MAPPING THE PREVALENCE AND ASSOCIATED FACTORS OF SEVERE ACUTE MALNUTRITION AMONG CHILDREN 0-59 MONTHS IN URBAN SLUMS OF BARODA

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BY

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CERTIFICATE

This is to certify that the research work presented in this thesis has been carried out independently by Ms. Hazel Mariamu Mwango under the guidance of Dr. Swati Dhruv in pursuit of a Master of Science in Foods and Nutrition (Public Health Nutrition) and this is her original work.

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ABBREVIATIONS

ARI – ACUTE RESPIRATORY ILLNESS

AWC – ANGANWADI CENTER

AWW – ANGANWADI WORKER

BMI – BODY MASS INDEX

CM – CENTIMETRES

DQQ – DIETARY QUALITY QUESTIONNAIRE

GDR – GLOBAL DIETARY RECOMMENDATIONS

HAZ – HEIGHT-FOR-AGE Z-SCORE

HCM – HOT COOKED MEALS

ICDS – INTERGRATED CHILD DEVELOPMENT SERVICES

IQ – INTELLECTUAL QUOTIENT

IYCF – INFANT AND YOUNG CHILD FEEDING

KG – KILOGRAMS

MAM – MODERATE ACUTE MALNUTRITION

MSU – THE MAHARAJA SAYAJIRAO UNIVERISTY OF BARODA

MUAC – MID UPPER ARM CIRCUMFERENCE

NCDs – NON-COMMUNICABLE DISEASES

NFHS – NATIONAL FAMILY HEALTH SURVEY

OBC – OTHER BACKWARD CASTE

ODK – OPEN DATA KIT

RUSF – READY TO USE SUPPLEMENTARY FOOD

RUTF – READY TO USE THERAPEUTIC FOOD

SAM – SEVERE ACUTE MALNUTRITION

SBCC – SOCIAL AND BEHAVIOR CHANGE COMMUNICATION

SC – SCHEDULED CASTE

SDGs – SUSTAINABLE DEVELOPMENT GOALS

SPSS – SOCIAL PACKAGES FOR STATISTICAL ANALYSIS

ST – SCHEDULED TRIBE

THR- TAKE HOME RATION

UNICEF - UNITED NATIONS CHILDREN'S FUND

WASH – WATER, SANITATION AND HYGIENE

WAZ – WEIGHT-FOR-AGE Z-SCORE

WFP -WORLD FOOD PROGRAMME

WHO – WORLD HEALTH ORGANIZATION

WHZ – WEIGHT-FOR-HEIGHT Z-SCORE

ABSTRACT

ABSTRACT

Malnutrition, specifically undernutrition, contributes to around 45% of deaths among children under 5 years of age. These deaths mostly occur in low- and middle-income countries (WHO, 2023). Undernourished children, particularly those with severe acute malnutrition, have a higher risk to succumb from common childhood illnesses such as diarrhea, pneumonia and malaria, as compared to relatively nourished children (WHO, 2022). The picture of acute malnutrition is no different when one looks into various countries. The national prevalence of stunting, wasting, severe wasting and underweight in India is at 35.5%, 19%, 7.7% and 32.1%, respectively (NFHS-5, 2019-21). Identification of the associated risk factors leading to acute malnutrition is of utmost importance for the management of the same. In the urban slums of Vadodara there is paucity of information pertaining to this, hence a need is felt to carry out a study addressing the same.

The present study was carried out with the aim of mapping the prevalence of severe acute malnutrition in children 0-59 months residing in urban slums of Vadodara and investigating the associating risk factors. The study was conducted in the urban slums of Baroda. 33 out of the 439 AWCs in the four zones of urban Baroda were randomly selected and all registered children aged 0-59 months were to be included in the study. There was a total of 2,999 children registered in these AWCs, 2740 were considered for the study as the rest, 257, were above 59 months. The screening for the study was done for 1784 children. The prevalence of various forms of malnutrition, i.e., wasting, underweight and stunting were found in these AWCs using WHZ, WAZ, HAZ and MUAC. Also, the prevalence of SAM by either WHZ or MUAC was mapped by using a pre-tested questionnaire, the associated risk factors for SAM were sought.

The results showed that the mean weight of boys was 10.56kg and that of girls was 10.24kg while the mean height of boys was 83.2cm while that of girls was 82.7cm. The prevalence of severe wasting was found to be 2.2%. Severe underweight and severe stunting were found to be at 5.3% and 7.7%, respectively. As for moderate malnutrition, the prevalence of wasting, stunting, underweight and moderate wasting based on MUAC was at 10.3%, 19.8%, 21.9% and 9.0%. Males were found to be more malnourished compared to girls. 9.1% of the children identified as SAM belonged to the age group of 0-6 months. 1.2% were categorized as SAM based on MUAC. East zone had the highest prevalence of malnutrition at 2.9% severe wasting, 12.1% moderate wasting, 7.2% severe underweight, 9.1% severe stunting and 23.3% moderate stunting. Children who were identified as SAM were born to mothers with a mean age of 27 and majority (72.1%) came from families that practiced Hinduism, 32.6% came from families belonging to OBC group and were

