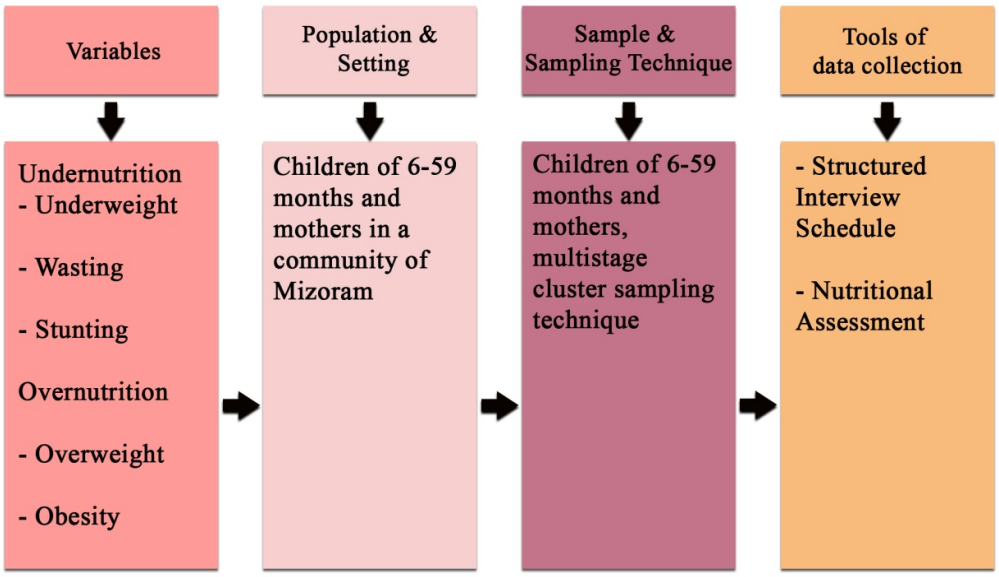
Data Analysis

Data analysis was done with Statistical Package for Social Sciences (SPSS) version 20.0 (Chicago II). Keeping in view the objectives of the study and nature of the data, the investigator employed the following statistical techniques for analyzing the data: Descriptive statistics such as frequency and percentage were employed for categorical variables such as age in child months, gender, birth weight, status of maturity at birth, immunization status, child's rank order, birth interval, history of diarrhoea, and history of cold and fever in the past 2 weeks to find out the nature of score distribution and for classifying the respondents into different categories. Frequency and percentage were also employed for maternal characteristics and feeding practices of the mothers. The z scores for the different nutritional indices like weight for age, height for age, and weight for height were calculated based on the

WHO Growth Standard. Inferential statistics such as Chi-square were used in the bivariate analysis to identify associations between nutritional status and the different factors. The Fisher Exact Test was used to test the significance wherever indicated. All variables with association ($p<0.05$) in the Chi Square were calculated by multiple logistic regression to identify the independent effect.

Fig. 5

Schematic Representation of Research Methodology



CHAPTER IV

Analysis and Interpretation

The analysis and interpretation of the data gathered to determine the prevalence and related risk factors of malnutrition are covered in this chapter.

The study's objectives and the hypotheses that were to be investigated served as the foundation for the data analysis and interpretation. There has been use of both descriptive and inferential statistics.

Study Objectives

The objectives of the present study are:

- To identify the prevalence of malnutrition among children.
- To find out association between prevalence of malnutrition(nutritional status) and child characteristics.
- To find out association between malnutrition (nutritional status) and maternal characteristics.
- To find out association between malnutrition(nutritional status) and feeding practices of the children
- To identify the risk factors of malnutrition among children.

Organization of Study Findings

The findings are presented and organized under the following headings

Section-1 Findings on sample characteristics, which deals with the description of child characteristics.

Section -2 Findings on sample characteristics, which deals with the description of mothers characteristics.

Section - 3 Findings on feeding practices for breastfed children.

Section - 4 Findings related to the prevalence of malnutrition of children.

Section-5 Findings on association between nutritional status and child characteristics.

Section-6 Findings on association between nutritional status and maternal and household characteristics.

Section - 7 Findings related to association between nutritional status and feeding practices for breastfed children.

Section - 8 Findings related to risk factors of malnutrition among children.

Section 1: Findings on Sample Characteristics (child)

This section describes the characteristics of the children in terms of selected variables. The sample (child) characteristics included in the study for the purpose of obtaining the descriptive background were age in months, gender, birth weight, status of maturity at birth, immunization status, child's rank order, birth interval, history of diarrhoea, history of cold and fever in the past 2 weeks.

Table 6

Frequency and percentage distribution of sample (child) characteristics

n=233

Sl. No	Variables		Frequency (f)	Percentage (%)
1	Age	6-11 months	31	13.3
		12-23 months	58	24.9
		24-35 months	47	20.2
		36-47 months	62	26.6
		48-59 months	35	15.0
2	Gender	Male	117	50.2
		Female	116	49.8
3	Birth weight(in gm)	<2500	12	5.2
		2501-4000	212	91.0
		>4001	9	3.9
4	Status of maturity at birth	Preterm	9	3.9
		Full-term	224	96.1
5	Immunization status	Full immunization	210	90.1
		Partial immunization	19	8.2
		No immunization	4	1.7
6	Child's birth order	First	99	42.5
		Second	77	33.0
		Third or more	57	24.5
7	Birth interval	Firstborn	99	42.5
		<24 months	26	11.2
		24-35 months	36	15.5
		36-47 months	21	9
		>47 months	51	21.9
8	History of diarrhoea in the past 2 weeks	Yes	12	5.2
		No	221	94.8
9	History of cold and fever in the past 2 weeks	Yes	19	8.2
		No	214	91.8

The data present in Table 6 shows that 233 children were participated. The maximum number of children among the participants are in the age group of 36-47 months (26.6%). 117 (50.2%) children are male, and 49.8% of the participants are female. 91% of the samples have birth weight within the normal range, 3.9% have birth weight more than the normal range, and 5.2% have a low birth weight. 96.1% of the samples were full-term, whereas only 3.9% were premature birth. Regarding

the immunization status of the children, most of the participants are fully immunized (90.1%), 19 (8.2%) children were partially immunized, and only 4 (1.7%) children were not given immunization due to poor knowledge of the mothers and family problems.

Section 2: **Findings on Sample Characteristics (mother)**

This section describes the characteristics of the mothers in terms of selected variables. The mother's characteristics included in the study for the purpose of obtaining the descriptive background were: maternal age at the time of birth of the child, maternal height, education status of the mother, type of family, numbers of family members, frequency of meals per day in the family, socioeconomic status, status of iron supplementation and antenatal visits during pregnancy, hand hygiene practice, and practice of breastfeeding.

Table 7

Frequency and percentage distribution of maternal characteristics

n=233

Sl. No	Variables		Frequency (f)	Percentage (%)
1	Maternal age at birth	≤18 years	7	3.0
		19-34 years	195	83.7
		≥35 years	31	13.3
2	Maternal height below 145cms	Yes	66	28.3
		No	167	71.7
3	Education of mother	No formal education	1	0.4
		Primary	10	4.3
		Middle	29	12.4
		Secondary	126	54.1
		Higher Secondary	29	12.4
		Graduate and above	38	16.3
4	Type of family	Nuclear	152	65.2
		Joint family	72	30.9
		Single parent family	9	3.9
5	Number of family members	<5	90	38.6
		≥5	143	61.4
6	Frequency of meals per day in the family	Twice	224	96.1
		Thrice	9	3.9
7	Socioeconomic status	Upper (I)	3	1.3
		Upper middle (II)	15	6.4
		Lower middle (III)	48	20.6
		Upper lower (IV)	163	70.0
		Lower (V)	4	1.7
8	Inadequate iron supplementation during pregnancy	Yes	47	20.2
		No	186	79.8
9	Number of antenatal visits	3 or less	15	6.4
		4 or more	218	93.6
10	Hand hygienic practice of mother	Adequate	137	58.8
		Inadequate	96	41.2
11	Breastfeeding done	Yes	228	97.8
		No	5	2.2

Maternal characteristics are presented in Table 7. Among the mothers, 83.7% of them were between the ages of 19 and 34 when their child was born. Out of all the mothers, 71.7% are taller than 145 cm, while 27.9% are shorter than 145 cm. The majority of the mothers had formal education; only 0.4% did not attend formal

education. Thirty-nine percent of mothers are from joint families, whereas the majority of mothers (65.2%) belong to nuclear families. 38.6% of mothers had less than five family members, whereas 61.4% of mothers have five or more. About 92.3% of mothers belonged to the lower socioeconomic class, while 7.7% belonged to the upper class. The majority of the mothers (79.8%) received adequate iron supplementation during pregnancy, whereas 20.2% did not receive adequate iron supplementation during pregnancy. 93.6% of the mothers have done sufficient antenatal checkups (4 times or more), whereas 6.4% have not done sufficient antenatal during pregnancy (3 or less than 3 times). 58.8% of the mothers maintain adequate hand hygiene practices. Five mothers were not able to breastfeed their children due to different reasons: the medical condition of the mother which hampers lactation, and the health problem of the baby, which makes it impossible to suck breast milk.

Section 3: Findings on feeding practices for breastfed children

This section describes the analysis, description, and interpretation of data collected to identify feeding practices among breastfed children. The frequency and percentage of feeding practice were computed and presented in Table 8.

Table 8

Distribution of feeding practices for breastfed children

n=228

Sl. No	Variables		Frequency (f)	Percentage (%)
1	Initiation of breastfeeding after birth	Within 1 hour	183	80.3
		1-24 hours	35	15.0
		After 24 hours	10	4.3
2	Pre-lacteal feed given	Yes	44	19.3
		No	184	80.7
3	Type of pre-lacteal feeding (n=44)	Formula	43	97.7
		Boiled cool water	1	3.3
4	Exclusive breastfeeding done for 6 months	Yes	173	75.9
		No	55	24.1
5	Age at the start of weaning	<6 months	44	19.3
		6 months	173	75.9
		7-12 months	11	4.8
6	Continued breastfeeding after weaning	1 year	11	4.8
		1 to ≤2 years	44	19.3
		2 years	45	19.7
		>2years	23	10.1
		Still breastfed	105	46.1
7	Duration of breastfeeding among 24- 59 months (n=143)	< 2 years	47	32.9
		2 or> 2 years	96	67.1
8	Bottle fed	Yes	22	9.4
		No	211	90.6

Data in Table 8 shows that among 233 participants, 228 (97.85%) were able to breastfeed their children, and 5 (2.15%) were unable to feed with breast milk since birth. 80.3% of the mothers were able to initiate breastfeeding within an hour of birth. 19.3% of the mothers have given prelacteal feed to their children, and the most common prelacteal feed was formula feed. 75.9% had breastfed exclusively for 6 months, but 24.1% were not able to practice exclusive breastfeeding. The majority of the children, 173 (75.9%), started weaning at the recommended month; 18.9% of children were provided weaning before 6 months of age, and 4.8% of mothers started between the ages of 7 and 12 months. The mean age of starting weaning was 5.8 months. On examining the duration of breastfeeding among children of 24-59 months, 32.9 % discontinues breastfeeding before reaching 2 years of age, 67.1% continued breastfeeding for 2 years or more.

Section 4: Findings on prevalence of malnutrition of the children

This section describes the analysis, description, and interpretation of the data collected to know the nutritional status of the children. The frequency and percentage of different indicators of nutritional status were computed and presented in Table 9.

Table 9

Nutritional status of participants

n=233

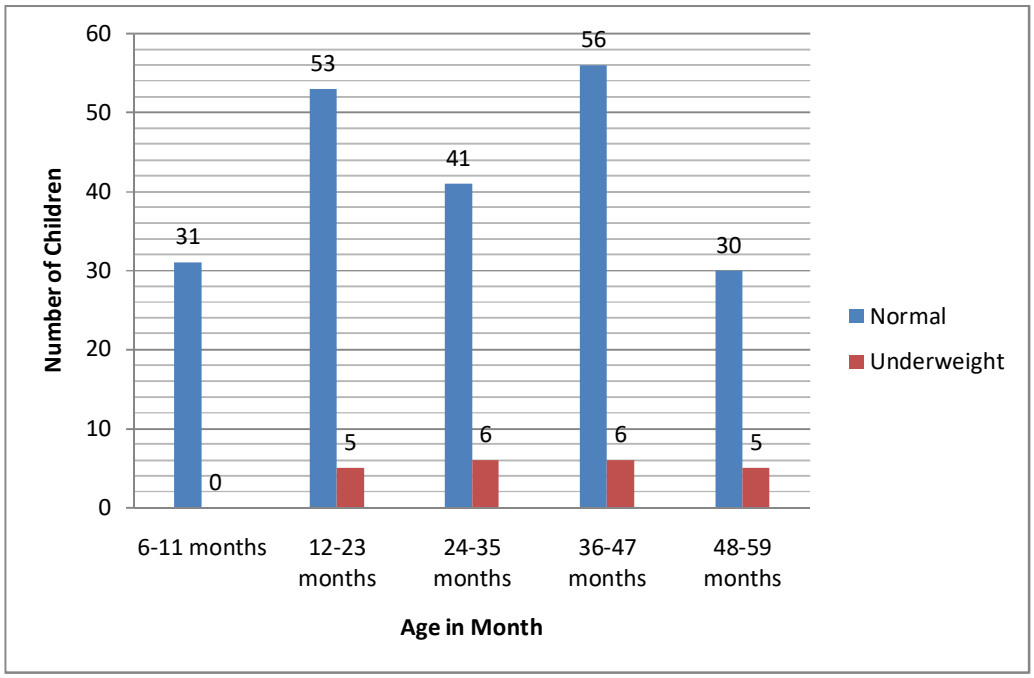
Sl. No	Nutritional Status		Frequency (f)	Percentage (%)	95% CI
1	Weight for age	Underweight	22	9.4	6.0-13.9
		Normal	201	86.3	81.2-90.4
		Overweight	10	4.3	2.1-7.8
2	Height for age	Normal	204	87.6	82.6-91.5
		Stunting	29	12.4	8.5-17.4
3	Weight for height	Wasting	10	4.3	2.1-7.8
		Normal	207	88.8	84.1-92.6
		Overweight	16	6.9	4.0-10.9

Data presented in Table 9 shows the prevalence of underweight, stunting, and wasting; overweight were 9.4%, 12.4%, 4.3%, and 6.9% respectively; stunting is the most common form of malnutrition.

Fig.6.1

Distribution of underweight among study participants

n=22

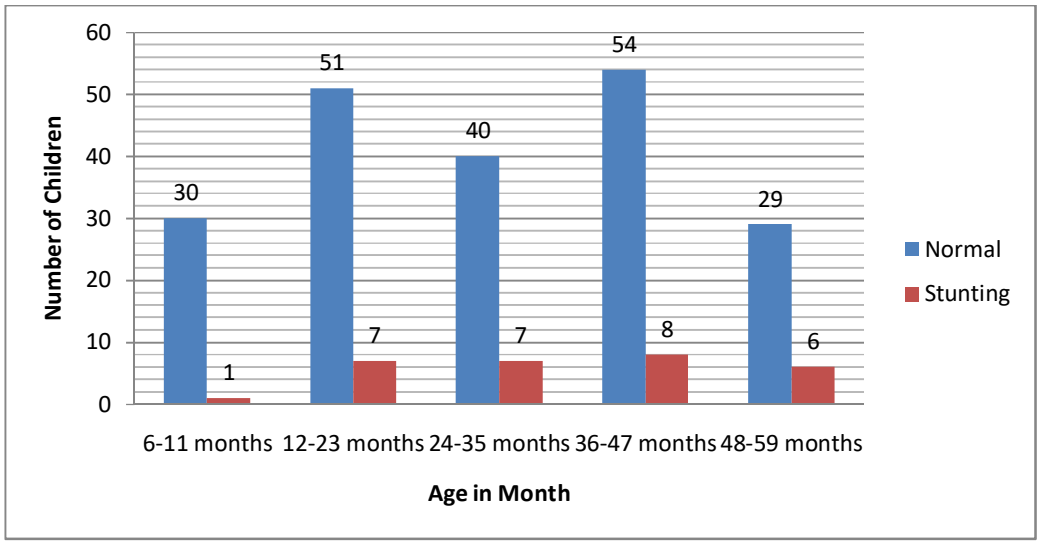


Data in Fig. 6.1 shows that the prevalence of underweight was 22 (9.4%). The prevalence of underweight is greatest among the age groups of 24-35 months and 36-47 months of age (27.3% each). There were no underweight children between the age groups of 6 and 11 months.

Fig. 6.2

Distribution of stunting among children aged 6-59 months

n=29

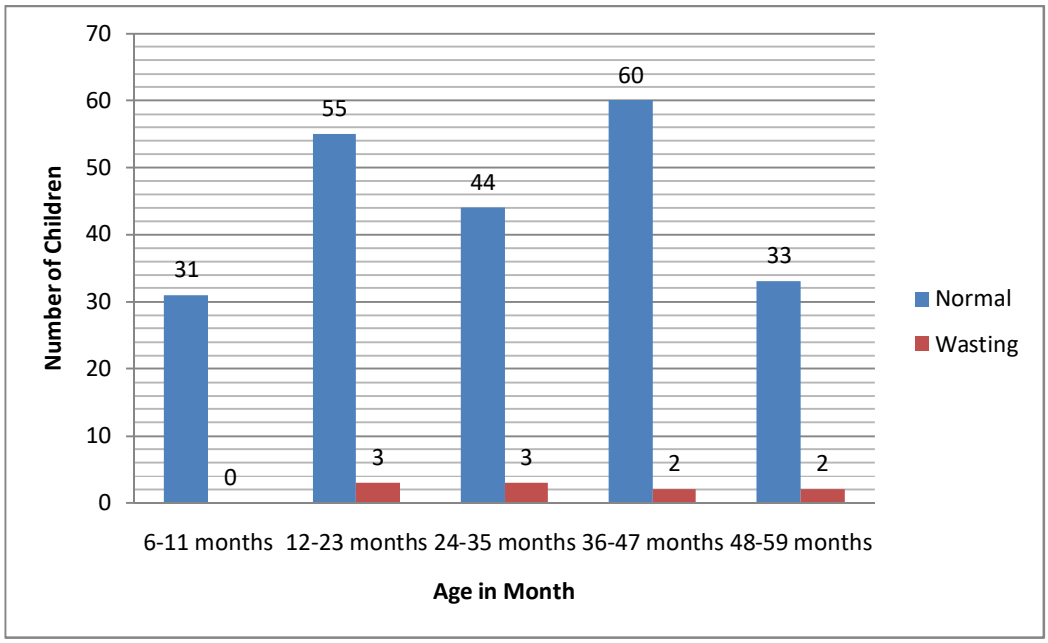


Data in Fig. 6.2 shows that the prevalence of stunting was found to be 29 (12.4%). The prevalence of stunting was higher (72.4%) between the age group of 24-59 months, where it was found only 1 child (3.44%) among the age group of 6-11 months.

Fig. 6.3

Distribution of wasting among study participants

n=10

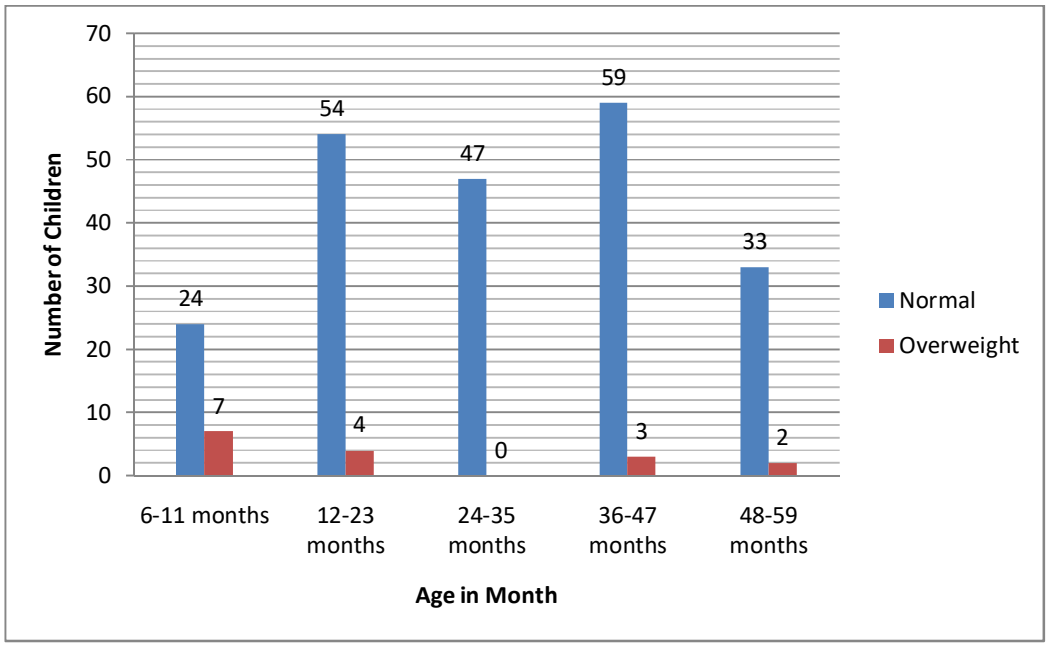


Data in Fig. 6.3 shows that the prevalence of wasting was 10 (4.3%). The prevalence of wasting is greatest among the age groups of 12-23 months and 24-35 months of age (30 % each). There were no wasted children between the age groups of 6 and 11 months.

Fig. 6.4

Distribution of overweight among study participants

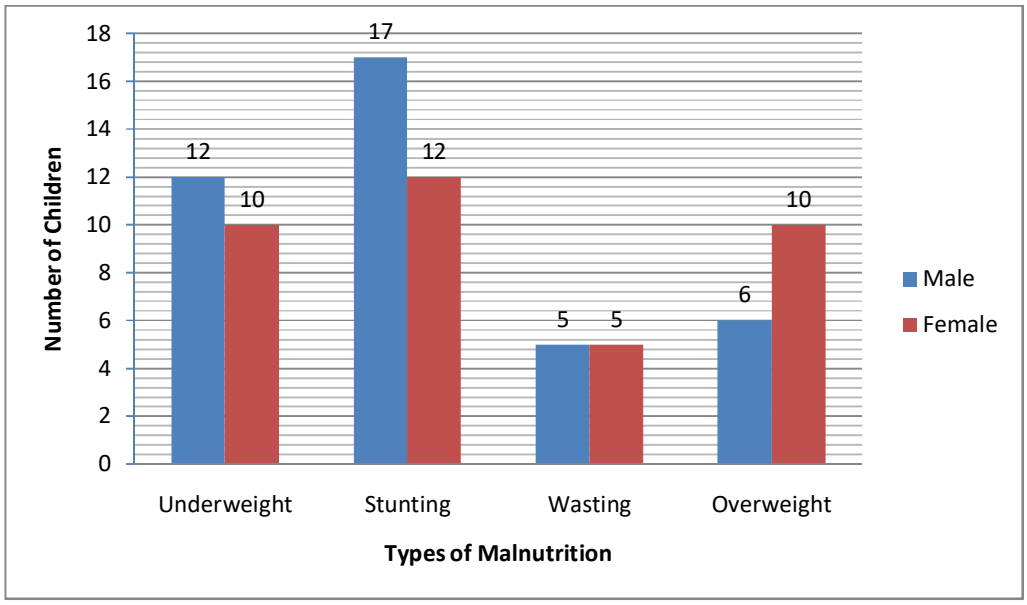
n=16



Data in Fig. 6.4 shows that the prevalence of overweight was 16 (6.9%). The prevalence of overweight is greatest among the age group of 6–11 months (43.8%). There were no overweight children in the age group of 24-35 months.

Fig. 6.5

Comparison of malnutrition among study participants by Gender



Data in Fig. 6.5 shows the distribution of malnutrition according to gender. Among underweight children, 12 (54.5%) are male and 10 (45.5%) are female, whereas among stunted children, 17 (58.6%) are male and 12 (41.4%) are female. There was an equal distribution of wasting by gender (50%). Among overweight children, 6 (37.5%) are male and 10 (62.5%) are female.

Section 5: Findings on association between nutritional status and child's characteristics

This section describes the association between the different indicators of malnutrition status and different children's characteristics, like age, gender, birth weight, status of maturity at birth, immunization status, child's rank order, birth interval, and history of diarrhoea, cold, and fever in the past 2 weeks.

Table 10.1

Association between underweight status and child's characteristics

n=233

Sl. No	Variables		Underweight (n=22) f (%)	Normal (n=211) f (%)	Chi square
1	Age	6-11 months	0	31 (100)	*P*=0.303 χ^2=4.850 df=4
		12-23 months	5 (8.6)	53 (91.4)	
		24-35 months	6 (12.8)	41 (87.2)	
		36-47 months	6 (9.7)	56 (90.3)	
		48-59 months	5 (14.3)	30 (85.7)	
2	Gender	Male	12 (10.3)	105 (89.7)	*P*=0.669 χ^2=0.182 df=2
		Female	10 (8.6)	106 (91.4)	
3	Birth weight (in gm)	<2500	4 (33.3)	8 (66.7)	***P*=0.014 χ^2=8.542 df=1**
		2501-4000	17 (8.0)	195 (92.0)	
		>4001	1 (11.1)	8 (88.9)	
4	Status of maturity at birth	Preterm	1 (11.1)	8 (88.9)	*P*=0.861 χ^2=0.030 df=1
		Full-term	21 (9.4)	203 (90.6)	
5	Immunization status	Full immunization	18 (8.6)	192 (91.4)	*P*=0.331 χ^2=2.214 df=2
		Partial immunization	3 (15.8)	16 (84.2)	
		No immunization	1 (25.0)	3 (75.0)	
6	Child's birth order	First	8 (8.1)	91 (91.9)	*P*=0.830 χ^2=.374 df=2
		Second	8 (10.4)	69 (89.6)	
		Third or more	6 (10.5)	51 (89.5)	
7	Birth interval	Firstborn	9 (8.9)	92 (91.1)	*P*=0.264 χ^2=5.234 df=4
		<24 months	5 (19.2)	21 (80.8)	
		24-35 months	2 (5.6)	34 (94.4)	
		36-47 months	3 (15.8)	16 (84.2)	
		>47 months	3 (5.9)	48 (94.1)	
8	History of diarrhoea in the past 2 weeks	Yes	6 (50.0)	6 (50.0)	***P*=<0.001 χ^2=24.339 df=1**
		No	16 (7.2)	205 (92.8)	
9	History of cold and fever in the past 2 weeks	Yes	4 (21.1)	15 (78.9)	*P*=0.071 χ^2=3.261 df=1
		No	18 (8.4)	196 (91.6)	

*Chi-square test; $p \leq 0.05$

The table shows the association between the underweight status and various child characteristics such as health and birth-related factors in children.

It can be seen from the table that no underweight children were found in the age group of 6–11 month while other age groups showed varying percentages of underweight children. For example, there are 12.8 per cent and 14.3 per cent underweight children in the age group of 24-35 months and 48-59 months respectively. In terms of gender, males (10.3%) and females (8.6%) had similar rates of underweight status. It can also be seen that children with low birth weight (<2500 gm) had the highest percentage of underweight status with (33.3%) as compared to the birth weight of 2501- 4000gm and >4001gm with 8% and 11.1% respectively. As for maturity at birth, preterm and full-term, children showed similar rates of underweight status with 11.1% and 9.4% respectively. The immunization status reveals that fully immunized children had the lowest underweight prevalence (8.6%) while partially and non-immunized children showed higher underweight rates 15.8% and 25% respectively. The child rank order shows that underweight prevalence was similar across birth orders (8.1%, 10.4%, and 10.5%). Children with a shorter birth interval i.e. <24 months has a higher underweight prevalence of 19.2% followed by birth interval of 36-47 months with 15.8%. The remaining birth interval of children shows lower rates.

The table also highlights children with history of diarrhoea, cold and fever in the past 2 weeks. It is observed that children with recent diarrhoea had a much higher prevalence of underweight status (50.0%) as compared to those without diarrhoea (7.2%). Similarly, children with history of cold and fever in the past 2 weeks have higher percentage of underweight status with 21.1%.

Table 10.1 also highlights the association between children with underweight status and certain characteristics. It can be seen from the table that the Chi-square test results of underweight and participants' characteristics such as birth weight and history of diarrhoea in the past 2 weeks shows significant results with *p* values of 0.014 and 0.001. Hence, we reject the null hypothesis in both cases that there are significant association between underweight status and birth weight, between underweight status and history of diarrhoea in the past 2 weeks. This result indicates the need for taking preventive measures such as access to clean water, hygienic conditions, and prompt medical attention. On the other hand, the Chi-square test results of the other characteristics such as age, gender, status of maturity at birth,

immunization status, child rank's order, birth interval and history of cold and fever in the past 2 weeks show no significant association with the underweight status.

Table 10.2

Association between stunting status and child characteristics

n=233

Sl. No	Variables		Stunting (n=29) f (%)	Normal (n=204) f (%)	Chi square
1	Age	6-11 months	1 (3.2)	30 (96.8)	*P*=0.493 χ^2=3.405 df=4
		12-23 months	7 (12.1)	51 (87.9)	
		24-35 months	7 (14.9)	40 (85.1)	
		36-47 months	8 (12.9)	54 (87.1)	
		48-59 months	6 (17.1)	29 (82.9)	
2	Gender	Male	17 (14.5)	100 (85.5)	*P*=0.333 χ^2=0.936 df=1
		Female	12 (10.3)	104 (89.7)	
3	Birth weight (in gm)	<2500	4 (33.3)	8 (66.7)	***P*=0.046** χ^2=6.167 df=2
		2501-4000	25 (11.8)	187 (88.2)	
		>4001	0	9 (100.0)	
4	Status of maturity at birth	Preterm	0	9 (100.0)	*P*=0.249 χ^2=1.331 df=1
		Full-term	29 (12.9)	195 (87.1)	
5	Immunization status	Full immunization	22 (10.5)	188 (89.5)	***P*=0.021 χ^2=7.709 df=2**
		Partial immunization	6 (31.6)	13 (68.4)	
		No immunization	1 (25.0)	3 (75.0)	
6	Child's birth order	First	11 (11.1)	88 (88.9)	*P*=0.591 χ^2=1.051 df=2
		Second	12 (15.6)	65 (84.4)	
		Third or more	6 (10.5)	51 (89.5)	
7	Birth interval	Firstborn	11 (10.9)	90 (89.1)	***P*=0.009 χ^2=13.565 df=4**
		<24 months	9 (34.6)	17 (65.4)	
		24-35 months	3 (8.3)	33 (91.7)	
		36-47 months	2 (10.5)	17 (89.5)	
		>47 months	4 (7.8)	47 (92.2)	
8	History of diarrhoea in the past 2 weeks	Yes	3 (25.0)	9 (75.0)	*P*=0.176 χ^2=1.830 df=1
		No	26 (11.8)	195 (88.2)	
	History of cold and fever in the past 2 weeks	Yes	4 (21.1)	15 (78.9)	*P*= 0.236 χ^2=1.406 df=1
		No	25 (11.7)	189 (88.3)	

*Chi-square test; $p \leq 0.05$

The table-10.2 shows the output of the Chi-square test. The test was performed at a 5% level of significance between stunting status and participants' characteristics.

It can be seen from the table that the Chi-square test values between stunting status and participants' characteristics such as birth weight, immunization status and birth interval show significant results with p values of 0.046, 0.021, and 0.009 respectively. The significant result between stunting status and birth weight shows stunting is more common in children weighing less than 2,500 grams at birth. Similarly, stunting is also common in children who have had little or no vaccinations and finally, stunting is more common in children whose birth interval is less than 24 months. However, there are no significant results between stunting status and participants' characteristics such as age, gender, status of maturity at birth, child's birth order, history of diarrhoea in the past 2 weeks, and history of cold and fever in the past 2 weeks.

Table 10.3

Association between children's weight-for-height status and child characteristics n=233

Sl. No	Variables		Wasting (n=10) f (%)	Normal (n=207) f (%)	Over weight (n=16) f (%)	*P*-Value
1	Age[1]	6-11 months	0	24 (77.4)	7 (22.6)	*P*=0.059 df=4
		12-23 months	3 (5.2)	51 (87.9)	4 (6.9)	
		24-35 months	3 (6.4)	44 (93.6)	0	
		36-47 months	2 (3.2)	57 (91.9)	3 (4.8)	
		48-59 months	2 (5.7)	31 (88.6)	2 (5.7)	
2	Gender[2]	Male	5 (4.3)	106 (90.6)	6 (5.1)	*P*=0.572 χ^2=0.182; df=1
		Female	5 (4.3)	101 (87.1)	10 (8.6)	
3	Birth weight[2] (in gm)	<2500	3 (25.0)	9 (75.0)	0	***P*=0.004 χ^2=9.54 df=2**
		2501-4000	6 (2.8)	191 (90.1)	15 (7.1)	
		>4001	1 (11.1)	7 (77.8)	1 (11.1)	
4	Status of maturity at birth[2]	Preterm	0	8 (88.9)	1 (11.1)	*P*=0.723 χ^2=0.647 df=1
		Full-term	10 (4.5)	199 (88.8)	15 (6.7)	
5	Immunization status[1]	Full immunization	9 (4.3)	186 (88.6)	15 (7.1)	*P*=0.907 df=2
		Partial immunization	1 (5.3)	17 (89.5)	1 (5.3)	
		No immunization	0	4 (100)	0	
6	Child's birth order[2]	First	3 (3.0)	87 (87.9)	9 (9.1)	*P*=0.261 χ^2=5.268 df=4
		Second	2 (2.6)	70 (90.9)	5 (6.5)	
		Third or more	5 (8.8)	50 (87.7)	2 (3.5)	
7	Birth interval[1]	Firstborn	4 (4.0)	88 (87.1)	9 (8.9)	*P*=0.712 df=1
		<24 months	2 (7.7)	23 (88.5)	1 (3.8)	
		24-35 months	1 (2.8)	32 (88.9)	3 (8.3)	
		36-47 months	1 (5.3)	16 (84.2)	2 (10.5)	
		>47 months	2 (3.9)	48 (94.1)	1 (2.0)	
8	History of diarrhoea in the past 2 weeks[2]	Yes	4 (33.3)	8 (66.7)	0	***P*<0.001 χ^2=26.431 df=2**
		No	6 (2.7)	199 (90.0)	16 (7.2)	
9	History of cold and fever in the past 2 weeks[2]	Yes	3 (15.8)	16 (84.2)	0	***P*=0.020 χ^2=7.842 df=2**
		No	7 (3.3)	191 (89.3)	16 (7.5)	

[1]Fisher's Exact test; [2]Chi-square test; $p \leq 0.05$

The table-10.3 shows the output of the Chi-square test and Fisher's Exact test. The test was performed at a 5% level of significance between weight for height and child characteristics.

As seen from the table, wasting status and three child characteristics viz; birth weight, history of diarrhoea in the past 2 weeks and history of cold and fever in the past 2 weeks show significant association with *p* values of 0.004, <0.001, and 0.020 respectively.

The significant association between wasting status and birth weight implies that the prevalence of wasting is higher in children weighing less than 2,500 grams at birth. Similarly, the wasting and a history of diarrhoea within the last two weeks are significantly correlated (*p* value < 0.001). It indicates that children with history of diarrhoea increase the risk of wasting. A significant association is also observed between wasting and a history of cold and fever within the previous two weeks. This finding indicates that children with a history of colds and fevers are more vulnerable to experience wasting.

As for the participants' characteristics viz; age, immunization status and birth interval, the Fisher's exact test significance values are 0.059, 0.907, and 0.712 respectively. Since the *p* values in all these variables are greater than 0.05, there is not enough evidence to suggest a significant association between the variables (age, immunization status and birth interval). It can be concluded that at 5% significance level, the null hypothesis is accepted for the three cases that there are no significant associations between the stunting status with the participants' characteristics viz; age, immunization status and birth interval.

The present study findings shows that there was significant association between underweight with birth weight (*p* value 0.014)and history of diarrhoea in the past 2 weeks (*p* value <0.001); stunting status with birth weight (*p* value 0.046), immunization status (*p* value 0.021), and birth interval (*p* value 0.009) and weight-for-height status with birth weight (p value 0.004), history of diarrhoea in the past 2 weeks (*p* value <0.001) and history of cold and fever in the past 2 weeks (*p* value 0.020) at 0.05 level of significance. Hence research hypothesis H_1 is accepted.

Section 6

Findings on association between nutritional status and mother's and household characteristics

This section describes the association between the different indicators of nutritional status and different mother's characteristics, like maternal age at the time of birth of the child, maternal height, educational status, type of family and number of family members, frequency of meals per day in the family, socioeconomic status, status of iron supplementation and antenatal visits during pregnancy, hand hygiene practice and practice of breastfeeding.