living in nuclear type of families. 55.8% of mothers had a middle school certificate while 44.2% of household heads, had a middle school certificate. 53.5% of the household heads were skilled workers and shop/market workers with an average monthly income was about 10,500 rupees. 67.4% of the children came from upper lower class (IV) families. All the families had access to piped water and 86.0% of the respondents stated that they take measures to make the water safe for drinking, including, boiling, straining with a cloth, use of a water filter. Once complementary food was cooked, 55.8% respondents stated that they did not store the remaining food as either all was completed in one sitting or the remaining food was discarded and fresh food cooked for the next meal. 95.3% of the homes and a home toilet facility. All respondents stated that their family members washed their hands with soap at various times throughout the day, including, after visiting the toilet and before cooking and before eating. 72.1% of the respondents stated that they cut their vegetables before washing while 27.9% of them first washed their vegetables then cut. 65.1% of the SAM children were receiving Bal Shakti from the AWCs and for those children below 6 months the mothers received the Matrushakti packets and those above 3 years get hot cooked meals in the AWC. Also, those children above three who are in the red and yellow zone receive double the ration from the AWC. However, a difference was observed in the anthropometric measurements taken by us and those reported by the AWW. Thus, those children falling in the yellow or red zone not necessarily falling in the same as per the data of the AWW, hence they would not have received the double ration. Also, those who received the packets received them regularly once a month and not all the packets were consumed solely by the child. Those who received the packets received them regularly once a month and not all the packets were consumed solely by the child. Bal Shakti was prepared in various ways including making porridge and 46.4% of the respondents reported that they saw some benefits of giving their children Bal Shakti while 54.6% saw no benefit. Majority of the children had received their vaccinations and less than 20% of the children had fallen ill in the last 15 days of the interview. All the children had been breastfed but only 62.8% had been breastfed in the 1st hour of life. 54.5% of the children 6-59 months had low dietary diversity and male children had a poor dietary diversity score as compared to females.

Hence, the results indicate an urgent need of training the AWW for screening and input of data into the software and continuous monitoring needs to be emphasized. Also, a need is felt to educate the families through SBCC approach so as to take care of the associating risk factors.

INTRODUCTION

INTRODUCTION

BACKGROUND

Food is one of the basic needs required for human survival but there are various elements that contribute to ensuring that the food assures this survival. Adequacy, sufficiency, availability, affordability and proper utilization of the food provides good nutrition, which is vital for a child's growth and development, with a major effect on its survival and general wellbeing. With the aim of achieving the Sustainable Development Goals (SDGs) 1, 2 and 3, which are no poverty, zero hunger and good health and wellbeing, together with the Global Nutrition targets, it seems vital to have a closer look into child health and nutrition and essentially reduce malnutrition.

Malnutrition, specifically undernutrition, contributes to around 45% of deaths among children under 5 years of age. These deaths mostly occur in low- and middle-income countries (WHO, 2023). Undernourished children, particularly those with severe acute malnutrition, have a higher risk to succumb from common childhood illnesses such as diarrhea, pneumonia and malaria, as compared to relatively nourished children (WHO, 2022).

The term malnutrition refers to inadequacies, excesses, or imbalances in a person's intake of nutrients from the food they consumed and also energy provided by the food. Malnutrition includes undernutrition, micronutrient deficiency, overweight, obesity, and resulting diet-related non-communicable diseases (WHO, 2021).

TYPES OF UNDERNUTRITION

Undernutrition refers to insufficient intake of energy and nutrients to meet an individual's needs to maintain good health and wellbeing (Maleta, 2006). Most of the time, in most literature, undernutrition is used synonymously with malnutrition, though "malnutrition", as seen earlier, is a broader term. There are 3 forms of undernutrition, i.e.:

- Wasting – this is demonstrated by low weight-for-height Z-score. It indicates severe and recent weight loss as a result of either lack of enough food to eat and/or as a result of illness/disease that results in weight loss, for example diarrhea.
- Stunting – this is demonstrated by low height-for-age Z-score. It indicates chronic and persistent undernutrition which is usually as a result of illness/disease, poor socioeconomic status, inadequate feeding practices and care and also poor maternal health and nutrition.
- Underweight – this is demonstrated by low weight-for-age Z-score and is found in children who are either wasted or stunted.

INTRODUCTION

CAUSES OF MALNUTRITION

UNICEF, in 1990, developed a conceptual framework that illustrated the causes for malnutrition (Figure 1). These causes were divided into 3 groups, i.e., immediate causes that act on the individual, underlying causes that act on households and communities and the basic causes that act on entire societies but have a greater or lesser impact on specific groups within society.

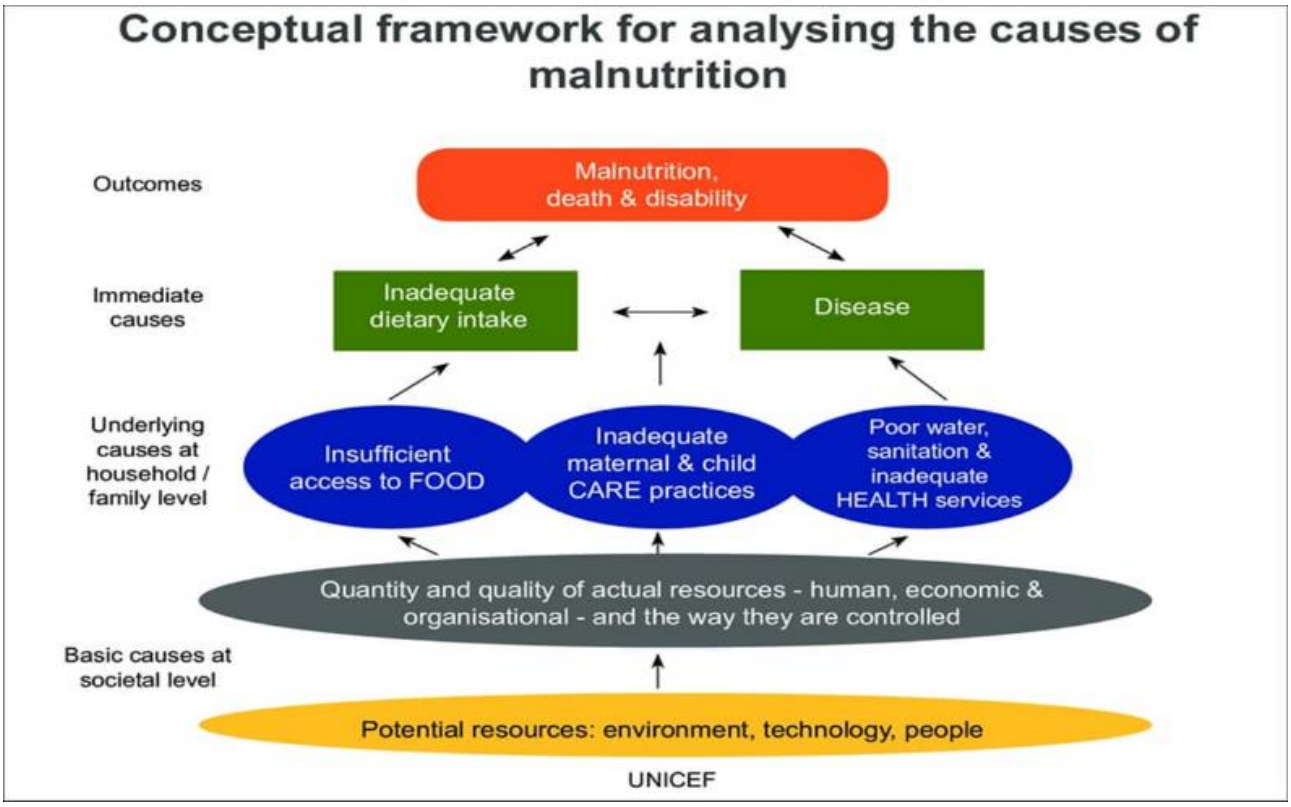
CONSEQUENCES OF MALNUTRITION

Any improvement in these positive factors leads to improved health, wellbeing and nutrition status but if nothing is done and the causes take a turn for the worst, then we as a population face the consequences of malnutrition. On a short-term basis, one develops a lower intelligence quotient (IQ), a weakened immune system and impaired brain development. As time progresses, those who are malnourished are seen to be predisposed to premature death, are at a greater risk of diabetes and cancer, are of smaller stature and the pinch is felt by all as there is a loss in productivity and increased healthcare costs (Prost & Martinez, 2018). Undernutrition also results in loss of body weight, growth retardation, cognitive, anemia and general developmental lagging (Wagle, 2020). When these malnourished children grow up, they turn to malnourished adolescents, and for the girls, when they reach reproductive age, their nutritional status is compromised and they give birth to low-birth-weight babies and the vicious cycle of malnutrition continues.