Table 11.1

Association between underweight status and maternal and household characteristics n=233

Sl. No	Variables		Under weight (n=22) f (%)	Normal (n=211) f (%)	*P* value
1	Maternal age at birth[1]	≤18 years	2 (28.6)	5 (71.4)	*P*=0.189 χ^2=3.330 df=2
		19-34	18 (9.2)	177 (90.8)	
		≥35 years	2 (6.5)	29 (93.5)	
2	Maternal height below 145cms[1]	Yes	15 (23.1)	50 (76.9)	***P*<0.001 χ^2=19.601 df=1**
		No	7 (4.2)	161 (95.8)	
3	Education of mother[1]	No formal education	0	1 (100)	*P*=0.081 χ^2=9.788 df=5
		Primary	1 (10.0)	9 (90.0)	
		Middle	7 (24.1)	22 (75.9)	
		Secondary	11 (8.7)	115 (91.3)	
		Higher Secondary	2 (6.9)	27 (93.1)	
		Graduate & above	1 (2.6)	37 (97.4)	
4	Type of family[1]	Nuclear	14 (9.2)	138 (90.8)	***P*=0.038 χ^2=6.54 df=2**
		Joint family	5 (6.9)	67 (93.1)	
		Single parent family	3 (33.3)	6 (66.7)	
5	Number of family members[1]	<5	10 (11.1)	80 (88.9)	*P*=0.489 χ^2=0.478 df=1
		≥5	12 (8.4)	131 (91.6)	
6	Frequency of meals per day in the family[1]	Twice	20 (8.9)	204 (91.1)	*P*=0.127 χ^2=2.324 df=1
		Thrice	2 (25.0)	6 (75.0)	
7	Socioeconomic status[2]	Upper (I)	0	3 (100.0)	***P*=0.035 df=4**
		Upper middle (II)	0	15 (100.0)	
		Lower middle (III)	3 (6.3)	45 (93.8)	
		Upper lower (IV)	17 (10.4)	146 (89.6)	
		Lower (V)	2 (50.0)	2 (50.0)	
8	Inadequate iron supplementation during pregnancy[1]	Yes	14 (29.8)	33 (70.2)	***P*<0.001 χ^2=28.502 df=1**
		No	8 (4.3)	178 (95.7)	
9	Number of antenatal visits[1]	3 or less	9 (60.0)	6 (40.0)	***P*<0.001 χ^2=47.927 df=1**
		4 or more	13 (6.0)	205 (94.0)	
10	Hygienic practice of the mother[1]	Adequate	13 (9.5)	124 (90.5)	*P*=0.977 χ^2=0.001 df=1
		Inadequate	9 (9.4)	87 (90.6)	

11	Breastfeeding done[2]	Yes	22 (9.6)	206 (90.4)	*P*=0.465 df=1
		No	0	5 (100.0)	
12	Bottlefeeding[1]	Yes	3 (13.6)	19 (86.4)	*P*=0.480 χ^2=0.500 df=1
		No	19 (9.0)	192 (91.0)	

[1]Chi-square test; [2]Fisher's Exact test; $p \leq 0.05$

Table-11.1 shows the output of the Chi-square test. The test was performed at a 5% level of significance between the underweight status and various maternal characteristics of children.

It can be seen from the table that the Chi-square test values of the maternal height below 145cms and the underweight, type of family and underweight, socioeconomic status and underweight, inadequate iron supplementation during pregnancy and underweight, and between the number of antenatal visits and underweight show significant results with *p* values of <0.001, 0.038, 0.035, < 0.001 and < 0.001 respectively. This implies that there are significant differences between the maternal characteristics (viz; maternal height below 145cms, type of family, socioeconomic status, inadequate iron supplementation during pregnancy and number of antenatal visits) and underweight. It also shows that mothers who are shorter than 145 cm are more likely to have underweight children. The significant result between type of family and underweight indicates that children from single-parent families have higher chance to be underweight. Similarly, children born underweight are much more inclined to be associated to lower socioeconomic strata. Furthermore, mothers who did not take enough iron supplements throughout pregnancy are at greater risk to give birth to underweight children and finally, children have a greater chance to be underweight if their mothers had fewer prenatal visits.

The Chi-square test values of maternal characteristics such as maternal age at birth, education of mother, number of family members, frequency of meals per day in the family, hygienic practice of the mother, Breastfeeding done, bottle feeding practice and underweight status in children show no significant results.

Table 11.2

Association between stunting status and maternal and household characteristic

n=233

Sl. No	Variables		Stunting (n=29) f (%)	Normal (n=204) f (%)	Chi square
1	Maternal age at birth	≤18 years	0	7 (100.0)	*P*=0.599 χ^2=1.026 df=2
		19-34	25 (12.8)	170 (87.2)	
		≥35 years	4 (12.9)	27 (87.1)	
2	Maternal height below 145cms	Yes	18 (27.7)	47 (72.3)	***P*<0.001 χ^2=19.229 df=1**
		No	11 (6.5)	157 (93.5)	
3	Education of mother	No formal education	0	1 (100.0)	*P*=0.273 χ^2=6.354 df=5
		Primary	3 (30.0)	7 (70.0)	
		Middle	6 (20.7)	23 (79.3)	
		Secondary	15 (11.9)	111 (88.1)	
		Higher Secondary	2 (6.9)	27 (93.1)	
		Graduate and above	3 (7.9)	35 (92.1)	
4	Type of family	Nuclear	18 (11.8)	134 (88.2)	*P*=0.657 χ^2=0.840 df=2
		Joint family	9 (12.5)	63 (87.5)	
		Single parent family	2 (22.2)	7 (77.8)	
5	Number of family members	<5	13 (14.4)	77 (85.6)	*P*=0.464 χ^2=0.537 df=1
		≥5	16 (11.2)	127 (88.8)	
6	Frequency of meals per day in the family	Twice	25 (11.2)	199 (88.8)	***P*=0.001 χ^2=10.653 df=1**
		Thrice	4 (50.0)	4 (50.0)	
7	Socioeconomic status	Upper (I)	0	3 (100.0)	*P*=0.874 χ^2=1.226 df=4
		Upper middle (II)	2 (13.3)	13 (86.7)	
		Lower middle (III)	5 (10.4)	43 (89.6)	
		Upper lower (IV)	21 (12.9)	142 (87.1)	
		Lower (V)	1 (25.0)	3 (75.0)	
8	Inadequate iron supplementation during pregnancy	Yes	21 (44.7)	26 (55.3)	***P*<0.001 χ^2=56.139 df=1**
		No	8 (4.3)	178 (95.7)	
9	Number of antenatal visits	3 or less	8 (53.3)	7 (46.7)	***P*<0.001 χ^2=24.595 df=1**
		4 or more	21 (9.6)	197 (90.4)	
10	Hygienic practice of the mother	Adequate	18 (13.1)	119 (86.9)	*P*=0.702 χ^2=0.146 df=1
		Inadequate	11 (11.5)	85 (88.5)	

11	Breastfeeding done	Yes	29 (12.7)	199 (87.3)	P=0.394 χ^2=0.726 df=1
		No	0	5 (100.0)	
12	Bottle feeding	Yes	4 (18.2)	18 (81.8)	P=0.392 χ^2=.733 df=1
		No	25 (11.8)	186 (88.2)	

*Chi-square test; $p \leq 0.05$

The table -11.2 highlights association between stunting status and maternal characteristics using a Chi-square test. The test was performed at a 5% level of significance.

It is observed from the table that stunting status and certain maternal characteristics such as maternal height below 145cms, frequency of meals per day in the family, inadequate iron supplementation during pregnancy, number of antenatal visits show significant association.

The significant association between stunting status and maternal height below 145cms implies that a higher prevalence of stunting among children born to women below 145 cm. considering the fact that a mother's low nutritional and health state impacts her child's growth pattern; this relationship shows the interdependence of malnutrition. The importance of food availability and dietary patterns on children's growth and development is shown by the significant association between stunting in children and the frequency of meals consumed daily in the family with a p value of 0.001. The significant association between stunting and inadequate iron supplementation during pregnancy indicates the substantial impact of mother's diet on a child's growth and development. This relationship highlights the need of iron for the health of both the mother and the child. Finally, as seen in the table, the significant association between stunting and number of antenatal visits indicates the importance of antenatal care for reducing early undernutrition and promoting healthy growth.

As for maternal characteristics viz; maternal age at birth, education of mother, type of family, number of family members, socioeconomic status, hygienic practice of the mother, breastfeeding done, bottle feeding practice, Chi-square test are not statistically significant. Since the p values in all these variables are greater

than 0.05, there is not enough evidence to suggest a significant association between the variables.

Table 11.3

Association between children's weight for height status and maternal and household characteristics

n=233

Sl. No	Variables		Wasting (n=10) f (%)	Normal (n=207) f (%)	Over weight (n=16) f (%)	*P* value
1	Maternal age at birth[1]	≤18 years	2 (28.6)	4 (57.1)	1 (14.3)	***P*=0.017 χ^2=11.980 df=4**
		19-34	7 (3.6)	174 (89.2)	14 (7.2)	
		≥35 years	1 (3.2)	29 (93.5)	1 (3.2)	
2	Maternal height below 145cms[1]	Yes	7 (10.8)	58 (89.2)	0	***P*=0.001 χ^2=15.005 df=2**
		No	3 (1.8)	149 (88.7)	16 (9.5)	
3	Education of mother[2]	No formal education	0	0 (100.0)	0	*P*=0.056 df=10
		Primary	1 (10)	9 (90.0)	0	
		Middle	5 (17.2)	20 (69.0)	4 (13.8)	
		Secondary	3 (2.4)	116 (92.1)	7 (5.6)	
		Higher Secondary	1 (3.4)	25 (86.2)	3 (10.3)	
		Graduate & above	0	36 (94.7)	2 (5.3)	
4	Type of family[1]	Nuclear	6 (3.9)	135 (88.8)	11 (7.2)	***P*=0.004 χ^2=20.354 df=4**
		Joint	1 (1.4)	66 (91.7)	5 (6.9)	
		Single parent	3 (33.3)	6 (66.7)	0	
5	Number of family members[1]	<5	4 (4.4)	81 (90.0)	5 (5.6)	*P*=0.820 χ^2=0.397 df=2
		≥5	6 (4.2)	126 (88.1)	11 (7.7)	
6	Frequency of meals per day in the family[1]	Twice	9 (4.0)	200 (89.3)	15 (6.7)	*P*=0.398 χ^2=1.844 df=2
		Thrice	1 (12.5)	6 (75.0)	1 (12.5)	
7	Socioeconomic status[2]	Upper	0	3 (100.0)	0	*P*=0.228 df=8
		Upper middle	0	15 (100.0)	0	
		Lower middle	1 (2.1)	42 (87.5)	5 (10.4)	
		Upper lower	8 (4.9)	145 (89.0)	10 (6.1)	
		Lower	1 (25.0)	2 (50.0)	1 (25.0)	

8	Inadequate iron supplementation during pregnancy[1]	Yes	7 (14.9)	39 (83.0)	1 (2.1)	***P*<0.001 χ^2=17.572 df=2**
		No	3 (1.6)	168 (90.3)	15 (8.1)	
9	Number of antenatal visits[1]	3 or less	4 (26.7)	11 (73.3)	0	***P*<0.001 χ^2=20.236 df=2**
		4 or more	6 (2.8)	196 (89.9)	16 (7.3)	
10	Hygienic practice of the mother[1]	Adequate	6 (4.4)	123 (89.8)	8 (5.8)	*P*=0.759 χ^2=0.550 df=2
		Inadequate	4 (4.2)	84 (87.5)	8 (8.3)	
11	Breastfeeding done[1]	Yes	10 (4.4)	203 (89.0)	15 (6.6)	*P*=0.461 χ^2=1.548 df=2
		No	0	4 (80.0)	1 (20.0)	
12	Bottlefeeding [1]	Yes	1 (4.5)	21 (95.5)	0	*P*=0.408 χ^2=1.791 df=2
		No	9 (4.3)	186 (88.2)	16 (7.6)	

[1]Chi-square test; [2]Fisher's Exact test; $p \leq 0.05$

Data in Table 11.3 highlights the output of the Chi-square test and Fisher's Exact test. The test was performed at a 5% level of significance between children's weight-for-height status and maternal characteristics. The *p* value is also provided to indicate the statistical differences between different statuses and the observed variables.

In table 11.3, a Chi- square test is performed to show the association between children's weight-for-height status and maternal characteristics like age, maternal height, type of family, number of family members, frequency of meals per day in the family, inadequate iron supplementation during pregnancy, number of antenatal visits, hygienic practice, breastfeeding practice and practice of bottle feeding. Whereas, Fisher's exact test is performed to show the association between children's weight-for-height status and maternal characteristics like education, socio economic status. Fisher's exact test determines whether a statistically significant association exists between two categorical variables of smaller sample size.

A Chi-square test results indicate that children's weight-for-height status and maternal age (*p* value 0.017), maternal height (*p* value 0.001) and type of family (*p* value 0.004), iron supplementation during pregnancy (*p* value <0.001), number of antenatal visits (*p* value <0.001) are statistically significant. This implies that there is significant association between children's height for weight status with maternal age

(p value 0.017), maternal height and type of family, iron supplementation during pregnancy, number of antenatal visits.

The significant association between children's weight-for-height status and maternal age at birth implies that the wasting is more common in children whose mothers are 18 years of age or younger. Similarly, the association between wasting and maternal height below 145 cm indicates wasting is more common in children whose mothers are shorter than 145 cm. A significant association between type of family and wasting implies that children in nuclear families have a higher prevalence of wasting. Pregnant women who did not take enough iron supplements had a higher chance of giving birth to children with wasting. The significant association between number of antenatal visits and wasting indicates that children whose mothers attended fewer antenatal visits during pregnancy had a higher prevalence of wasting compared to those whose mothers had more visits.

The Fisher's exact test result shows that children's weight-for-height status and various maternal characteristics like education status and socio economic status of the family are not statistically significant.

The present study findings shows that there was significant association between underweight status with maternal height (p value <0.001), type of family (p value 0.038), socio economic status (p value 0.04), inadequate iron supplementation during pregnancy (p value <0.001) and number of antenatal visits(p value <0.001); stunting status with maternal height (p value <0.001),frequency of meals per day in the family (p value 0.001), inadequate iron supplementation during pregnancy (p value <0.001) and number of antenatal visits(p value <0.001); weight for height status with maternal age (p value 0.017), maternal height (p value 0.001) and type of family (p value 0.004),iron supplementation during pregnancy (p value <0.001), number of antenatal visits (p value <0.001) at 0.05 level of significance. Therefore, research hypothesis H_2 is accepted.

Section 7: Findings on association between nutritional status and feeding practices for breastfed children

This section describes the association between nutritional status and feeding practices among breastfed children.

Table 12.1

Association between underweight status and feeding practices for breastfed children

n=228

Sl. No	Variables		Underweight (n=22) f (%)	Normal (n=206) f (%)	Chi square
1	Initiation of breastfeeding after birth	Within 1 hour	20 (10.9)	163 (89.1)	*P*=0.070 χ^2=5.947 df=2
		1-24 hours	0	35 (100.0)	
		After 24 hours	2 (20.0)	8 (80.0)	
2	Pre-lacteal feed given	Yes	4 (10)	36 (90.0)	*P*=0.930 χ^2=0.008 df=1
		No	18 (9.6)	170 (90.4)	
3	Exclusive breastfeeding done for 6 months	Yes	15 (8.7)	158 (91.3)	*P*=0.375 χ^2=1.336 df=1
		No	7 (12.7)	48 (87.3)	
4	Age at the start of weaning	<6 months	3 (7.0)	40 (93.0)	*P*=0.116 χ^2=4.929 df=2
		6 months	16 (9.2)	158 (90.8)	
		7-12 months	3 (27.3)	8 (72.7)	
5	Continued breastfeeding after weaning	1 year	2 (18.2)	9 (81.8)	***P*=0.041 χ^2=10.685 df=4**
		1 to ≤2 years	4 (9.1)	40 (90.9)	
		2 years	4 (8.9)	41 (91.1)	
		>2years	6 (26.1)	17 (73.9)	
		Still breastfed	6 (5.7)	99 (94.3)	

*Chi-square test; $p \leq 0.05$

The table 12.1 shows the distribution of underweight and feeding practices for breastfed children of different variables based on their weight status (underweight or normal). The *p* value is also provided to indicate the statistical significance of any observed differences between the groups (feeding practices and underweight status).

Table 12.1 shows the association between underweight status and feeding practices for breastfed children. From the result of the analysis, it is evident that all other test results are not statistically significant, except for the Chi-square test between underweight and continued breastfeeding after weaning which is statistically

significant with a p value of 0.041. This implies that there is significant association between underweight status and continued breastfeeding after weaning. Therefore, we reject the null hypothesis.

The Chi-square test results of the underweight status and the other variables of breastfeeding practices such as initiation of breastfeeding after birth, prelacteal feed given, exclusive breastfeeding done for 6 months and age at the start of weaning with p values of 0.070, 0.934, 0.375 and 0.116 respectively are not statistically significant.

Table 12.2

Association between stunting status and feeding practices for breastfed children

n=228

Sl. No	Variables		Stunting (n=29) f (%)	Normal (n=199) f (%)	Chi square
1	Initiation of breastfeeding after birth	Within 1 hour	25 (13.7)	158 (86.3)	P=0.330 χ^2=2.938 df=2
		1-24 hours	2 (5.7)	33 (94.3)	
		After 24 hours	2 (20.0)	8 (80.0)	
2	Pre-lacteal feed given	Yes	4 (10.0)	36 (90.0)	P=0.570 χ^2=0.560 df=1
		No	25 (13.3)	163 (86.7)	
3	Exclusive breastfeeding done for 6 months	Yes	22 (12.7)	151 (87.3)	P=0.998 χ^2=0.726 df=1
		No	7 (12.7)	48 (87.3)	
4	Age at the start of weaning	<6 months	5 (11.6)	38 (88.4)	P=0.898 χ^2=0.946 df=2
		6 months	23 (13.2)	151 (86.8)	
		7-12 months	1 (9.1)	10 (90.9)	
5	Continued breastfeeding after weaning	1 year	3 (27.3)	8 (72.7)	P=0.518 χ^2=4.033 df=4
		1 to ≤2 years	4 (9.1)	40 (90.9)	
		2 years	6 (13.3)	39 (86.7)	
		>2years	4 (17.4)	19 (82.6)	
		Still breastfed	12 (11.4)	93 (88.6)	

*Chi-square test; $p \leq 0.05$

Table 12.2 shows the association between stunting status and feeding practices for breastfed children. From the result of the analysis, it is evident that the Pearson Chi-square test between stunting status and the variables of breastfeeding

practices such as initiation of breastfeeding after birth, pre-lacteal feed given, exclusive breastfeeding done for 6 months, age at the start of weaning and continued breastfeeding after weaning with *p* values of 0.330, 0.570, 0.998, 0.898 and 0.518 respectively are not statistically significant. This implies that there are no significant association between stunting status and the observed variables and hence, we fail to reject the null hypothesis in all the observed cases that there is no association between stunting status and breastfeeding practices. This means that stunting status is independent from the breastfeeding practices.

Table 12.3

Association between children's weight-for-height status and feeding practices for breastfed children

n=228

Sl. No	Variables		Wasting (n=10) f (%)	Normal (n=203) f (%)	Overweight (n=15) f (%)	*P* value
1	Initiation of breastfeeding after birth[1]	Within 1 hour	8 (4.4)	166 (90.7)	9 (4.9)	***P*=0.020 χ^2=13.239 df=4**
		1-24 hours	0	30 (85.7)	5 (14.3)	
		After 24 hours	2 (20.0)	7 (70.0)	1 (10.0)	
2	Pre-lacteal feed given[1]	Yes	3 (7.5)	32 (80.0)	5 (12.5)	*P*=0.129 χ^2=4.954 df=2
		No	7 (3.7)	171 (91.0)	10 (5.3)	
3	Exclusive breastfeeding done for 6 months[1]	Yes	8 (4.6)	155 (89.6)	10 (5.8)	*P*=0.666 χ^2=2.334 df=2
		No	2 (3.6)	48 (87.3)	5 (9.1)	
4	Age at the start of weaning[1]	<6 months	1 (2.3)	39 (90.7)	3 (7.0)	*P*=0.777 χ^2=3.311 df=4
		6 months	8 (4.6)	154 (88.5)	12 (6.9)	
		7-12 months	1 (9.1)	10 (90.9)	0	
5	Continued breastfeeding after weaning[2]	1 year	2 (18.2)	9 (81.8)	0	***P*=0.020 df=8**
		1 to ≤2 years	2 (4.5)	42 (95.5)	0	
		2 years	2 (4.4)	40 (88.9)	3 (6.7)	
		>2years	3 (13.0)	19 (82.6)	1 (4.3)	
		Still breastfed	1 (1.0)	93 (88.6)	11 (10.5)	

[1]Chi-square test; [2]Fisher's exact test; $p \leq 0.05$

Table 12.3 shows the distribution of children's weight-for-height status and feeding practices for breastfed children of different variables based on their wasting, normal and overweight status. The *p* value is also provided to indicate the statistical significance of any observed differences between different statuses and the observed variables.