WASTING

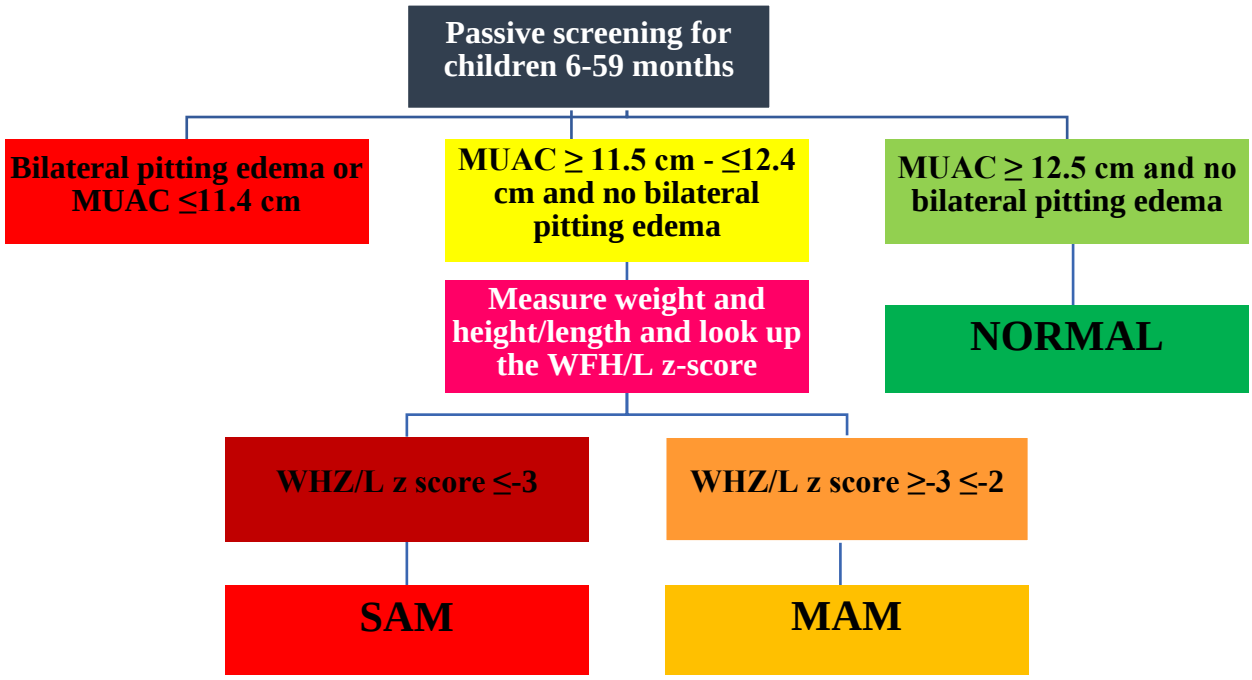
As initially stated, one form is undernutrition and specifically wasting. Wasting, according to WHO, is defined as low weight-for-height and often indicates recent severe weight loss, (which can also persist for a long time). It usually occurs when one has not had adequate food, in terms of quality and quantity. This can also be the case if they have had frequent or prolonged illnesses. Wasting is categorized into two categories, severe and moderate (Figure 2). Severe wasting, commonly referred to as severe acute malnutrition (SAM) is defined by a very low weight for height (below -3 Z-scores of the median WHO growth standards), by visible severe wasting, by the mere presence of nutritional oedema or by a child having a MUAC of $\leq$ 11.4 cm. On the other hand, moderate wasting, commonly referred to as moderate acute malnutrition (MAM) is defined by a low weight for height (between -2 and -3 Z-scores of the median WHO growth standards), by visible wasting or by a child having a MUAC of between 11.5 – 12.4 cm. If unresolved, MAM progresses to SAM which is a life-threatening condition requiring urgent treatment (WHO, 2007).

Figure 1. 2 Conceptual Framework for Analyzing the Causes of Malnutrition



Source: UNICEF, 1990

Figure 1.2: Screening Criteria for SAM and MAM Children Age between 6-59 months



INTRODUCTION

Each year, malnutrition affects millions of children globally. According to the Global Nutrition Report 2021, 22% and 6.7% of children under 5 years were stunted and wasted, respectively. In Asia, the prevalence of stunting and wasting in children under 5 years is 21.8% and 8.9% respectively (GNR, 2021). The national prevalence of stunting, wasting, severe wasting and underweight in India is at 35.5%, 19%, 7.7% and 32.1%, respectively (NFHS-5, 2019-21). Approximately 10.4% and 24.6% children under 5 years are severely wasted and wasted, respectively, in Gujarat state (NFHS-5, 2019-21). Since the prevalence of wasting in children is on the higher side, it is essential to map down the malnourished children especially in urban slums of Baroda as they are the vulnerable group with limited resources. Moreover, due to paucity of data with respect to acute malnutrition in slum areas of Baroda, the current study was undertaken.

PROBLEM STATEMENT

Wasting, also termed as acute malnutrition, is a global concern and public health problem as it is associated with high morbidity and mortality if it goes undiagnosed for a prolonged period of time. Undernourished children, particularly those with severe acute malnutrition, have a higher risk to succumb from common childhood illness as compared to relatively nourished children. The prevalence of wasting in Vadodara District is at approximately 12.65%, at which SAM is at 5.2% (NFHS-5, 2019-21) and this depicts medium prevalence based on the malnutrition cut-offs values hence being of public health concern (Table 1).

Globally, to tackle the burden of acute malnutrition, the use of RUTF and RUSF is employed for the management of SAM and MAM, respectively. RUTF and RUSF are a paste that is made from powdered milk, peanuts, butter, vegetable oil, sugar, and a mix of vitamins and minerals. One sachet contains 500-550 calories and micronutrients that are of high nutritional value allowing malnourished children to gain weight quickly (UNICEF, 2022). However, in India, this intervention was banned and instead, other approaches were put into place in an aim of addressing malnutrition. Improving ICDS (Integrated Child Development Services) services and Mid-Day Meal schemes are some of the attempts to provide adequate nutritious food to the children. One major limitation of the above intervention is institutionalization of the effort. This institutionalization excludes all the children not attending these institutions. Also, through the ICDS, double rations of take-home rations (THR) are provided to malnourished children, primarily identified as severely underweight. These THRs are widely shared among family members and so the calories really required for this undernourished child to gain the required weight, is not met, making it not as efficient and something more needs to be done. With such limitations it is evident

that aims at reducing prevalence of malnutrition are restrained and much more needs to be done. There is then a need to identify/map SAM children in the community before coming up with more appropriate interventions for their management.

RESEARCH QUESTIONS

1. What is the prevalence of acute malnutrition among children 0-59 months in Urban Baroda?
2. What is the nutrition status, morbidity profile and immunization status of children 0-59 months in urban Baroda?
3. What is the socio-economic status of the families from which the children come from?
4. What is the minimum dietary diversity and IYCF practices of children 0-59 months in urban Baroda?
5. Is there any association between socio-economic status, morbidity profile, immunization status, WASH practices, minimum dietary diversity and IYCF practices and severe acute malnutrition?

PURPOSE OF THE STUDY

The study was designed to determine the prevalence of severe acute malnutrition in children 0-59 months residing in Urban Baroda, Gujarat State, and the association between socio-economic status of the families from which the children come from, morbidity profile, immunization status, WASH practices, minimum dietary diversity and IYCF practices of the children and severe acute malnutrition.

OBJECTIVES

The Study was carried out keeping in mind the following objectives: :

- To assess prevalence of acute malnutrition among children 0-59 months in Urban slums of Baroda.
- To assess the nutrition status, morbidity profile and immunization status of children 0-59 months in urban slums of Baroda.
- To determine the socio-economic status of the families from which the children come from and the minimum dietary diversity and IYCF practices of the children.

- To determine the association between socio-economic status of the families from which the children come from, morbidity profile, immunization status, WASH practices, minimum dietary diversity and IYCF practices of the children and severe acute malnutrition.

CONCEPTUAL FRAMEWORK

A **conceptual framework** visually demonstrates the expected relationship between the independent and dependent variables. For this study, the conceptual framework was developed based on review of literature from related studies (Figure 1.3).

SIGNIFICANCE OF THE STUDY

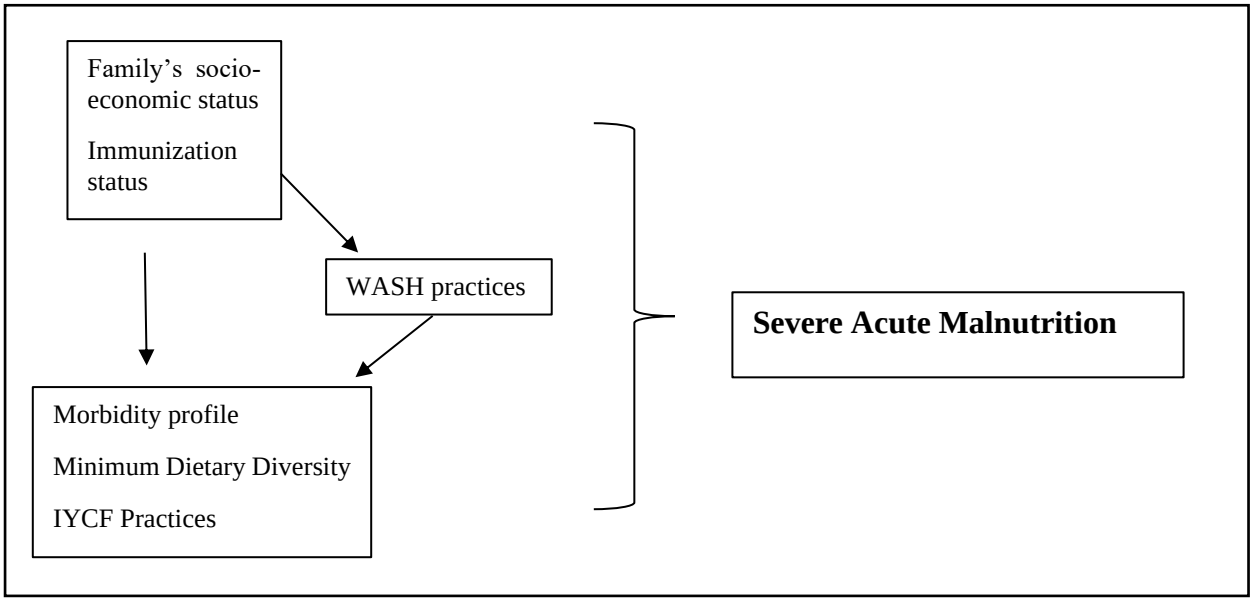
The study findings will provide an insight on the prevalence of severe acute malnutrition and its associated risk factors in Urban Slums of Baroda. Data collected during research can also be used to look at the other forms of malnutrition such as undernutrition and stunting. Furthermore, this study will lay a foundation for further studies that may look into the use of MUAC in children below 6 months as an assessment for nutrition status.

Knowledge on SAM will increase and this may also help AWWs enroll wasted children to receive the correct rations for the supplementary nutrition provided and the government at large, put into consideration long term protocols for the management of malnutrition at community level, for example development of therapeutic and supplementary foods for management of SAM and MAM, respectively.