In table 12.3, a Chi-square test is performed to show the association between children's weight-for-height status and feeding practices such as initiation of breastfeeding after birth, pre-lacteal feed given, and exclusive breastfeeding done for 6 months and age at the start of weaning. Whereas, Fisher's exact test is performed to show the association between children's weight-for-height status and breastfeeding practice of continued breastfeeding after weaning. Fisher's exact test determines whether a statistically significant association exists between two categorical variables of smaller sample size.

A Chi-square test results indicate that children's weight-for-height status and the various breastfeeding practices are not statistically significant, except for initiation of breastfeeding after birth, which is statistically significant with *p* value 0.020. This implies that there is significant association between children's weight-for-height status and initiation of breastfeeding after birth.

The Fisher's exact test result shows that children's weight-for-height status and continued breastfeeding after weaning is statistically significant. This suggests that there is a significant relationship between a child's weight-for-height status and their decision to keep breastfeeding even after weaning.

The findings indicate significant association exist between underweight with duration of breastfeeding after weaning (*p* value of 0.041) and weight for height status with feeding practice of children like initiation of breastfeeding after birth (*p* value of 0.020) and duration of breastfeeding after weaning (*p* value of 0.020) at 0.05 level of significance and hence, we reject the null hypothesis. Hence research hypothesis H_3 is accepted.

Section 8: Findings on risk factors of malnutrition among children.

This section describes the risk factors of different malnutrition status of children like underweight, stunting, wasting and overweight.

Table 13.1

Multivariable binary logistic regression for predictors of underweight

Sl. No	Variables	Adjusted Odds Ratio	95% CI	*p* value
1	**Birth weight (in gm)**			
	<2500	5.884	0.956, 36.223	0.056
	2501-4000	ref		
	>4001	0.732	0.015, 34.773	0.874
2	**History of diarrhoea in the past two weeks**			**0.006**
	Yes	8.742	1.854, 41.213	
	No	ref		
3	**Maternal height below 145cms**			**0.031**
	Yes	4.477	1.143, 17.535	
	No	ref		
4	**Type of family**			
	Nuclear	ref		
	Joint family	0.765	0.184, 3.182	0.713
	Single parent family	2.036	0.204, 20.280	0.545
5	**Socioeconomic status**			
	Upper (I)	NA		
	Upper middle (II)	NA		
	Lower middle (III)	0.914	0.135, 6.189	0.927
	Upper lower (IV)	ref		
	Lower (V)	24.284	1.316, 448.036	**0.032**
6	**Inadequate iron supplementation during pregnancy**			**0.008**
	Yes	5.581	1.570, 19.842	
	No	ref		
7	**Number of antenatal visits**			**0.001**
	Three or less	13.326	2.981, 59.572	
	Four or more	ref		

All the variables significantly associated with underweight status (*p* value ≤0.05) were entered into a multivariable binary logistic regression model as shown in Table 13.1.

The odds of a child being underweight are 5.884 times higher when their birth weight is less than 2500 gm while adjusting for other variables like maternal

height, type of family, socioeconomic status, iron supplementation, antenatal visits, and history of diarrhoea. The 95% confidence interval of the odds ratio ranges from 0.956 to 36.223; therefore, it is not considered a statistically significant predictor despite the high odds ratio. Statistically significant predictors of underweight status were a history of diarrhoea in the past two weeks (*p* value 0.006), maternal height below 145 cm (*p* value 0.031), lower socioeconomic status (*p* value 0.032), inadequate iron supplementation (*p* value 0.008) and three ORless than three antenatal visits during pregnancy (*p* value 0.001). Children with a history of diarrhoea in the past two weeks have 8.742 (95%CI: 1.854-41.213) times higher odds of being underweight, as compared to other children when adjusted for all other variables. Children from lower socio-economic status were more likely to be underweight as compared with other socio-economic statuses, with an adjusted odds ratio of 24.284 (95% CI: 1.316-448.036). With a maternal height of less than 145 cm, children have 4.477 (95% CI: 1.143-17.535) higher odds of being underweight, as compared to other children while holding all the other variables constant. Concerning antenatal care, the odds of being underweight among children were 5.581 and 13.326 times higher among antenatal mothers with inadequate iron supplementation and fewer antenatal visits (three or fewer), respectively, when adjusted for other variables.

Table 13.2

Multivariable binary logistic regression for predictors of stunting

Sl. No	Variables	Adjusted Odds Ratio	95% CI	*p* value
1	**Birth weight (in gm)**			
	<2500	4.329	0.793, 23.635	**0.091**
	2501-4000	ref		
	>4001	NA		
2	**Immunization status**			
	Full immunization	ref		
	Partial immunization	3.158	0.509, 19.615	0.217
	No immunization	6.653	0.187, 236.726	0.298
3	**Birth interval**			
	Firstborn	ref		
	<24 months	3.136	0.701, 14.028	0.135
	24-35 months	0.819	0.160, 4.183	0.810
	36-47 months	0.941	0.138, 6.406	0.951
	>47 months	0.862	0.183, 4.055	0.851
4	**Maternal height below 145cms**			
	Yes	4.370	1.435, 13.307	**0.009**
	No	ref		
5	**Frequency of meals per day in the family**			
	Twice	0.053	0.007, 0.419	**0.005**
	Thrice	ref		
6	**Inadequate iron supplementation during pregnancy**			
	Yes	18.721	5.772, 60.718	**<0.001**
	No	ref		
7	**Number of antenatal visits**			
	Three or less	4.105	0.873, 19.294	0.074
	Four or more	ref		

All the variables with significant association to stunting status (*p* value ≤0.05) were entered into a multivariable binary logistic regression model in Table 13.2. The model shows that children with a birth weight of <2500 gm and a maternal height below 145 cm have a 4.3 times higher risk of having stunted growth, as compared to

other children, when adjusted for other variables of immunization status, birth interval, frequency of meals, iron supplementation, and number of antenatal visits. A meal frequency of twice per day is associated with a significantly reduced likelihood of stunting, with an odds ratio of 0.053 (0.007, 0.419) at *p* value 0.005. The odds of stunting were 18.721 higher among children whose mothers did not receive adequate iron supplementation during pregnancy. The 95% confidence interval of the odds ratio ranges from 5.772 to 60.718.

Table 13.3

Multi variable multinomial logistic regression for predictors of wasting

Sl. No	Variables	Adjusted Odds Ratio	95% CI	*p* value
1	**Birth weight (in gm)**			
	<2500	19.729	1.560, 249.468	**0.021**
	2501-4000	ref		
	>4001	4.534	0.086, 238.931	0.455
2	**History of diarrhoea in the past two weeks**			
	Yes	14.692	1.325, 162.887	**0.029**
	No	ref		
3	**History of cold and fever in the past two weeks**			
	Yes	0.961	0.050, 18.366	0.979
	No	ref		
4	**Maternal age at birth**			
	<18 years	12.429	1.939, 79.674	**0.008**
	19-34 years	ref		
	≥35 years	0.857	0.102, 7.226	0.887
5	**Maternal height below 145cms**			
	Yes	8.515	0.941, 77.085	0.057
	No	ref		
6	**Type of family**			
	Nuclear	ref		
	Joint family	0.275	0.019, 3.899	0.340
	Single parent family	9.383	0.905, 97.276	0.061
7	**Inadequate iron supplementation during pregnancy**			
	Yes	5.034	0.693, 36.558	0.110
	No	ref		
8	**Number of antenatal visits**			
	Three or less	6.311	0.859, 46.359	0.070
	Four or more	ref		

The variable associated with wasting status are entered into the multi monomial logistic regression model for predicting weight for height status were birth weight, history of diarrhoea, history of fever, maternal age, maternal height, type of family, iron supplementation and number of antenatal visits as shown in Table 13.3. Children with a birth weight of <2500gm are 19.729 times (95% CI: 1.560-249.468) more likely to have wasting, as compared to other children when adjusted for all entered variables. The odds of wasting are also 14.692 times (95% CI: 1.325-

162.887) that of normal children for children who had diarrhoea in the past two weeks. Children with mothers <18 years during birth were more likely to be wasted as compared with other children, with an adjusted odds ratio of 12.429 (95%CI: 1.939-79.674). The odds of children being wasted in a joint family are approximately 72.5% lower as compared to other participants when all other factors are adjusted.

Table 13.4

Multi variable multinomial logistic regression for predictors of overweight

Sl. No	Variables	Adjusted Odds Ratio	95% CI	*p* value
1	**Birth weight**			
	<2500	NA		
	2501-4000	ref		
	>4001	1.314	0.147, 11.729	0.807
2	**History of diarrhoea in the past two weeks**			
	Yes	NA		
	No	ref		
3	**History of cold and fever in the past two weeks**			
	Yes	NA		
	No	ref		
4	**Maternal age at birth**			
	<18 years	3.107	0.325, 29.715	0.325
	19-34 years	ref		
	≥35 years	0.429	0.054, 3.384	0.422
5	**Maternal height below 145cms**			
	Yes	NA		
	No	ref		
6	**Type of family**			
	Nuclear	ref		
	Joint family	0.965	0.314, 2.965	0.950
	Single parent family	NA		-
7	**Inadequate iron supplementation during pregnancy**			
	Yes	0.720	0.086, 6.024	0.762
	No	ref		
8.	**Number of antenatal visits**			
	Three or less	NA		
	Four or more	ref		

All predictors modelled for overweight status were non-significant and negative (except for birth weight and maternal age at birth). The odds of a child being overweight are 1.314 times higher (95%CI: 0.147-11.729) when their birth weight is more than 4000 gm when adjusted for other variables like maternal age at birth, type of family, iron supplementation, and antenatal visits.

CHAPTER V

Discussion, Summary and Conclusion

This chapter deals with the discussion and conclusion drawn. The implications in the field are forethought, the limitations are identified and the recommendations for further research study are put forth for further consideration.

PROBLEM STATEMENT

Prevalence and its associated risk factors of malnutrition among children.

Objectives

The objectives of this study are:

- To identify the prevalence of malnutrition among children.
- To find out association between prevalence of malnutrition(nutritional status) with child characteristics.
- To find out association between prevalence of malnutrition (nutritional status) and maternal characteristics.
- To find out association between malnutrition(nutritional status) and feeding practices of the children
- To identify the risk factors of malnutrition among children.

Research Hypothesis

On the basis of the objectives of the study, the hypotheses are formulated

- **H_1** There is a significant association between malnutrition and child characteristics.
- **H_2** There is a significant association between malnutrition and maternal characteristics.
- **H_3**There is a significant association between malnutrition and feeding practices of children.

Major Findings

Major findings of the study are summarized as below

- **Description of sample characteristics**
  - 50.2% of the participants are male, and 49.8% are female.
  - Most of the participants 90.1% are fully immunized, 8.2% children were partially immunized, and only 1.7% children were not given immunization.
  - Among the mothers, 83.7% of them were between the ages of 19 and 34 when their child was born.
  - The majority of the mothers had formal education; only 0.4% did not attend formal education.
  - The majority of the mothers (65.2%) belong to nuclear families. Thirty-nine percent of mothers are from joint families, and 38.6% of mothers had less than five family members, whereas 61.4% of mothers have five or more.
  - About 92.3% of mothers belonged to the lower socioeconomic class, while 7.7% belonged to the upper class.
  - The majority of the mothers 79.8% received adequate iron supplementation during pregnancy, whereas 20.2% did not receive adequate iron supplementation during pregnancy.
  - 93.6% of the mothers have done sufficient antenatal checkups (4 times or more), whereas 6.4% have not done sufficient antenatal during pregnancy.
  - 58.8% of the mothers maintain adequate hand hygiene practice.
- **Description of feeding practice**
  - Among 233 participants, 228 (97.85%) were able to breastfeed their children, and 5 (2.15%) were unable to feed with breast milk since birth.
  - 80.3% of the mothers were able to initiate breastfeeding within an hour after birth.

- 19.3% of the mothers have given prelacteal feed to their children, and the most common prelacteal feed was formula feed. 75.9% had breastfed exclusively for 6 months, but 24.1% were not able to practice exclusive breastfeeding.
- The majority of the children, 75.9%, started weaning at the recommended month; 18.9% of children were started weaning before 6 months of age, and 4.8% of mothers started between the ages of 7 and 12 months.
- The mean age of weaning was 5.8 months.
- 67.1% of the participants continued breastfeeding for 2 years or more.

❖ **Finding related to prevalence of malnutrition**

The prevalence of underweight, stunting and wasting, overweight were 9.4%, 12.4% , 4.3% and 6.9% respectively; stunting is the most common form of malnutrition.

❖ **Finding related to association between malnutrition and child characteristics.**

There is a significant association between malnutrition with child characteristics. Therefore, the null hypothesis H_0 is rejected and accepted the alternative hypothesis H_1.

❖ **Finding related to association of malnutrition with maternal characteristics.**

There is a significant association between malnutrition with maternal characteristics. Therefore, the null hypothesis H_0 is rejected and accepted the alternative hypothesis H_2.

❖ **Finding related to association of malnutrition with feeding practice of children.**

There is a significant association between malnutrition and feeding practices of children. Therefore, the null hypothesis $H_0$is rejected and accepted the alternative hypothesis H_3.

❖ **Finding related to risk factors of malnutrition of children.**

- The risk of a child being underweight is high among children who have history of diarrhoea in the past two weeks, maternal height below 145 cm, lower socio economic status, inadequate iron supplementation and less than four antenatal visits during pregnancy.
- The significant predictors of stunting were children with a birth weight of <2500gm and a maternal height below 145 cm and inadequate iron supplementation during pregnancy. A meal frequency of twice per day reduced likelihood of stunting.
- Children with a birth weight of <2500, diarrhoea in the past two weeks children with mothers <18 years of age during birth were the predictors of wasting in children. Wasting was less likely found in children from joint families.
- The risk of overweight is higher among children with a birth weight of more than 4000 gm.

Discussion in Relation to Other Studies

Prevalence of malnutrition

According to the present study, the prevalence of underweight is 9.4%, stunting 12.4%, wasting 4.3%, and overweight 6.9% which were less than the prevalence of malnutrition of Mizoram as per National Family Health Survey 5 findings.

The findings of prevalence of underweight of the present study are lower than studies conducted by Vasudevan et al. (2019) in Pondicherry and How et al. (2020) in Malaysia. The present finding of the prevalence of underweight is similar to the study conducted by Baharudin et al. (2019) in Malaysia.

Wasting indicates recent weight loss, which may be due to recent infections such as diarrhoea or a person who does not have enough food to eat. The burden of wasting is highest in India (18.7%). As per the Global Hunger Index, the prevalence of wasting above 15% is categorized as “very high." India is the only one in this category (Newsreel Asia, 2023). The prevalence of wasting of under five children in Mizoram is 4.3% according to the present finding, which is almost the same as the

prevalence of wasting in Mizoram as per the national family health survey report (4.9%), but it is much lower than the national prevalence 18.7% and other study findings of Yazew11.8% (2022) in Ethiopia and Choudhary et al.17.3% (2024) in India.

Stunting continues to be a serious public health concern, particularly in developing nations. Stunting indicates chronic malnutrition, which results from persistent or recurring undernutrition. As per the report of UNICEF, WHO and World Bank (2021), the highest rates of stunting are in Oceania 41.4%, Sub-Saharan Africa 36.7%, and South Asia 31.8%. The present study findings indicate that stunting is the most common form of malnutrition 12.4%, which is in line with the previous study finding of Gangurde et al. (2023). The prevalence of the present study is lower than the study conducted by Misty et al. 29.9% (2018) in Bangladesh, Goyal et al.66.8% (2019) in Faridabad and Javid et al.45% (2020) in Pakistan.

According to the present study, the prevalence of underweight and stunting is greatest among children who are more than 24 months of age, whereas the prevalence of wasting is greatest in the age group of 12-35 months.

Undernutrition in any kind is uncommon in infants younger than 12 months of age. The findings were consistent with previous research findings of Getu et al. (2023) in Ethiopia, Amoah et al (2024) in Ghana and Ashar et al. (2024) in Indonesia where the prevalence of undernutrition was more common among children in the age group of 12-23 months and children below 12 months were less affected by undernutrition. According to the present study, the prevalence of undernutrition increases as age increases according to the present study which was in line with the previous findings of Gupta et al. (2020) in India, Irawan et al.(2021)in Indonesia, Tafese et al.(2022)in Rural Ethiopia, Engidaye et al, (2022)in Ethiopia, Shaikh et al.(2023) in Maharastra in their studies reported that undernutrition is more prevalent when the child age is increasing. A child's growth is influenced by their surroundings, diet, feeding practices and health care. The kinds and variety of dietary items given to children in the older age group need to be further examined in the study. Parents may give older children less attention than they do to younger children beyond the age of twelve months.

The present study findings show that the prevalence of underweight and stunting is found more among male children, which is in line with the previous research findings of Jawaregowda et al. (2015)in Karnataka, India, Nzefa et al. (2019)in Cameroon, Benedict et al. (2020)in Thailand, Fatima et al. (2020)in Pakistan, Asra et al. (2020)in Maldives, Das et al. (2022)in West Bengal and Addo et al. (2023)in Benin. But the previous study conducted by Shaban et al. (2017) in Egypt did not support the present finding, where there is no significant difference in the distribution of stunting by sex. A probable reason for this disparity could be differences in biological make-up which make boys more influenced by environmental stress and it may be due to girls receive superior care and nutrition than infant boys in Mizoram.

There was an equal distribution by gender in wasting in the present study findings. The study was not in line with the previous study conducted among tribal children in Chhattisgarh, India by Sinha et al. (2019), Saha et al. (2022) in Gujarat, India reported that the prevalence of wasting is higher among male children. The findings of undernutrition in the study is considered as public health concern in Mizoram.

Overweight and obesity result from an imbalance between energy consumption and expenditure. The burden of overweight and obesity under five children is highest in the area of Latin America and the Caribbean, where the prevalence of overweight is 8.6%, with more than 4 million children affected (UNICEF Report, 2023)

The prevalence of overweight in the present study 6.9% is much higher than the global average 5.6% and the national prevalence 3.4% and previous studies conducted by Bishwajit et al.1.91% (2020) in South Asia, Gebremichael et al. 2.14 (2022) in Ethiopia and Ayele et al. 5.10%(2022) in Sub-Saharan Africa. However, the present finding is lower than studies conducted by Ra et al. 11.4% (2020) in Korea and Song et al.88.7% (2020) in Central and Western China.

The present study findings show that the prevalence of overweight is greatest among the age group of 6-11 months (43.8%), which was in contrast with the previous research findings of Da Silva et al. (2019) and Zhang et al. (2022) reported highest prevalence of obesity among 6-12 months age group.

Among overweight children, the prevalence is higher among female children 62.5% than male children 37.5% in the present study. The present finding is not consistent with the similar study by Javedan et al. (2016) in Iranand Saha et al. (2022) in India and, where the prevalence of overweight is higher among male children.

Feeding practice

Appropriate feeding practices during infancy are crucial to develop normally and maintain optimal nutrition, health, and development for children. Studies on infant and child feeding have shown that improper feeding practices can have a significant impact on a child's ability to grow, develop, and survive. In the present study, among 233 participants, 228 (97.85%) were able to breastfeed their children, and 5 (2.15%) were unable to feed with breast milk since birth. Gaurav et al. (2019) in their study shows that 14.4% were never breastfed.

Starting breastfeeding as early as possible after birth is important for both the mother and the child. It is recommended to initiate breastfeeding within an hour of birth. In the present study, 80.3% of the mothers initiate breastfeeding within an hour of birth, which is much better than the findings of the Mizoram NFHS-5 report 60% and the national prevalence of children receiving breastfeeding within an hour after birth 41.6% and other research studies by Mekonen et al.70.5% (2021) in Ethiopia andAppiah et al.61.1% (2021) in Ghana. The variation in practice of initiation of breast feeding might be influenced by place and mode of delivery, maturity of the child at birth, and level of awareness of the mothers and caregivers regarding the benefit of early initiation of breastfeeding and practice in the health institute where delivery takes place.

19.3% of the mothers have given prelacteal feeding to their children in this study, which is lower than previous research findings of Varma et al.31.19% (2015) in Hyderabad, India and Gaurav et al.24.4% (2019) in rural Meeru.

Maternal employment and the belief that the milk supply is insufficient are two factors that have been found to hinder exclusive breastfeeding. A barrier to exclusive breastfeeding is also created by the beliefs of the mother and significant others on infant nutrition. According to the present study, 75.9% had breastfed exclusively for 6 months, but 24.1% were not able to practice exclusive

breastfeeding. This finding is higher when compared with Mizoram state prevalence 67.9% and national prevalence of exclusive breastfeeding 63.7% and many of the previous research findings ofThirunavukkarasy et al. 22% (2019) in Puducherry, Seghal et al. 43.6% (2020) in Uttar Pradesh and Appiah et al.43.7% (2021) in Ghana. But the previous study findings conducted by Uppiretla et al.79.1% (2019) in Andhra Pradesh, the findings are higher than the present study finding.

In the present study, 174 (76.3%) children were started complementary feeding at the recommended month, which is much higher than the national figure 45.9% and Mizoram status 57%, and the previous study result of Gaurav et al.30.3% (2019) in rural Meerut, Uttar Pradesh , Seghal et al.40.4% (2020) in Uttar Pradesh , Mekonen et al.69.2% (2021) in Ethiopia. But the result is lower than the previous study conducted by Bagchi et al. 87.9% (2021) in an urban slum of West Bengal.

The World Health Organization recommends that breastfeeding be continued for the first two years in addition to supplementary feeding. 67.1% continued breastfeeding for 2 years or more, according to the present study. The finding is finding is much lower from the previous research findings of Ahmad et al. 79.5% (2022) in Lucknow, Divya et al.88.7% (2022) in Mysuru and Jeyakumar et al. 93.68% (2023) in Pune, India.

Association of underweight with different factors

Many characteristics of the child, family, and household are associated with the presence of malnutrition, which include birth weight, immunization status, birth interval, history of diarrhoea in the past two weeks, maternal height, maternal age at birth, educational level, socioeconomic status, inadequate iron supplementation, and less than three antenatal visits during pregnancy, frequency of meals in the family, and type of family.

Children with low birth weight had a significantly higher prevalence of malnutrition than children with normal birth weight as evidenced from the previous finding of Sari et al. (2020) in Indonesia. Low birth weight infants have higher chance of developing underweight or stunted in early life (Ntenda, 2019) in Malawi. The present study finding also support that low birth among the participants was associated with underweight status.

Malnutrition in children under five years old is largely caused by infections such as diarrhoea, which can contribute to weight loss. During diarrhoea, increased nutritional requirements and decreased food intake and nutrient absorption frequently coexist, causing weight loss and failure to grow. It was observed that children with a history of diarrhoea in the past two weeks were associated with being underweight among under five of age. A similar finding was also observed by a study conducted by Irawan et al. (2021) in Iran.

Another important factor affecting underweight was maternal height; it is regarded maternal height has linked to child anthropometric outcome. Children with a maternal height of less than 145 cm was found to have association with underweight in the children and it has 4.477 (95% CI: 1.143-17.535) higher odds of being underweight which are in line with the previous findings of Rana et al. (2020) in Gujarat and Javid et al. (2020) in Pakistan.

Children's growth and development are greatly influenced by their families in various ways. It is vital for supplying necessities for physical development, such as food, medical treatment, and housing. According to the study of Sigdel et al. (2021) in Chitwan andSamrina et al. (2024) in Pakistan, when compared to children from nuclear families, children from joint families had much lower rates of stunting and underweight.The present study findings also shows significant association between type of family in which the child live and underweight in children.

The risk of undernutrition increases with decreasing socioeconomic level as people from poor sections have less access to the basic needs. In the present study, it was observed that socio-economic status of the family has association with underweight among five years of age. With an adjusted odds ratio of 24.284 (95% CI: 1.316-448.036), children from lower socioeconomic backgrounds were more likely to be underweight than children from other socioeconomic backgrounds.This finding was supported by other research studies of Shahid et al. (2022) in Pakistan, Ambreeni et al. (2023), Obasohani et al. (2024) in Nigeria and Birhanu et al. (2024) in where children from the lowest wealth quintile have a higher risk of all forms of undernutrition.

Maternal iron deficiency during pregnancy has an impact on the outcome of pregnancy which further can influence growth of the child. It was observed that

underweight in children was associated with mothers of inadequate iron supplementation and the odds of underweight were 5.581 higher among mothers with inadequate iron supplementation. The present finding is supported by previous studies conducted among South Asian children by Nisar et al. (2016) and Sari et al. (2023) in Indonesia.

Antenatal checkups offer different valuable services that will prevent, detect, and treat problems during pregnancy, which will influence the outcome of pregnancy and the growth of the children. It was observed that underweight status was associated with inadequate antenatal checkups and the odds of underweight were higher among mothers with inadequate antenatal checkups with an AOR of 13.326.The present finding is supported by the study conducted by Hamel et al. (2015) in Nigeria and Abdullah et al. (2023) in Bangladesh. But research finding of Shyam et al. (2020) in Madhya Pradesh shows that antenatal attendance does not have an association with malnutrition in the children.

Association of stunting with different factors

The child's birth weight indicates their likelihood of survival as well as their future growth, health, and psychological development. In the present study, child's birth weight was associated with stunted growth and have a 4.3 times higher risk of having stunted growth,, which was in contrast with the different study of Shukla et al. (2018) in Madhya Pradesh, India, Ntenda (2019) in Malawi and Siddiqa et al. (2022) in Pakistan.

The link between infection and malnutrition has been known for many years. Due to their high susceptibility to infection, children require protection from infections. The current study finding shows that stunting was significantly associated with immunization status of the children which was in line with the study conducted by Mulyani et al. (2023) in Indonesia stating that compared to children who receive full vaccinations, children who receive incomplete vaccinations are 1.2 times more likely to experience stunting.

For the mother's health and nutritional status to recuperate after each delivery, a sufficient birth gap is essential. WHO report (2005) recommended birth interval to be at least 24 months before attempting next pregnancy. In the previous study, children with a birth interval less than 24 months had a higher risk of experiencing

stunting compared with those with a birth interval more than 24 months of Chungkhama et al. (2020) in India, Yaseen et al. (2020) in Shirqat City, Das et al. (2021), Haghighi et al. (2022)in Iran. But the present finding also support the previous findings where the birth interval of the children have an association with stunting with *p* value (0.009)

Mothers are generally primary caregivers to the children. Education and other personal traits have an impact on the choices they make for their children and health seeking behavior. The previous study findings of Dessie et al. (2019) in Ethiopia, Octaria et al. (2021) in Indonesia and Oo et al. (2023) in Myanmar shows that stunting among under 5 children was associated with maternal education level but the present study finding was not in line with the previous study finding.

Maternal height was another important factor affecting stunting. Maternal height was associated stunted growth and maternal height greatly influences the length of the child. Children born to mother with small stature frequently experience stunted growth. The present study shows that compared to other children, mothers who are shorter than 145 cm are 4.3 times more likely to have stunted growth which was supported by the previous research findings of Mangngala et al. (2018) in Indonesia, Nshimyiryo et al. (2019) in Rwanda, Puspitasari et al.2020 in East Java and Hall et al. (2020) in Bougainville.

A meal frequency of twice per day is a protective factor in reducing likelihood of stunting with an odds ratio of 0.053(0.007, 0.419) at *p*value0.005. The previous study finding of Sewnet et al. (2021) in Ethiopia support the present finding stating that children who were received meals less than three times have significantly associated with stunting.

Women of reproductive age and children are more vulnerable to iron deficiency. Adequate supplementation is essential during pregnancy to prevent iron deficiency anemia. It was observed in the current study that stunting was significantly associated with iron supplementation during pregnancy and odds of stunting were 18.721 higher among children whose mothers did not receive adequate iron supplementation during pregnancy, which was supported by previous research findings of Nisar et al. (2016) among South Asian children, Misty et al. (2018) in Bangladesh and Hinojosa et al. (2021) in Philippines .

Antenatal care is crucial for safeguarding women's health. Skilled health personnel can teach mothers about healthful habits. Abeway et al. (2018) in Ethiopia and Amaha et al. (2021) among Ethiopian children in the study finding show that a significant association exists between stunting status and the number of antenatal visits, but the present study also find a significant association between stunting status and antenatal visits.

Association of wasting with different factors

A child's birth weight or size at birth is a significant predictor of their susceptibility to various health issues. It also affects the child's growth and health in the future. In the present study, birth weight of the child was associated with wasting. The risk of wasting is 19.729 times higher for children weighing less than 2,500 gm at birth (95% CI: 1.560-249.468) which was in contrast with the finding of Birhan et al. (2021) in Ethiopia.

Diarrhoea can negatively impact a child's nutrition in several ways. The child loses the nourishment they need to grow with each episode. It was observed that under five children with a history of diarrhoea in the past two weeks was associate with the child being wasting status and have a higher risk of wasting 14.692 times (95% CI: 1.325-162.887) which was supported by the previous research finding of Asabe et al. (2024) in sub Saharan countries .

According to Wali et al. (2021) in South Asian Countries shows that young maternal age at childbirth (<20 years) is associated with poor child growth.Due to her struggles to finish her own growth, the young mother wants a double set of nutrients. Early marriage will shorten education, which in turn will influence the ability to provide child care. Mature and experienced mothers will better take care of their children. The current study also shows that maternal age was significantly associated with wasting among the participants, children with mothers <18 years during birth were more likely to be wasted, with an adjusted odds ratio of 12.429 (95% CI: 1.939-79.674).

The present study result shows that education of the mother was not significantly associated with wasting status in children which was not in line with the previous study findings of Fufa et al. (2021) in Ethiopia, Adeyonu et al.(2022) in Nigeria and Chen (2023) in 45 low and middle income countries.

The type of family has an influence on undernutrition in the current study. Joint families frequently divide up household duties and obligations. This can more fairly divide the labour and lessen the pressure of particular home chores. In addition to lowering stress levels individually, sharing responsibility among family members promotes collaboration and teamwork. The odds of children being wasted in a joint family are approximately 72.5% lower as compared to other participants when all other factors are adjusted which are in line with the previous finding of Gupta et al. (2020) in Gwalior City.

According to the present study, there was significant association between inadequate iron supplementation during pregnancy and an increased prevalence of wasting in children which highlight the crucial role that maternal nutrition during pregnancy plays in determining the nutritional and general health status of a child. Pregnant women who did not take enough iron supplements had a higher chance of giving birth to children with wasting. It could be because iron deficiency during pregnancy affects the growth and development of the child. Since wasting is mainly characterized by low weight-for-height, is a sign of acute malnutrition and is associated with serious health issues.

The significant association between number of antenatal visits and wasting indicates that children whose mothers attended fewer antenatal visits during pregnancy had a higher prevalence of wasting compared to those whose mothers had more visits(p value <0.001).

Association of overweight with different factors

The odds of a child being overweight are 1.314 times higher (95%CI: 0.147-11.729) when their birth weight is more than 4000 g when adjusted for other variables according to the current finding which was also reported by Ayele et al.(2022) in Sub Saharan Africa, Choi et al. (2022) in Korea and Osei et al. (2022) in Egypt.

Association of feeding practice with malnutrition

The main causes of malnutrition include improper supplementary foods, improper weaning foods, and delayed initiation of breastfeeding. The present study result shows that there was a significant association between underweight status and duration of breastfeeding after introduction of weaning with a p value of 0.041. But

the previous research findings of Haradanhalli et al. (2017) and Varma et al.(2015) in Hyderabad indicate that underweight status was associated with prelacteal feeds, colostrum, exclusive breastfeeding, weaning, and giving food items at the age of 1 year.

The present finding shows that there was no significant association between stunting status and feeding practices of children. The study finding was consistent with the study conducted by Mhamad et al. (2024) in Iraq. In contrast to the present finding, Ahmad et al. (2022) in Lucknow reported that stunting status was found to be significantly associated with colostrums, exclusive breastfeeding, weaning, and giving all food items at the age of 1 year. Abeway et al. (2018) in Ethiopia also found that stunting was significantly associated with starting complementary food at the right time.

There was a significant association between a child's weight for height (wasting) status and the initiation of breastfeeding after birth and their decision to keep breastfeeding after weaning, with a *p* value of 0.020, which was in line with the previous research finding of Palupi et al. (2016) in Indonesia.

The present study finding shows wasting status was significantly associated with duration of breastfeeding after weaning which was not in line with the study finding of Syeda et al. (2021) in Pakistan shows that wasting was not significantly associated with duration of breastfeeding.

Limitations

The limitations of the study were:

- The Anganwadi Centre register was taken as a sampling frame; there may be some children who were not registered in the register.
- Reasons for non-compliance of recommended guidelines and supplementation to be followed during pregnancy and many significant issues regarding feeding practices of young children identified from the study results cannot be explored due to the restriction of the scope of the present study.
- There may be a chance of recall bias where mothers might not provide accurate information.

Recommendation

On the basis of the findings, the following recommendations are made:

- Mothers must be encourage to wash their hands with soap and water during critical periods- before eating, before preparing food, before feeding, after using the restroom, and after cleaning up child faeces.
- The child needs to receive the same level of care when they turn 12 months old. Children should be fed age-appropriate foods to meet the nutritional requirement.
- In order to promote infant feeding practices, mothers need to be informed and educated about initiation of breastfeeding, avoiding pre-lacteal feedings, exclusive breastfeeding, and correct time to start weaning from the beginning of pregnancy. Raising public awareness of the recommendation of feeding and strengthening the intention of mother to breastfeed could lead to adopt correct feeding practice of the children.
- Obstacles to the initiation of breastfeeding within 1 hour need to identify, a policy to be followed in health care setting where delivery takes place to initiate breastfeeding within the recommended hour.
- Non compliance to recommended iron supplementation during pregnancy need immediate action and the possible reasons need to explore. Guidance can be given to mothers for management of side effect of iron tablet. In addition to iron supplementation, motivate the pregnant mothers to increase intake of iron rich diet to maintain the normal hemoglobin level.
- Further study can be conducted on cultural feeding practice and its influence on nutritional status of the children.
- Further study can be conducted on the influence of family on nutrition of the children
- Further research study can be conducted on the practice of pre lacteal feeding, and the reasons for prelacteal feeding can be explored.

Summary

The prevalence of all forms of undernutrition is 26.1 % and the prevalence of overnutrition is 6.9% which shows the existence of a double burden of malnutrition in the study population. The overall prevalence of malnutrition is 33% among the participants indicate high prevalence of malnutrition in the study population. Stunting was the most common form of malnutrition, which denotes malnourished children in the study population have chronic malnutrition. All forms of undernutrition are more prevalent among children who are above 12 months of age, whereas the prevalence of overweight is maximum among the age group of 6–11 months. Among the participants, there were no identified obese children.

Among the participants, 228(97.85%) were able to breastfeed their children. The practice of prelacteal feeding exists from the study result, even though it is not recommended to give prenatal feeding among the newborn baby. Most of the participants 175 (75.9%) are given exclusive breastfeeding and started weaning at the recommended month. Children among the age group of 24-59 months, 67.1 % of the mothers continued breast feeding for 2 years or more. There was a significant association between underweight status and duration of breastfeeding after weaning. There was a significant association between wasting status with initiation of breastfeeding and duration of breastfeeding after weaning.

Birth weight of the child, inadequate iron supplementation during pregnancy and adequacy of antenatal visits during pregnancy were found to be significantly associated with all forms of undernutrition. History of diarrhoea in the past two weeks was significantly associated with underweight and stunting status. Child birth order was not significantly associated with any form of malnutrition which might indicates equal attention and importance are given to all children irrespective of the birth order. Maternal height was found to be significantly associated with underweight and stunting in children. Education of the mother was also found not to have association with malnutrition. They were able to take care of their children irrespective of the educational status

Conclusions

- The significant percentage of malnutrition among participants (33%) suggests that malnutrition is a public health issue affecting children under five that requires prompt care.
- Socio economic condition of the family greatly influence the nutritional status of the children, Children with lower household socioeconomic status were more likely to be underweight.
- The type of family a child lives in affects the nutritional status. Children from joint families showed better nutritional status than those from nuclear families.
- The most prevalent kind of undernutrition among study participants was stunting- a sign of chronic undernutrition in malnourished children.
- Undernutrition is more common in children older than 12 months, and overweight is more common in children younger than 12 months. The prevalence of undernutrition rises with age, which may mean that as a child reaches 12 months, less attention was paid to their nutritional health.
- Young maternal age greatly impacts the nutritional status of the children. Among children whose mothers are 18 years of age or younger, wasting was more prevalent.
- Birth weight plays a significant role in determining the nutritional status of the children. Children with low birth weight were undernourished. Malnutrition at birth seems to continue even in childhood and it is a strong predictors of stunting and wasting. At the same time, high birth weight increases a child to have overweight status.
- The mean age of starting weaning was less than the recommended age of weaning.
- Most of the children were given recommended feeding practice. Exclusive breastfeeding and the duration of breastfeeding are the two feeding practice parameters that require the greatest improvement.
- The duration of breastfeeding was found to be an important underlying determinant of underweight and wasting status.

- Maternal and child characteristics have more influence on the stunting status in children than feeding practice. Stunting status does not have significant association with feeding practices.
- Overweight was mainly influenced by birth weight of the child; feeding practice of the child and maternal characteristics does not affect the child to be in overweight status.
- Among the different maternal characteristics studied in the present investigation, maternal height was found to influence on the child being undernutrition.
- Maternal health during pregnancy was also found to have greatly influence on the nutritional status of the children. Mothers who follow recommended antenatal check up and received adequate supplementation of iron are the important protective factors of malnutrition which emphasizes the significance of ante natal care in preventing malnutrition in children.