Table 1.1: Prevalence thresholds for malnutrition

MALNUTRITION STATUS	LOW (%)	MEDIUM (%)	HIGH (%)	VERY HIGH (%)
UNDERWEIGHT	<10	10-19	20-29	≥30
STUNTING	<20	20-29	30-39	≥40
WASTING	<5	5-9	10-14	≥15

Figure 1.3: Conceptual framework of the study



INDEPENDENT VARIABLES **DEPENDENT VARIABLE**

REVIEW OF LITERATURE

Each year, malnutrition affects millions of children globally. Around 45% of deaths among children under 5 years of age are linked to undernutrition and these mostly occur in low- and middle-income countries (WHO, 2021). In 2017, it was estimated that 51 million of children under 5 years were wasted and 16 million severely wasted (UNICEF & WHO, 2020). The estimations in 2019 were not good either according to the State of the World's Children report which showed 50 million children under 5 years were wasted and 149 million stunted. According to the Global Nutrition Report 2021, 22% and 6.7% of children under 5 years were stunted and wasted, respectively.

According to the UNICEF, WHO, World Bank Group joint malnutrition estimates in 2019, 144 million children under 5 years globally are stunted and the highest prevalence of stunting hails from Southern Asia, Ocenia, Central and East Africa (≥30%). Western and Southern Africa and South-Eastern Asia have a prevalence ranging 20 - <30%. Northern Africa, Western and Southern Asia and Central America have a low prevalence rate of stunting at 10 - <20%. The regions with the lowest prevalence have been observed in North and South America and East Asia.

The same report estimates that 47 million children are wasted and that highest prevalence of stunting hailing from Southern Asia (10 - <15%). Most parts of Africa have a medium prevalence (5 - <10%) while Sothern Africa and Western Asian have a low prevalence of wasting. All the other regions have very low prevalence (<2.5%).

The picture of acute malnutrition is no different when one looks into various countries. In a study done by Mohamed & Hussein (2014) in Northern Sudan, 17.8% of the children under the study were severely wasted. In Northern Ethiopia, 33.4% and 24.6% of children under 5 years were underweight and wasted, respectively (Kelati et.al, 2014). 35.0% of children were acutely malnourished in Afghanistan (Frozanfar et.al, 2016), 28.2% were wasted in South Ethiopia (Tsedeke, Tefera & Debebe, 2016), 4% wasted in Uganda (Adebisi et.al, 2019) and in Roma, underweight accounted for 7.6% and wasting 2.9% (Giampaolo et.al, 2021).

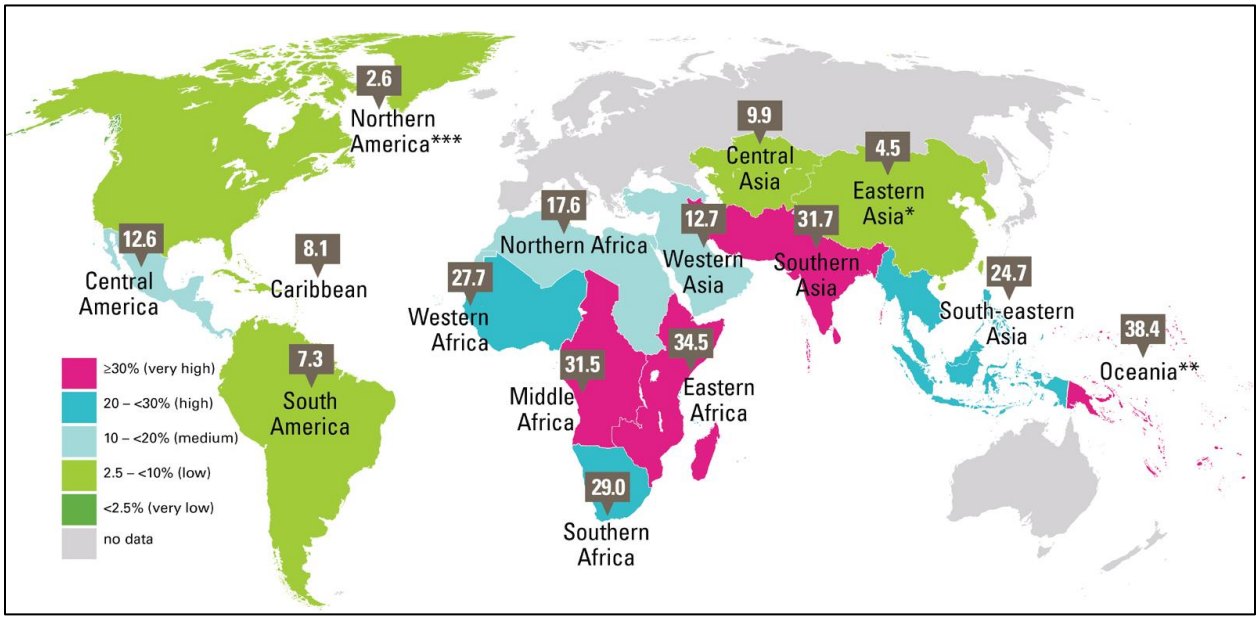
In Asia, the prevalence of stunting and wasting in children under 5 years is 21.8% and 8.9% respectively (GNR, 2021). The national prevalence of stunting, wasting, severe wasting and underweight in India is at 35.5%, 19%, 7.7% and 32.1%, respectively (NFHS-5, 2019-21). There have been several studies done in India to look into the prevalence and possible factors for acute malnutrition such as a study conducted by Bhadoria et.al (2017) which showed the prevalence of SAM was at 2.2% in Northern India. 16% of children under 5 in Maharashtra were wasted (Purohit, Sahu & Godale, 2017) and 28.9% in West Bengal (Sabud et.al, 2020). Approximately 10.4% and