APPENDIX-A_1

PERMISSION FROM HUMAN ETHICS COMMITTEE

Human Ethics Committee
MIZORAM UNIVERSITY
A Central University
(Accredited by NAAC with "A Grade")
Aizawl - 796 004, Mizoram, India

No. MZU/ HEC/ 2022/008

Dated: 08.03.2022

To
Laltanpuii
College of Nursing
RIPANS, Zemabawk
Aizawl, Mizoram

The Human Ethics Committee in its meeting held on 05.03.2022 has reviewed and discussed your application to conduct the project entitled; "**Prevalence and its associated risk factors of Malnutrition Among Children**".

The following documents were reviewed:

a. Proposal for Ethics Committee and trial protocol (including protocol amendments)/ project.
b. Participant/ Patient Information Sheet and Informed Consent Form (including updates if any) in, English and/ or vernacular language.
c. Current CV of investigator(s).
d. Insurance Policy/Compensation for participation and for serious adverse events occurring during the study participation, if any.
e. DCGI/DBT/BARC/Hospital / Centre approval letter/submission letter, if any.

Decision of Committee: **Approved**

Member Secretary
Institutional Human Ethics Committee
MZU

Chairman
Institutional Human Ethics Committee
MZU
(DR. JOHN ZOHMINGTHANGA)
MBBS, MD (Path)
Dy. Medical Superintendent
Civil Hospital, Aizawl : Mizoram
Regn. No. MCI-6514

APPENDIX-A_2

PERMISSION OF RESEARCH STUDY

OFFICE OF THE CHIEF MEDICAL OFFICER
AIZAWL EAST DISTRICT : MIZORAM : AIZAWL

No.A.12031/1/2011-CMO'E' : dated 16.01.2023

OFFICE ORDER

Smt. Laltanpuii Ph.D in Nursing Scholar is going to conduct research study on 'Prevalence and its associated risk factors of Malnutrition' among Children under Mizoram University.

In this connection, She is permitted to collect information among children under 5 years and their mother in the area of Aizawl North & East Main Centre.

SD/-
DR.LALPARLIANI
Chief Medical Officer
Aizawl East District

Memo No.A.12031/1/2011-CMO'E'/44 Dated Aizawl, the 16.01.2023

Copy to :-

1. CHO i/c Aizawl North & East Main Centre
2. Person Concern
3. Office copy

16/01/2023
Chief Medical Officer
Aizawl East District

APPENDIX B_1

LETTER REQUESTING CONTENT VALIDITY OF THE TOOL

To,

_____

Subj : Request for expert opinion to establish content validity of the research tool.

Respected Sir,

I, Laltanpuii, PhD in Nursing scholar under the supervision of Dr. Vikas Kumar Roy, Mizoram University and Dr. Lukima Saikia, Regional Nursing College, Guwahati have selected the under mentioned topic for my dissertation to be submitted to the Mizoram University in the partial fulfillment of the University requirements for the award of Ph.D in Nursing degree. **Topic - Prevalence and its associated risk factors of malnutrition among children.**

Herewith I have enclosed :

1. Objectives of the study
2. Research tool: **Part I** Demographic data
   Part II Anthropometric measurement
   Part III Risk factors of malnutrition
3. Evaluation criteria check list
4. Validation certificate

I request you to kindly go through the tool and give your expert opinion for any modification and improvement needed in the content. I shall be grateful to you for giving your valuable remarks and suggestions.

Thanking you

Dated :

Yours sincerely,

(LALTANPUII)

APPENDIX B_2

CERTIFICATE OF VALIDATION

This is to certify that the tool

Part I : Background information

Part II : Anthropometric measurement of the Child

Part III : Risk factor of malnutrition

Prepared for data collection by Laltanpuii, Ph.D in Nursing scholar of Mizoram University, who has undertaken the study on "**Prevalence and its associated risk factors of malnutrition among children**" been validated by me.

Signature of the expert

Name : _____

Designation : _____

Date : _____

APPENDIX B_3

CRITERIA CHECK-LIST FOR VALIDATION OF RESEARCH TOOL

Respected Sir/Madam,

Kindly give your expert opinion and suggestions on the basis of mentioned criteria. Kindly put a tick (√) mark in the column provided against each section of the tool.

Sections of the tools		Relevance				Clarity				Remarks
		No relevance at all (1)	Item is somewhat relevant (2)	Item is quite relevant (3)	Items is highly relevant (4)	Not clear (1)	Item need some revision (2)	Clear but need minor revision (3)	Very clear (4)	
PART I **Section A: Identification information**										
Section B: Profile of the child and family										
1	Age of the child									
2	Sex of the child									
3	Child's weight at birth									
4	Status of immunization									

5	Mother's age at birth									
6	Education of the mother									
7	Type of family									
8	Religion of family									
9	No of family members									
10	Meal eating frequency per day in the family									
Section D										
(i)	Mothers practice regarding child's nutrition									
(ii)	Mothers practice regarding hygiene									
PART II **Anthropometric measurement of the child**										
PART III **(i) Risk factor of under nutrition at the child level**										
1	Child's birth weight									
2	Terms of pregnancy at birth									

3	Status of immunization									
4	Child's rank/ order among live siblings									
5	The child was not fed on breastfed									
6	Time of initiation of breastfeeding after birth									
7	Pre lacteal feed was given									
8	Duration of exclusive breastfeeding									
9	The child was fed on bottle fed									
10	Time of introduction of complementary foods									
11	Frequency of meal in a day									
12	History of diarrhoea in the past 2 weeks									
13	History of cold and fever in the past 2 weeks									

(ii) Risk factor of under nutrition at the mother and household level										
1	Maternal age at child's birth									
2	Maternal height									
3	Educational status									
4	Birth interval									
5	Inadequate iron supplementation during pregnancy									
6	Number of antenatal clinic visit during pregnancy									
7	Inadequate hygiene practice by the mother									
8	Socio economic class of the family									
9	No of family members									

(iii) Risk factor of over nutrition										
1	Child's birth weight									
2	Number of siblings									
3	The child was never fed on breastfed									
4	Duration of exclusive breastfeeding									
5	The child was fed on bottle fed									
6	Duration of continued breastfeeding after weaning									
7	Socio economic class of the family									

APPENDIX B_4

LIST OF EXPERTS

Sl. No	Name of the Validator	Designation	Signature with Seal
1	Dr.M.Hemamalini Ph. D	Principal Hindu Mission College of Nursing West Tambaram Chennai 45	Signature of the expert NAME : DR. M. Hemamalini DESIGNATION : Principal DATE : 11/2/22
2	Dr.S.Vasanthakumari	Associate Professor (Pediatric Nursing) Institute of Health Sciences WOLLEGA UNIVERSITY Ethiopia	Signature of the expert NAME: Dr. S. VASANTHAKUMARI DESIGNATION: ASSOCIATE PROFESSOR DEPARTMENT OF PEDIATRICS NEONATAL NURSING, INSTITUTE OF HEALTH SCIENCES WOLLEGA UNIVERSITY ETHIOPIA DATE: 30/5/2023
3	Dr. F. Elizabeth Lalhmangaihzuali	Associate Professor Department of Pediatrics Zoram Medical College (ZMC)	Signature of the expert NAME:Dr.F.Elizabeth Lalhmangaihzuali DESIGNATION: Associate Professor Paediatrics Dept. Zoram Medical College Falkawn, Mizoram DATE: 20/2/22
4	Dr. C. Vankhuma	Assistant Professor Department of Community Medicine Zoram Medical College (ZMC)	Signature of the expert NAME : Dr. C. VANKHUMA DESIGNATION: Assistant Professor, Community Medicine DATE : 11/02/2022
5	Dr.Lalrochhuanga	Senior Resident Department of Pediatrics Civil Hospital, Aizawl	Dr.Lalrochhuanga Consultant, Dept. of Pediatrics Civil Hospital, Aizawl Signature of the expert NAME : Dr. LALROCHHUANGA DESIGNATION : CONSULTANT DATE : 16.02.2022

APPENDIX B_5

DATA COLLECTION TOOL

PART I: **Interview schedule for background data of the family and child and practice regarding child's nutrition**

Purpose: The structured interview schedule is developed to collect background data of the child and family and practice of child's nutrition and hygienic practice.

Instruction : The investigator will give a tick mark (√) against the data given.

Section A **Identification Information**

Schedule No._____ Date: _____

Section B **Profile of the child and family**

1	Age of the child				
	1.1 6-11 months	☐	1.2	12-23 months	☐
	1.3 24-35 months	☐	1.4	36-47 months	☐
	1.5 48-59 months	☐			
2	Sex of the child				
	2.1 Male	☐	2.2	Female	☐
	2.3 Transgender	☐			
3	Child's weight at birth				☐
	3.1 <2500	☐	3.2	2501-4000	☐
	3.3 >4001	☐			
4	Status of immunization				
	4.1 Full immunization	☐	4.2	Partial immunization	☐
	4.3 No immunization	☐			
5	Mother's age at birth(years)				☐
	5.1 ≤18	☐	5.2	19- 34	☐
	5.3 ≥35	☐			
6	Education of the mother				
	6.1 No formal education	☐	6.2	Primary	☐
	6.3 Middle	☐	6.4	Secondary	☐
	6.5 Higher secondary	☐	6.6	Graduate and above	☐
7	Type of family				
	7.1 Nuclear	☐	7.2	Joint family	☐
	7.3 Extended family	☐	7.4	Single parent family	☐

8 Religion of the family

8.1	Christian	☐	8.2	Hindu	☐
8.3	Muslim	☐	8.4	Bhudist	☐
8.5	Other (Specify)				

9 No of family members

9.1	2	☐	9.2	3	☐
9.3	4		9.4	5 or more	☐

10 Meal eating frequency per day in the family

10.1	Once	☐	10.2	2 times	☐
10.3	3 times	☐	10.4	More than 3 times	☐

Section C: (i) Socio-Economic Condition of the Family

Kuppuswamy's socio-economic status scale- 2021

Occupation of the head of the family

Sl. No	Occupation of the Head	Score
1	Legislators, Senior Officials & Managers	10
2	Professionals	9
3	Technicians and Associate Professionals	8
4	Clerks	7
5	Skilled Workers and Shop & Market Sales Workers	6
6	Skilled Agricultural & Fishery Workers	5
7	Craft & Related Trade Workers	4
8	Plant & Machine Operators and Assemblers	3
9	Elementary Occupation	2
10	Unemployed	1

☐

Education of the head of the family

Sl. No	Education of the Head	Score
1	Profession or Honours	7
2	Graduate	6
3	Intermediate or diploma	5
4	High school certificate	4
5	Middle school certificate	3
6	Primary school certificate	2
7	Illiterate	1

☐

Total monthly income of the family

Sl. No	Updated Monthly Family Income in Rupees (2021)	Score
1	≥ 123,322	12
2	61,663–123,321	10
3	461,29-61,662	6
4	30,831–46,128	4
5	18,497-30,830	3
6	6,175-18,496	2
7	≤ 6,174	1

Sl. No	Score	Socioeconomic Class
1	26-29	Upper (I)
2	16-25	Upper Middle (II)
3	11-15	Lower Middle (III)
4	5-10	Upper Lower (IV)
5	<5	Lower (V)

Section D: Mother's practice regarding child's nutrition and hygiene

(i)Practice regarding child's nutrition

1. Did you feed your baby any substance other than breast milk before initiation of breast feeding? Yes/ No

If yes, what did you give to your baby? _____

2. When did you start breastfeeding after birth? _____
3. Did you exclusively breastfed your child? Yes/ No

If yes, for how long did you exclusively breastfed your child?____(in months)

4. At what age did you start weaning to your child (in months)? _____
5. How long you continued breastfeeding after introduction of weaning _____

(ii) Mother's hygienic practice

Sl No	Hygienic Practice	Remark
1	Washing hands with soap and water before eating	
2	Washing hands with soap and water before preparing food	
3	Washing hands with soap and water before feeding the baby	
4	Washing hands with soap and water after using toilet	
5	Washing hands with soap and water after disposing excreta in the toilet	

PART-II : Anthropometric measurement of the Child

Purpose : To assess the nutritional status of the child

Instruction: Investigator will measure the child's weight and height/length, put the findings in the space given in the box.

1	Child's age on the date of interview:	months
2	Child's weight on the interview's date:	Kilogram
3	Child's height/ length on the interview's date:	centimetre
4	Child's weight for length/height	
5	Mid upper arm circumference	centimetre

PART-III

Risk factors of malnutrition

Purpose: The structured interview schedule is developed to identify risk factors of malnutrition

Instruction : The investigator will give a tick mark (√) against the correct option.

(i) Risk factor of under nutrition at the child level

1	Child's birth weight				
	1.1 < 2500gm	☐	1.2	2501-4000	☐
	1.3 >4001	☐			☐
2	Terms or pre term at birth				
	2.1 Preterm	☐	2.2	Full term	☐
	2.3 Post term	☐			☐
3	Status of immunization				
	3.1 Fully Immunized	☐	3.2	Partially Immunized	☐
	3.3 Non Immunized	☐			☐
4	Child's rank/ order among live siblings				
	4.1 1	☐	4.2	2	☐
	4.3 3 or more	☐			☐
5	The child was not breastfed				
	5.1 Yes	☐	5.2	No	☐
6	Time of initiation of breastfeeding after birth				
	6.1 Within 1 hour	☐	6.2	Between 1-24 hours	☐
	6.3 After 24 hours	☐			☐
7	Pre lacteal feed was given				
	6.1 Yes	☐	6.2	No	☐
8	Exclusive breastfeeding done				
	7.1 <6 months	☐	7.2	>6 months	☐
9	The child was fed on bottle fed				
	8.1 Yes	☐	8.2	No	☐
10	Time of introduction of weaning				
	9.1 <6 months	☐	9.2	Between 6-12 months	☐
	9.3 After 12 months	☐			☐
11	Frequency of meal in a day				☐
	10.1 1 time	☐	10.2	2-3times	☐
	10.3 3-4 times	☐	10.4	>4 times	☐
12	History of diarrhoea in the past 2 weeks				
	10.1 Yes	☐	10.2	No	☐
13	History of cold and fever in the past 2 weeks				
	11.1 Yes	☐	11.2	No	☐

(ii) Risk factor of under nutrition at the mother and household level

1 Maternal age at child's birth

1.1 ≤18 ☐ 1.2 18-35 ☐

≥35 ☐

2 Maternal height below 145 cm

2.1 Yes ☐ 2.2 No ☐

3 Educational status

4.1 No formal education ☐ 4.2 Primary ☐

4.3 Middle ☐ 4.4 Secondary ☐

4.5 Higher secondary ☐ 4.6 Graduate and above ☐

4 Birth interval

5.1 First born ☐ 5.2 <24 months ☐

5.3 24-35 months ☐ 5.4 36-47 months ☐

5.5 48 months and above ☐

5 Inadequate iron supplementation during pregnancy

6.1 Yes ☐ 6.2 No ☐

6 Number of antenatal clinic visit during pregnancy

7.1 3 or less ☐ 7.2 4 or more ☐

7 Inadequate hygiene practice by the mother

8.1 Yes ☐ 8.2 No ☐

8 Socio economic class of the family

9.1 I ☐ 9.2 II ☐

9.3 III ☐ 9.4 IV

9.3 V ☐

9 No of family members

10.1 ≤5 ☐ 10.2 >5 ☐

(iii) Risk factor of over nutrition

1 Child's birth weight (gm)

1.1 <2500 ☐ 1.2 2500-4000 ☐

>4001 ☐

2 Number of siblings

2.1 No sibling living with the child ☐ 2.2 1 ☐

2.3 2 ☐ 2.4 ≥3 ☐

3 The child was not breastfed since birth

4.1 Yes ☐ 4.2 No ☐

4 Exclusive breastfeeding done

5.1 <6 months ☐ 5.2 ≥ 6 months ☐

5 The child was bottle fed

6.1 Yes ☐ 6.2 No ☐

6 Duration of breastfeeding after starting complementary feeding

7.1 < 1 year ☐ 7.2 1-2 years ☐

7.3 ≥2 years ☐

7 Socio economic class of the family

8.1 I ☐ 8.2 II ☐

8.3 III ☐ 8.4 IV ☐

8.5 V ☐

APPENDIX- C

INFORMED CONSENT

You are invited to participate in research topic on '**Prevalence and its associated risk factors of malnutrition among children**'. This is a research project being conducted by Ms. Laltanpuii, Ph.D in Nursing scholar of Mizoram University. It will take approximately 15 minutes to collect information and measuring the child growth parameters.

Participation Your participation in this research is voluntary. You may refuse to take part in the research or exit the research at any time without penalty.

Benefits You will receive no direct benefits from participating in this research study. Your participation will help to know more about malnutrition and its associated risk factors among children of Mizoram. You will be able to know your child's nutritional status from the growth parameter we are going to measure.

Risks There are no risks involved in participating in this study.

Confidentiality Information collected will be kept confidential, no one will be able to identify you or your answers, your response will remain anonymous. If you have questions at any time about the study or the procedures, you may contact my research supervisor, Associate Professor Dr. Vikas Kumar Roy via phone no at 8794821930 or via email at vikasroy4araria@gmail.

I have been informed about all the aspects of the study, the procedures and I am hereby giving consent in a fully mentally fit state to be included in the study done by Ms. Laltanpuii by my own will.

Signature of the witness **Signature of the mother**

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Investigator
Ms. Laltanpuii
Phone: 9774401421

APPENDIX- D

WHO GROWTH STANDARD

Length-for-age BOYS
Birth to 2 years (z-scores)

World Health Organization

Year: Month	Months	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
0: 0	0	44.2	46.1	48.0	49.9	51.8	53.7	55.6
0: 1	1	48.9	50.8	52.8	54.7	56.7	58.6	60.6
0: 2	2	52.4	54.4	56.4	58.4	60.4	62.4	64.4
0: 3	3	55.3	57.3	59.4	61.4	63.5	65.5	67.6
0: 4	4	57.6	59.7	61.8	63.9	66.0	68.0	70.1
0: 5	5	59.6	61.7	63.8	65.9	68.0	70.1	72.2
0: 6	6	61.2	63.3	65.5	67.6	69.8	71.9	74.0
0: 7	7	62.7	64.8	67.0	69.2	71.3	73.5	75.7
0: 8	8	64.0	66.2	68.4	70.6	72.8	75.0	77.2
0: 9	9	65.2	67.5	69.7	72.0	74.2	76.5	78.7
0:10	10	66.4	68.7	71.0	73.3	75.6	77.9	80.1
0:11	11	67.6	69.9	72.2	74.5	76.9	79.2	81.5
1: 0	12	68.6	71.0	73.4	75.7	78.1	80.5	82.9
1: 1	13	69.6	72.1	74.5	76.9	79.3	81.8	84.2
1: 2	14	70.6	73.1	75.6	78.0	80.5	83.0	85.5
1: 3	15	71.6	74.1	76.6	79.1	81.7	84.2	86.7
1: 4	16	72.5	75.0	77.6	80.2	82.8	85.4	88.0
1: 5	17	73.3	76.0	78.6	81.2	83.9	86.5	89.2
1: 6	18	74.2	76.9	79.6	82.3	85.0	87.7	90.4
1: 7	19	75.0	77.7	80.5	83.2	86.0	88.8	91.5
1: 8	20	75.8	78.6	81.4	84.2	87.0	89.8	92.6
1: 9	21	76.5	79.4	82.3	85.1	88.0	90.9	93.8
1:10	22	77.2	80.2	83.1	86.0	89.0	91.9	94.9
1:11	23	78.0	81.0	83.9	86.9	89.9	92.9	95.9
2: 0	24	78.7	81.7	84.8	87.8	90.9	93.9	97.0

Height-for-age BOYS
2 to 5 years (z-scores)

World Health Organization

Year: Month	Months	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
2: 0	24	78.0	81.0	84.1	87.1	90.2	93.2	96.3
2: 1	25	78.6	81.7	84.9	88.0	91.1	94.2	97.3
2: 2	26	79.3	82.5	85.6	88.8	92.0	95.2	98.3
2: 3	27	79.9	83.1	86.4	89.6	92.9	96.1	99.3
2: 4	28	80.5	83.8	87.1	90.4	93.7	97.0	100.3
2: 5	29	81.1	84.5	87.8	91.2	94.5	97.9	101.2
2: 6	30	81.7	85.1	88.5	91.9	95.3	98.7	102.1
2: 7	31	82.3	85.7	89.2	92.7	96.1	99.6	103.0
2: 8	32	82.8	86.4	89.9	93.4	96.9	100.4	103.9
2: 9	33	83.4	86.9	90.5	94.1	97.6	101.2	104.8
2:10	34	83.9	87.5	91.1	94.8	98.4	102.0	105.6
2:11	35	84.4	88.1	91.8	95.4	99.1	102.7	106.4
3: 0	36	85.0	88.7	92.4	96.1	99.8	103.5	107.2
3: 1	37	85.5	89.2	93.0	96.7	100.5	104.2	108.0
3: 2	38	86.0	89.8	93.6	97.4	101.2	105.0	108.8
3: 3	39	86.5	90.3	94.2	98.0	101.8	105.7	109.5
3: 4	40	87.0	90.9	94.7	98.6	102.5	106.4	110.3
3: 5	41	87.5	91.4	95.3	99.2	103.2	107.1	111.0
3: 6	42	88.0	91.9	95.9	99.9	103.8	107.8	111.7
3: 7	43	88.4	92.4	96.4	100.4	104.5	108.5	112.5
3: 8	44	88.9	93.0	97.0	101.0	105.1	109.1	113.2
3: 9	45	89.4	93.5	97.5	101.6	105.7	109.8	113.9
3:10	46	89.8	94.0	98.1	102.2	106.3	110.4	114.6
3:11	47	90.3	94.4	98.6	102.8	106.9	111.1	115.2
4: 0	48	90.7	94.9	99.1	103.3	107.5	111.7	115.9
4: 1	49	91.2	95.4	99.7	103.9	108.1	112.4	116.6
4: 2	50	91.6	95.9	100.2	104.4	108.7	113.0	117.3
4: 3	51	92.1	96.4	100.7	105.0	109.3	113.6	117.9

Length-for-age GIRLS
Birth to 2 years (z-scores)

World Health Organization

Year: Month	Months	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
0: 0	0	43.6	45.4	47.3	49.1	51.0	52.9	54.7
0: 1	1	47.8	49.8	51.7	53.7	55.6	57.6	59.5
0: 2	2	51.0	53.0	55.0	57.1	59.1	61.1	63.2
0: 3	3	53.5	55.6	57.7	59.8	61.9	64.0	66.1
0: 4	4	55.6	57.8	59.9	62.1	64.3	66.4	68.6
0: 5	5	57.4	59.6	61.8	64.0	66.2	68.5	70.7
0: 6	6	58.9	61.2	63.5	65.7	68.0	70.3	72.5
0: 7	7	60.3	62.7	65.0	67.3	69.6	71.9	74.2
0: 8	8	61.7	64.0	66.4	68.7	71.1	73.5	75.8
0: 9	9	62.9	65.3	67.7	70.1	72.6	75.0	77.4
0:10	10	64.1	66.5	69.0	71.5	73.9	76.4	78.9
0:11	11	65.2	67.7	70.3	72.8	75.3	77.8	80.3
1: 0	12	66.3	68.9	71.4	74.0	76.6	79.2	81.7
1: 1	13	67.3	70.0	72.6	75.2	77.8	80.5	83.1
1: 2	14	68.3	71.0	73.7	76.4	79.1	81.7	84.4
1: 3	15	69.3	72.0	74.8	77.5	80.2	83.0	85.7
1: 4	16	70.2	73.0	75.8	78.6	81.4	84.2	87.0
1: 5	17	71.1	74.0	76.8	79.7	82.5	85.4	88.2
1: 6	18	72.0	74.9	77.8	80.7	83.6	86.5	89.4
1: 7	19	72.8	75.8	78.8	81.7	84.7	87.6	90.6
1: 8	20	73.7	76.7	79.7	82.7	85.7	88.7	91.7
1: 9	21	74.5	77.5	80.6	83.7	86.7	89.8	92.9
1:10	22	75.2	78.4	81.5	84.6	87.7	90.8	94.0
1:11	23	76.0	79.2	82.3	85.5	88.7	91.9	95.0
2: 0	24	76.7	80.0	83.2	86.4	89.6	92.9	96.1

Height-for-age GIRLS
2 to 5 years (z-scores)

World Health Organization

Year: Month	Months	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
2: 0	24	76.0	79.3	82.5	85.7	88.9	92.2	95.4
2: 1	25	76.8	80.0	83.3	86.6	89.9	93.1	96.4
2: 2	26	77.5	80.8	84.1	87.4	90.8	94.1	97.4
2: 3	27	78.1	81.5	84.9	88.3	91.7	95.0	98.4
2: 4	28	78.8	82.2	85.7	89.1	92.5	96.0	99.4
2: 5	29	79.5	82.9	86.4	89.9	93.4	96.9	100.3
2: 6	30	80.1	83.6	87.1	90.7	94.2	97.7	101.3
2: 7	31	80.7	84.3	87.9	91.4	95.0	98.6	102.2
2: 8	32	81.3	84.9	88.6	92.2	95.8	99.4	103.1
2: 9	33	81.9	85.6	89.3	92.9	96.6	100.3	103.9
2:10	34	82.5	86.2	89.9	93.6	97.4	101.1	104.8
2:11	35	83.1	86.8	90.6	94.4	98.1	101.9	105.6
3: 0	36	83.6	87.4	91.2	95.1	98.9	102.7	106.5
3: 1	37	84.2	88.0	91.9	95.7	99.6	103.4	107.3
3: 2	38	84.7	88.6	92.5	96.4	100.3	104.2	108.1
3: 3	39	85.3	89.2	93.1	97.1	101.0	105.0	108.9
3: 4	40	85.8	89.8	93.8	97.7	101.7	105.7	109.7
3: 5	41	86.3	90.4	94.4	98.4	102.4	106.4	110.5
3: 6	42	86.8	90.9	95.0	99.0	103.1	107.2	111.2
3: 7	43	87.4	91.5	95.6	99.7	103.8	107.9	112.0
3: 8	44	87.9	92.0	96.2	100.3	104.5	108.6	112.7
3: 9	45	88.4	92.5	96.7	100.9	105.1	109.3	113.5
3:10	46	88.9	93.1	97.3	101.5	105.8	110.0	114.2
3:11	47	89.3	93.6	97.9	102.1	106.4	110.7	114.9
4: 0	48	89.8	94.1	98.4	102.7	107.0	111.3	115.7
4: 1	49	90.3	94.6	99.0	103.3	107.7	112.0	116.4
4: 2	50	90.7	95.1	99.5	103.9	108.3	112.7	117.1
4: 3	51	91.2	95.6	100.1	104.5	108.9	113.3	117.7

Weight-for-age BOYS
Birth to 5 years (z-scores)

World Health Organization

Year: Month	Months	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
2: 6	30	9.4	10.5	11.8	13.3	15.0	16.9	19.0
2: 7	31	9.5	10.7	12.0	13.5	15.2	17.1	19.3
2: 8	32	9.6	10.8	12.1	13.7	15.4	17.4	19.6
2: 9	33	9.7	10.9	12.3	13.8	15.6	17.6	19.9
2:10	34	9.8	11.0	12.4	14.0	15.8	17.8	20.2
2:11	35	9.9	11.2	12.6	14.2	16.0	18.1	20.4
3: 0	36	10.0	11.3	12.7	14.3	16.2	18.3	20.7
3: 1	37	10.1	11.4	12.9	14.5	16.4	18.6	21.0
3: 2	38	10.2	11.5	13.0	14.7	16.6	18.8	21.3
3: 3	39	10.3	11.6	13.1	14.8	16.8	19.0	21.6
3: 4	40	10.4	11.8	13.3	15.0	17.0	19.3	21.9
3: 5	41	10.5	11.9	13.4	15.2	17.2	19.5	22.1
3: 6	42	10.6	12.0	13.6	15.3	17.4	19.7	22.4
3: 7	43	10.7	12.1	13.7	15.5	17.6	20.0	22.7
3: 8	44	10.8	12.2	13.8	15.7	17.8	20.2	23.0
3: 9	45	10.9	12.4	14.0	15.8	18.0	20.5	23.3
3:10	46	11.0	12.5	14.1	16.0	18.2	20.7	23.6
3:11	47	11.1	12.6	14.3	16.2	18.4	20.9	23.9
4: 0	48	11.2	12.7	14.4	16.3	18.6	21.2	24.2
4: 1	49	11.3	12.8	14.5	16.5	18.8	21.4	24.5
4: 2	50	11.4	12.9	14.7	16.7	19.0	21.7	24.8
4: 3	51	11.5	13.1	14.8	16.8	19.2	21.9	25.1
4: 4	52	11.6	13.2	15.0	17.0	19.4	22.2	25.4
4: 5	53	11.7	13.3	15.1	17.2	19.6	22.4	25.7
4: 6	54	11.8	13.4	15.2	17.3	19.8	22.7	26.0
4: 7	55	11.9	13.5	15.4	17.5	20.0	22.9	26.3
4: 8	56	12.0	13.6	15.5	17.7	20.2	23.2	26.6
4: 9	57	12.1	13.7	15.6	17.8	20.4	23.4	26.9
4:10	58	12.2	13.8	15.8	18.0	20.6	23.7	27.2
4:11	59	12.3	14.0	15.9	18.2	20.8	23.9	27.6
5: 0	60	12.4	14.1	16.0	18.3	21.0	24.2	27.9

Weight-for-age GIRLS
Birth to 5 years (z-scores)

World Health Organization

Year: Month	Months	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
0: 0	0	2.0	2.4	2.8	3.2	3.7	4.2	4.8
0: 1	1	2.7	3.2	3.6	4.2	4.8	5.5	6.2
0: 2	2	3.4	3.9	4.5	5.1	5.8	6.6	7.5
0: 3	3	4.0	4.5	5.2	5.8	6.6	7.5	8.5
0: 4	4	4.4	5.0	5.7	6.4	7.3	8.2	9.3
0: 5	5	4.8	5.4	6.1	6.9	7.8	8.8	10.0
0: 6	6	5.1	5.7	6.5	7.3	8.2	9.3	10.6
0: 7	7	5.3	6.0	6.8	7.6	8.6	9.8	11.1
0: 8	8	5.6	6.3	7.0	7.9	9.0	10.2	11.6
0: 9	9	5.8	6.5	7.3	8.2	9.3	10.5	12.0
0:10	10	5.9	6.7	7.5	8.5	9.6	10.9	12.4
0:11	11	6.1	6.9	7.7	8.7	9.9	11.2	12.8
1: 0	12	6.3	7.0	7.9	8.9	10.1	11.5	13.1
1: 1	13	6.4	7.2	8.1	9.2	10.4	11.8	13.5
1: 2	14	6.6	7.4	8.3	9.4	10.6	12.1	13.8
1: 3	15	6.7	7.6	8.5	9.6	10.9	12.4	14.1
1: 4	16	6.9	7.7	8.7	9.8	11.1	12.6	14.5
1: 5	17	7.0	7.9	8.9	10.0	11.4	12.9	14.8
1: 6	18	7.2	8.1	9.1	10.2	11.6	13.2	15.1
1: 7	19	7.3	8.2	9.2	10.4	11.8	13.5	15.4
1: 8	20	7.5	8.4	9.4	10.6	12.1	13.7	15.7
1: 9	21	7.6	8.6	9.6	10.9	12.3	14.0	16.0
1:10	22	7.8	8.7	9.8	11.1	12.5	14.3	16.4
1:11	23	7.9	8.9	10.0	11.3	12.8	14.6	16.7
2: 0	24	8.1	9.0	10.2	11.5	13.0	14.8	17.0
2: 1	25	8.2	9.2	10.3	11.7	13.3	15.1	17.3
2: 2	26	8.4	9.4	10.5	11.9	13.5	15.4	17.7
2: 3	27	8.5	9.5	10.7	12.1	13.7	15.7	18.0
2: 4	28	8.6	9.7	10.9	12.3	14.0	16.0	18.3
2: 5	29	8.8	9.8	11.1	12.5	14.2	16.2	18.7

Weight-for-length BOYS
Birth to 2 years (z-scores)

World Health Organization

cm	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
45.0	1.9	2.0	2.2	2.4	2.7	3.0	3.3
45.5	1.9	2.1	2.3	2.5	2.8	3.1	3.4
46.0	2.0	2.2	2.4	2.6	2.9	3.1	3.5
46.5	2.1	2.3	2.5	2.7	3.0	3.2	3.6
47.0	2.1	2.3	2.5	2.8	3.0	3.3	3.7
47.5	2.2	2.4	2.6	2.9	3.1	3.4	3.8
48.0	2.3	2.5	2.7	2.9	3.2	3.6	3.9
48.5	2.3	2.6	2.8	3.0	3.3	3.7	4.0
49.0	2.4	2.6	2.9	3.1	3.4	3.8	4.2
49.5	2.5	2.7	3.0	3.2	3.5	3.9	4.3
50.0	2.6	2.8	3.0	3.3	3.6	4.0	4.4
50.5	2.7	2.9	3.1	3.4	3.8	4.1	4.5
51.0	2.7	3.0	3.2	3.5	3.9	4.2	4.7
51.5	2.8	3.1	3.3	3.6	4.0	4.4	4.8
52.0	2.9	3.2	3.5	3.8	4.1	4.5	5.0
52.5	3.0	3.3	3.6	3.9	4.2	4.6	5.1
53.0	3.1	3.4	3.7	4.0	4.4	4.8	5.3
53.5	3.2	3.5	3.8	4.1	4.5	4.9	5.4
54.0	3.3	3.6	3.9	4.3	4.7	5.1	5.6
54.5	3.4	3.7	4.0	4.4	4.8	5.3	5.8
55.0	3.6	3.8	4.2	4.5	5.0	5.4	6.0
55.5	3.7	4.0	4.3	4.7	5.1	5.6	6.1
56.0	3.8	4.1	4.4	4.8	5.3	5.8	6.3
56.5	3.9	4.2	4.6	5.0	5.4	5.9	6.5
57.0	4.0	4.3	4.7	5.1	5.6	6.1	6.7
57.5	4.1	4.5	4.9	5.3	5.7	6.3	6.9
58.0	4.3	4.6	5.0	5.4	5.9	6.4	7.1
58.5	4.4	4.7	5.1	5.6	6.1	6.6	7.2
59.0	4.5	4.8	5.3	5.7	6.2	6.8	7.4
59.5	4.6	5.0	5.4	5.9	6.4	7.0	7.6

Weight-for-height BOYS
2 to 5 years (z-scores)

World Health Organization

cm	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
65.0	5.9	6.3	6.9	7.4	8.1	8.8	9.6
65.5	6.0	6.4	7.0	7.6	8.2	8.9	9.8
66.0	6.1	6.5	7.1	7.7	8.3	9.1	9.9
66.5	6.1	6.6	7.2	7.8	8.5	9.2	10.1
67.0	6.2	6.7	7.3	7.9	8.6	9.4	10.2
67.5	6.3	6.8	7.4	8.0	8.7	9.5	10.4
68.0	6.4	6.9	7.5	8.1	8.8	9.6	10.5
68.5	6.5	7.0	7.6	8.2	9.0	9.8	10.7
69.0	6.6	7.1	7.7	8.4	9.1	9.9	10.8
69.5	6.7	7.2	7.8	8.5	9.2	10.0	11.0
70.0	6.8	7.3	7.9	8.6	9.3	10.2	11.1
70.5	6.9	7.4	8.0	8.7	9.5	10.3	11.3
71.0	6.9	7.5	8.1	8.8	9.6	10.4	11.4
71.5	7.0	7.6	8.2	8.9	9.7	10.6	11.6
72.0	7.1	7.7	8.3	9.0	9.8	10.7	11.7
72.5	7.2	7.8	8.4	9.1	9.9	10.8	11.8
73.0	7.3	7.9	8.5	9.2	10.0	11.0	12.0
73.5	7.4	7.9	8.6	9.3	10.2	11.1	12.1
74.0	7.4	8.0	8.7	9.4	10.3	11.2	12.2
74.5	7.5	8.1	8.8	9.5	10.4	11.3	12.4
75.0	7.6	8.2	8.9	9.6	10.5	11.4	12.5
75.5	7.7	8.3	9.0	9.7	10.6	11.6	12.6
76.0	7.7	8.4	9.1	9.8	10.7	11.7	12.8
76.5	7.8	8.5	9.2	9.9	10.8	11.8	12.9
77.0	7.9	8.5	9.2	10.0	10.9	11.9	13.0
77.5	8.0	8.6	9.3	10.1	11.0	12.0	13.1
78.0	8.0	8.7	9.4	10.2	11.1	12.1	13.3
78.5	8.1	8.8	9.5	10.3	11.2	12.2	13.4
79.0	8.2	8.8	9.6	10.4	11.3	12.3	13.5
79.5	8.3	8.9	9.7	10.5	11.4	12.4	13.6

Weight-for-length GIRLS
Birth to 2 years (z-scores)

World Health Organization

cm	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
45.0	1.9	2.1	2.3	2.5	2.7	3.0	3.3
45.5	2.0	2.1	2.3	2.5	2.8	3.1	3.4
46.0	2.0	2.2	2.4	2.6	2.9	3.2	3.5
46.5	2.1	2.3	2.5	2.7	3.0	3.3	3.6
47.0	2.2	2.4	2.6	2.8	3.1	3.4	3.7
47.5	2.2	2.4	2.6	2.9	3.2	3.5	3.8
48.0	2.3	2.5	2.7	3.0	3.3	3.6	4.0
48.5	2.4	2.6	2.8	3.1	3.4	3.7	4.1
49.0	2.4	2.6	2.9	3.2	3.5	3.8	4.2
49.5	2.5	2.7	3.0	3.3	3.6	3.9	4.3
50.0	2.6	2.8	3.1	3.4	3.7	4.0	4.5
50.5	2.7	2.9	3.2	3.5	3.8	4.2	4.6
51.0	2.8	3.0	3.3	3.6	3.9	4.3	4.8
51.5	2.8	3.1	3.4	3.7	4.0	4.4	4.9
52.0	2.9	3.2	3.5	3.8	4.2	4.6	5.1
52.5	3.0	3.3	3.6	3.9	4.3	4.7	5.2
53.0	3.1	3.4	3.7	4.0	4.4	4.9	5.4
53.5	3.2	3.5	3.8	4.2	4.6	5.0	5.5
54.0	3.3	3.6	3.9	4.3	4.7	5.2	5.7
54.5	3.4	3.7	4.0	4.4	4.8	5.3	5.9
55.0	3.5	3.8	4.2	4.5	5.0	5.5	6.1
55.5	3.6	3.9	4.3	4.7	5.1	5.7	6.3
56.0	3.7	4.0	4.4	4.8	5.3	5.8	6.4
56.5	3.8	4.1	4.5	5.0	5.4	6.0	6.6
57.0	3.9	4.3	4.6	5.1	5.6	6.1	6.8
57.5	4.0	4.4	4.8	5.2	5.7	6.3	7.0
58.0	4.1	4.5	4.9	5.4	5.9	6.5	7.1
58.5	4.2	4.6	5.0	5.5	6.0	6.6	7.3
59.0	4.3	4.7	5.1	5.6	6.2	6.8	7.5
59.5	4.4	4.8	5.3	5.7	6.3	6.9	7.7