24.6% children under 5 years are severely wasted and wasted, respectively, in Gujarat state and 5.2% and 20.1% children under 5 years are severely wasted and wasted, respectively, in Vadodara District (NFHS-5, 2019-21).

Some departmental studies done have also revealed that the prevalence of malnutrition in Vadodara District and its surroundings is almost similar to the prevalence seen in other studies and surveys. In a study conducted by Chandorkar & Jagota (2015) in Vadodara, it was reported that 18.95%, 43.6% and 58.69% children were wasted, underweight and stunted respectively of which, 7.48%, 21.77% and 32.08% were severely wasted, severely underweight and severely stunted. An experimental study was done 2 years later in the same area by Gandhi & Patni (2017) whereby they found that there was 1% wasting, 7.3% stunting and 3.1% underweight in the experimental group as compared to 14% wasting, 12% stunting and 18% underweight in control group. Kantawala & Shah (2020) reported that the prevalence of SAM was at 6.42% among children registered in AWCs of Urban Vadodara.

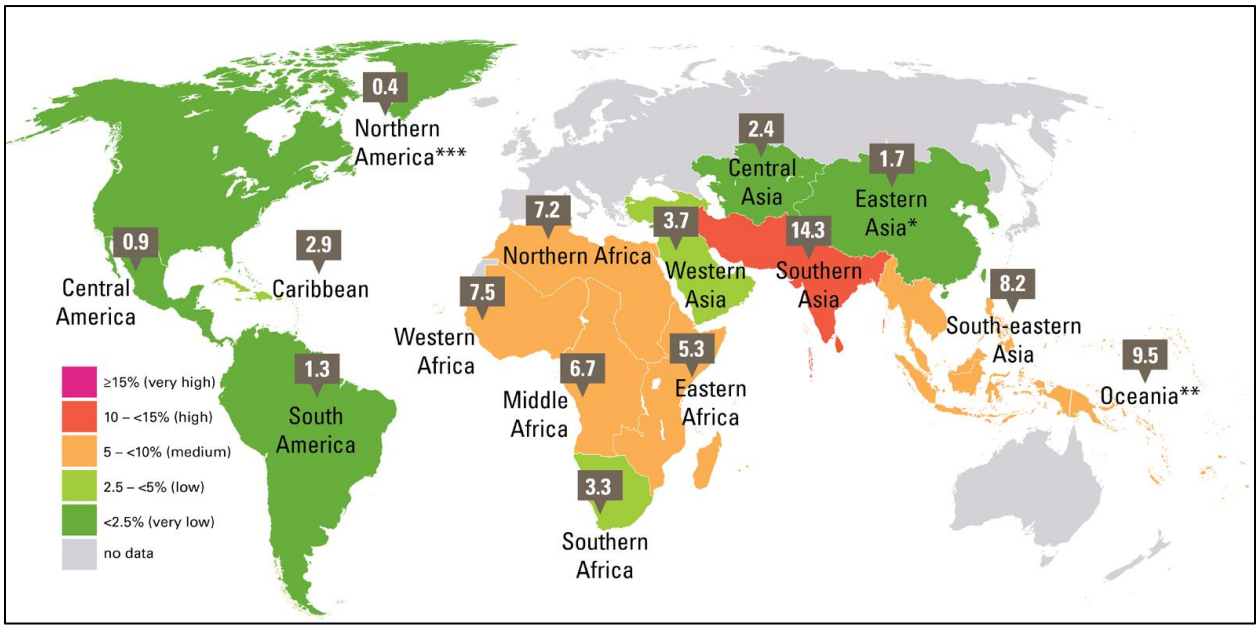
When these indicators are put alongside the WHO cut-off values for malnutrition, then it is evident that they are of public health significance, i.e., wasting prevalence ranges between 5 to <10% (medium risk) and 10 to <15% (high risk).

Figure 2. 5 Percentage of stunted children under 5



(Source: United Nations sub-region, 2019)

Figure 2. 6 Percentage of wasted children under 5



(Source: United Nations sub-region, 2019)

Malnutrition, as forementioned, is as a result of a wide array of factors, some of which are discussed in this chapter.