Weight-for-height GIRLS
2 to 5 years (z-scores)

World Health Organization

cm	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
65.0	5.6	6.1	6.6	7.2	7.9	8.7	9.7
65.5	5.7	6.2	6.7	7.4	8.1	8.9	9.8
66.0	5.8	6.3	6.8	7.5	8.2	9.0	10.0
66.5	5.8	6.4	6.9	7.6	8.3	9.1	10.1
67.0	5.9	6.4	7.0	7.7	8.4	9.3	10.2
67.5	6.0	6.5	7.1	7.8	8.5	9.4	10.4
68.0	6.1	6.6	7.2	7.9	8.7	9.5	10.5
68.5	6.2	6.7	7.3	8.0	8.8	9.7	10.7
69.0	6.3	6.8	7.4	8.1	8.9	9.8	10.8
69.5	6.3	6.9	7.5	8.2	9.0	9.9	10.9
70.0	6.4	7.0	7.6	8.3	9.1	10.0	11.1
70.5	6.5	7.1	7.7	8.4	9.2	10.1	11.2
71.0	6.6	7.1	7.8	8.5	9.3	10.3	11.3
71.5	6.7	7.2	7.9	8.6	9.4	10.4	11.5
72.0	6.7	7.3	8.0	8.7	9.5	10.5	11.6
72.5	6.8	7.4	8.1	8.8	9.7	10.6	11.7
73.0	6.9	7.5	8.1	8.9	9.8	10.7	11.8
73.5	7.0	7.6	8.2	9.0	9.9	10.8	12.0
74.0	7.0	7.6	8.3	9.1	10.0	11.0	12.1
74.5	7.1	7.7	8.4	9.2	10.1	11.1	12.2
75.0	7.2	7.8	8.5	9.3	10.2	11.2	12.3
75.5	7.2	7.9	8.6	9.4	10.3	11.3	12.5
76.0	7.3	8.0	8.7	9.5	10.4	11.4	12.6
76.5	7.4	8.0	8.7	9.6	10.5	11.5	12.7
77.0	7.5	8.1	8.8	9.6	10.6	11.6	12.8
77.5	7.5	8.2	8.9	9.7	10.7	11.7	12.9
78.0	7.6	8.3	9.0	9.8	10.8	11.8	13.1
78.5	7.7	8.4	9.1	9.9	10.9	12.0	13.2
79.0	7.8	8.4	9.2	10.0	11.0	12.1	13.3
79.5	7.8	8.5	9.3	10.1	11.1	12.2	13.4

APPENDIX- E

HLL Lifecare Limited

Planned Preventive Maintenance Checklist

Scales, Patient, Floor

ME CODE : 13-461

CHECKLIST NO : TRI-OM-117
Ver. 1.0

PART 1 EQUIPMENT DETAILS

WORK ORDER NO ▸ ME NO ▸

MANUFACTURER ▸ Omron HN 289 MODEL ▸

FREQUENCY ▸ 3 MONTHLY ( ) 6 MONTHLY ( ) 12 MONTHLY ( ) PPM HOURS ▸

PART 2 SPECIAL PRECAUTION

If there is evidence of body fluid contamination, submit the device for cleaning and decontamination before inspecting it.

Wear appropriate Personnel Protection Equipment (PPE) during work.

Wear grounded electrostatic wristband when handling PCB or electronic components.

Refer to the safety procedure for additional precautions and guidance as per manufacturer guidelines.

Make sure the test equipment used are duly calibrated.

PART 3 TEST APPARATUS

Tick (√) where appropriate

NO	ASSET NO	DESCRIPTION	SERIAL NO	CALIBRATION DUE ON
		WEIGHTS		

PART 4 QUALITATIVE TASKS

Tick (√) where appropriate

		PASS	FAIL	NA
1	Chassis - verify physical integrity. cleanliness and condition	(✓)	( )	( )
2	Mount/ Fasteners - verify physical integrity	(✓)	( )	( )
3	Fittings/ Connectors - check all fittings/connectors	(✓)	( )	( )
4	Indicators - verify proper illumination and operation	( )	( )	( )
5	Platfrom -Verify physical integrity	(✓)	( )	( )
6	Calibration	(✓)	( )	( )

PART 5 PREVENTIVE MAINTENANCE TASKS

Tick (√) where appropriate

		* DONE	NOT DONE **	NA
1	Clean the Exterior/Interior	(✓)	( )	( )
2	Adjust/align mechanical components	(✓)	( )	( )
3	Clean platform	(✓)	( )	( )

Notes:

* For all Parts, NA is defined as NOT APPLICABLE
** If you have ticked 'NOT DONE', then justify in Part 8
*** Choose Whichever Applicable

HLL Lifecare Limited

HLL Lifecare Limited

Planned Preventive Maintenance Checklist

Scales, Patient, Floor

ME CODE : 13-461

CHECKLIST NO : TRI-OM-117
Ver. 1.0

PART 6 QUANTITATIVE TASKS

Tick (√) where appropriate

No	Description	Units / UOM	Set Values	Measured Values	Limit/Tolerance	PASS	FAIL	NA
1	Weight	Kgms	10	10.2	± 5%.	✓		
			20	20.1	± 5%.	✓		
			40	40.2	± 5%.	✓		

PART 7 ELECTRICAL SAFETY TEST

ELECTRICAL SAFETY TEST. (attach report)

(In accordance to IEC 60601)

☐ PASS ☐ FAIL ☐ NA

PART 8 NOTES

Equipment calibrated as mention above

☐ CORRECTIVE MAINTENANCE REQUIRED ☑ FUNCTIONING ☐ NOT FUNCTIONING

WORK ORDER NO ► _____ NEXT PPM DATE ► _____

PPM has been performed in accordance to the checklist and the equipment is functioning to the intended purpose.

COMPLETED BY: Lakshmanan

DATE : 16/2/22

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LIST OF PUBLICATIONS

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2. Laltanpuii, VK Roy, Lukima S., H.T. Lalthanthuami.(2024). Feeding practice and Malnutrition among under five children in Mizoram. (2024). *Mizoram Educational Journal*, IX (3&4), 79-90.
3. Laltanpuii, VK Roy, Lukima S., H.T. Lalthanthuami.(2024). Relationship of Maternal Characteristics and Stunting among Children. *Indian Journal of Public Health Research and Development*, 15(4), 197-203.

CONFERENCE/ SEMINAR/ WORKSHOP ATTENDED

1. National level training on Research Methodology for Nursing Professionals. 6th-10thDecember 2021. Organised by National Institute of Health and Family Welfare.
2. Five Day National Workshop (online) on 'Research Methodology and Statistics in Behavioural Sciences'. 21st to 25th February 2022. Organized by Institute of Advance Study Centre (IASE), Aizawl.
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4. National seminar on "Biotechnology for Sustainable in Agriculture and Human Health". 12 &13th June 2023. Organized by the Department of Biotechnology, organized by Pachhunga University College (PUC), Aizawl, lndia .
5. National seminar on "Biotechnology for Sustainable Biosphere". *3*0th June - 1st July 2023. Organized by the Department of Biotechnology, Mizoram University, Aizawl, lndia .
6. National level CNE Programme on "National Education policy & Nursing education: A path towards Transformative Excellence". 24th August 2023. Organized by Regional Nursing College, Guwahati, Assam
7. International Conference on "Emerging trends in Psychological Interventions (Health and Allied Sciences): Future Aspects and Challenges. 14th -16th November 2023. Organized by School of Medical and Paramedical Sciences, Mizoram University.
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ABSTRACT

PREVALENCE AND ITS ASSOCIATED RISK FACTORS OF MALNUTRITION AMONG CHILDREN

AN ABSTRACT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

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DEPARTMENT OF NURSING

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ABSTRACT

PREVALENCE AND ITS ASSOCIATED RISK FACTORS OF MALNUTRITION AMONG CHILDREN

By

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Abstract

Background of the Study

Malnutrition and hunger is the greatest single threat to the world's public health. Malnutrition is major public health problem particularly in those children under five of age. All forms of malnutrition endangered a child's ability to grow and survive. People living in low and middle-income countries are more danger of malnutrition during pregnancy, infancy and during childhood.

Nutrition, growth and development in children are intricately inter-linked aberrations of one aspect tend to significantly influence the others (Elizabeth, 2010). Infant feeding practices are the significant factor which can determine the nutritional status. Singh (2004) mentioned that feeding practices are linked to almost two-thirds of child deaths that occur during the first year of life.

Nutritional status of the children are influenced by different factors. The present study stress on identifying the prevalence of malnutrition among children under five years of age and factors associated with malnutrition namely child characteristics, maternal characteristics and practice of feeding practice.

Need of the study

Malnutrition is a universal problem, it can affect people of all ages and it can severely affect vulnerable children, especially those under five years of age. Park (2019) reported that a young child under 5 years is most vulnerable to the vicious cycles of malnutrition, infection, and disability, all of which influence the present condition of a child and the future human resource development of the nation as a whole. Through literature review, several recent studies have studied the problem of malnutrition under five children in different parts of India, it was identified that there was scanty of publication about study on malnutrition of children in Mizoram. Hence the researcher felt the need to assess the ground reality on prevalence and associated risk factors of malnutrition in children.

Organization of the report

There are five distinct chapters in the study's report.

Chapter I is introductory information of malnutrition and feeding practices are mentioned, status of malnutrition and feeding practice- global, India, Mizoram are included. It also included problem statement, objectives, and operational definition of the terms, research hypotheses, delimitation and the conceptual framework.

Chapter II deals with overview of research studies on malnutrition and children's feeding practices that have been deemed pertinent to the current study.

Chapter III deals with the methods of the study which includes research approach, research design, setting of the study, population, sample and sampling technique, data collection tools and techniques, ethical consideration and description of data analysis used in the study.

Chapter IV deals with the analysis and interpretation of data based on the objectives of the study.

Chapter V deals with the summary, discussion and conclusions drawn from the findings. Limitation and recommendations of further study are also included in this chapter.

PROBLEM STATEMENT

Prevalence and its associated risk factors of malnutrition among children.

Objectives

The objectives of this study are:

- To identify the prevalence of malnutrition among children.
- To find out association between prevalence of malnutrition(nutritional status) and child characteristics.
- To find out association between prevalence of malnutrition (nutritional status) and maternal characteristics.

- To find out association between malnutrition(nutritional status) and feeding practices of the children
- To identify the associated risk factors of malnutrition among children.

There are three hypotheses in the study

- **H_1** There is a significant association between malnutrition and child characteristics.
- **H_2** There is a significant association between malnutrition and maternal characteristics.
- **H_3** There is a significant association between malnutrition and feeding practices of children.

The present study is based on UNICEF conceptual framework on Maternal and Child Nutrition (2020).

Review of Literature

In chapter II, relevant books and journals were reviewed which give tremendous information about the current topic. 7 journal articles on prevalence of malnutrition, 32 journal articles on associated risk factors of malnutrition and 15 journal articles about articles on risk factors of child characteristics, maternal characteristics- 14 articles and 5 research articles each on household characteristics and risk factors of overweight among children below 5 years of age and 3 books and many other relevant official website contents are reviewed .

Research Methodology

Research Approach: The present study is a quantitative approach

Research Design: Community based cross sectional study is adopted in the study.

Setting: The study was conducted in the area of Aizawl East main centre and Aizawl North main centre.

Population: The populations in the study are children between the age of 6-59 months of age and their mothers.

Sample: Participants were selected from 15 Anganwadi centres who met the inclusion criteria and who are willing to participate in the present study.

Inclusion criteria

- ✓ Children who are in the age group of 6 -59 months of age.
- ✓ Children who are enrolled in ICDS Centre.
- ✓ Children whose mothers are available during data collection.

Exclusion criteria

- ✓ Children with musculoskeletal conditions (such as bony deformities, spasticity, casts, or splints) limit standard nutritional measurements.
- ✓ Children with known debilitating illnesses that can affect growth, such as sickle cell anemia, chronic kidney disease, or congenital heart defect.

Sampling Technique: A multistage cluster sampling technique has been used to select the required sample size.

Sample Size: 233 children under 5 years of age and their mothers were included in the study.

Data Collection Tools: Structured interview schedule was used to collect demographic information about the participants and anthropometric measurement was taken and the parameters are compared with WHO growth standards to identify the nutritional status of the participants. Kuppuswamy's Socio-economic Status Scale was used to assess the socio economic condition of the family.

Ethical Consideration: Official ethical permission were taken from Human Ethic committee of Mizoram University (MZU/HEC/2022/008) and Chief Medical Officer of Aizawl East 1 (No. A. 12031/1/2011/- CMO'E') and informed consent was taken from mothers before collection of data.

Pilot study: Pilot study was conducted in the Chanmari local council area on 21st - 23rd Sept 2022. Children with their mothers who met the inclusion criteria were selected. Twenty three children and their mothers were selected from the list of the

Anganwadi Centre. Demographic variables and necessary information were assessed by the structured interview method. Anthropometric measurements of the child were taken and mother height was taken.

Final Data collection: Data collection was conducted from February 2023 to June 2023.After self-introduction and establishment of rapport, the purpose of the study was explained to the subjects and confidentiality was assured. Necessary information was taken from the mothers. Anthropometric measurements of the child were taken and mother height was also measured. It takes about 20 minutes to complete for each participant. Mothers are informed about the nutritional status of the child after comparing with WHO growth standards.

Data analysis

Descriptive statistics such as frequency and percentage were employed for categorical variables to find out the nature of score distribution and for classifying the respondents into different categories. Frequency and percentage were also employed for maternal characteristics and feeding practices of the mothers. The z scores for the different nutritional indices like weight for age, height for age, and weight for height were calculated based on the WHO Growth Standard. Inferential statistics such as Chi-square were used in the bivariate analysis to identify associations between nutritional status and the different factors. The Fisher Exact Test was used to test the significance wherever indicated. All variables with association (p <0.05) in the Chi Square were calculated by multiple logistic regression to identify the independent effect.

Result, Recommendation, Conclusion

Major findings of the study are summarized as below

❖ **Description of Sample Characteristics**

117 (50.2%) children are male, and 49.8% of the participants are female. Most of the participants are fully immunized (90.1%). Among the mothers, 83.7% of them were between the ages of 19 and 34 when their child was born. Majority of the mothers (65.2%) belong to nuclear families. About 92.3% of mothers belonged to the lower socioeconomic class. Majority of the mothers (79.8%) received adequate

iron supplementation during pregnancy.93.6% of the mothers have done sufficient antenatal checkups (4 times or more). 58.8% of the mothers maintain adequate hand hygiene practice.

❖ **Description of Feeding Practice**

Among 233 participants, 228 (97.85%) were able to breastfeed their children, 80.3% of the mothers were able to initiate breastfeeding within an hour after birth.19.3% of the mothers have given prelacteal feed to their children, 75.9% had breastfed exclusively for 6 months. 173 (75.9%), started weaning at the recommended month.. The mean age of weaning was 5.8 months. 67.1% of the participants continued breastfeeding for 2 years or more.

❖ **Finding Related to Prevalence of malnutrition**

The prevalence of underweight, stunting and wasting, overweight were 9.4%, 12.4% , 4.3% and 6.9% respectively.

❖ **Finding related to association between malnutrition and child characteristics.**

There is a significant association between malnutrition with child characteristics. Therefore, the null hypothesis H_0 is rejected and accepted the alternative hypothesis H_1.

❖ **Finding related to association of malnutrition with maternal characteristics.**

There is a significant association between malnutrition with maternal characteristics. Therefore, the null hypothesis H_0 is rejected and accepted the alternative hypothesis H_2.

❖ **Finding related to association of malnutrition with feeding practice of children.**

There is a significant association between malnutrition and feeding practices of children. Therefore, the null hypothesis H_0 is rejected and accepted the alternative hypothesis H_3.

❖ **Finding Related to Associated factors of malnutrition**

- The risk of a child being underweight is high among children who have history of diarrhoea in the past two weeks, maternal height below 145 cm, lower socio economic status, inadequate iron supplementation and less than three antenatal visits during pregnancy.
- The significant predictors of stunting were children with a birth weight of <2500gm and a maternal height below 145 cm and inadequate iron supplementation during pregnancy.
- Children with a birth weight of <2500, diarrhoea in the past two weeks children with mothers <18 years of age during birth were the predictors of wasting in children. Wasting was less likely found in children from joint families.
- The risk of overweight is higher among children with a birth weight of more than 4000 gm.

Recommendation

On the basis of the findings, the following recommendations are made:

- Mothers must be encourage to wash their hands with soap and water during critical periods.
- The child needs to receive the same level of care when they turn 12 months old. Children should be fed age-appropriate foods to meet the nutritional requirement.
- Mothers need to be informed and educated about initiation of breastfeeding, avoiding pre-lacteal feedings, exclusive breastfeeding, and correct time to start weaning from the beginning of pregnancy.
- Obstacles to the initiation of breastfeeding within 1 hour need to identify.
- Non compliance to recommended iron supplementation during pregnancy need immediate action and the possible reasons need to explore.

- Further study can be conducted on cultural feeding practice and its influence on nutritional status of the children.
- Further study can be conducted on the influence of family on nutrition of the children
- Further research study can be conducted on the practice of pre lacteal feeding, and the reasons for prelacteal feeding can be explored.

Conclusion

The total prevalence of all form of malnutrition among the participants is high which need immediate attention. Under nutrition is more prevalent among children more than 12 months of age. Overweight was influenced mainly by the birth weight of the child; feeding practice of the child and maternal characteristics does not influence the child to be in overweight status.

Majority of the mothers among the participants followed infant young feeding practice recommendation. The mean age of starting weaning was less than the recommended age of weaning. Duration of breastfeeding after weaning was found to be important underlying determinants of underweight and wasting status.

Stunting was the most common form of under nutrition which indicates malnourished children among the study participants are chronic undernutrition. Stunting status does not have significant association with feeding practices. Therefore, maternal and child characteristics have more influence on the stunting status in children. Birth weight influence growth of the child and it is one of the strong predictor of wasting. Maternal height was found to influence on the child being stunting and underweight status. Maintenance of maternal health during pregnancy was also found to have greatly influence on the nutritional status of the children.