Birth weight

Birth weight has extensively been used as a key predictor to child mobility and mortality, more so, up to the age of 5 years. Rayhan and Khan (2006) reported that children with very low and low birth weight were 1.89 and 1.96 times, respectively, more likely to be wasted than children with larger size at birth. This study was further compounded by Rahman, Chowdhury & Hossain (2009) who conducted a somewhat similar study in Bangladesh and reported that children whose birth weight was less than the national average were 1.7% more severely wasted and 6.2% more moderately wasted when contrasted by others of similar age who had a normal birth weight. This issue of birth weight and malnutrition is more severe in developing countries which lack the necessary infrastructure and resources to care for the special needs of children who are born underweight, with low birth weight being an important predictor of acute malnutrition among this age group (Legason & Dricile, 2018). While numerous interventions have come to picture in the recent years, the vicious relationship between low birth weight and malnutrition still lingers. A study conducted in India revealed that low birth weight (<2.5kgs) was found to adversely predict (OR=3.4, 95% CI, 1.7-6.8) the occurrence of wasting among these children (Ambadekar & Zodpey, 2017). The findings of this study have further been echoed by Fagbamigbe, Kandala & Uthman (2020) who reported that children under 5 years with very low and low birth weight were significantly at higher odds of developing severe wasting compared to those with normal birth weight (very low: OR= 1.62; 95% CI, 1.52-1.4; low: OR=1.21; 95% CI, 1.15-1.26). Narrowing down to the situation in Gujarat, it is no better than the national trends as reported by Ravi (2022) showing that 34.7% of the underweight children screened in the study were born with low birth weight and 50% of the wasted children had very low weight at birth. These trends indicate that there is a significant relationship between the birth weight of the child and their nutritional status, and this study aims to affirm whether the reported trends are still valid despite the various interventions by the government to break this cycle such as the Pehchan program, and whether such programs have been effective over the years since their inception.

Parents' level of education

Poverty, food insecurity and illiteracy are significant predictors of malnutrition, not only amongst children, but also among adults, with children born to mothers with low education levels being

more predisposed (Adebisi et al., 2019). A study conducted in Bangladesh suggested that a mother's education played an important role in reducing malnutrition as chronic malnutrition was found to be highest among children of illiterate mothers, 52.6% being stunted, 12.2% being wasted and 55.7% underweight. It also found out that children to fathers who had higher levels of education were less likely to be malnourished than those whose fathers were illiterate and this was attributed to the fact that fathers were most likely the decision makers for the family and hence with higher education came the ability to ensure that children had better nutrition. The risk of underweight among children born to fathers with at least primary and secondary education was 0.98 and 0.70 times lower, respectively, as compared to the children who had illiterate fathers. (Rayhan & Khan, 2006). Further enhancing this trend, a study conducted in Afghanistan portrayed there to be an association between the level of education of the parents and the nutrition status of the children. It was observed that the education level of the household head had a significant effect on the children's nutritional status (OR=1.49; 95% CI, 1.02–2.17) and that those heads who had primary or higher level of education were more knowledgeable on balanced diets and its importance in improving the nutritional status of their children. The study also indicated that a mother's education was a predicator for child wasting (OR=2.21; 95% CI, 1.00–4.88), and suggested that ensuring the mother acquires education at primary level and higher may result in more than twice a decrease in the incidence of wasting among children. This is because educated mothers may be educated on nutrition and have more knowledge on good IYCF practices (Frozanfar et.al, 2016).

Bringing these trends to India, a study in Odisha revealed that mother's educational level was not linked to the child's nutritional status (X^2=4.0671, p=0.2543) as malnutrition was widely prevalent among mothers of all education levels (Sethy et.al, 2017). While this finding is somewhat contraindicative of the relationship between parents' level of education and the nutrition status of the child, Odisha as a state has been ranked amongst the poorest states in India, with over 30% of its residents living below the national average poverty line. This consequently means that despite the education levels being varied across the population, socioeconomic aspects play a bigger role in determining the nutrition status of the people. A metanalysis synthesized by Fagbamigbe, Kandala and Uthman (2020) reported that children whose mothers had no formal education were significantly more likely to be severely wasted compared to those whose mothers had secondary or higher education (OR=1.11; 95% CI, 1.06-1.16). This may be because with poor education

come restricted knowledge on best feeding practices. Ravi (2022) conducted a study in Gujarat State and reported that 40.3% of children who were wasted in Vadodara District, were born to mothers who were illiterate and only 39.7% of wasted children were born to literate mothers. With this in mind, it is clear that the relationship between parents' education levels and the nutritional status of the child is critical in defining key predictors of childhood malnutrition, more so in developing countries.

Pre-lactate foods

Breastfeeding is an essential part of child health care for the optimum start to life and a critical initial step on the child's path to a healthy future and a baby's first vaccine and best source of nutrition, not forgetting about the benefits to the mother too. While exclusive breastfeeding has been promoted to bring forth desired health results, in some cases, it might not be feasible, thereby leading to prelacteal feeding practices. Adem et al. (2021) define prelacteal feeding as the introduction of other substances to newborns before the initiation of breastfeeding within the first three days of life.

While this practice usually stems from cultural contexts, it is more common in Africa and South East Asia, and studies done on this area indicate that this precludes childhood malnutrition by affecting breastfeeding practices where the occurrence of severe acute malnutrition is 11 times more in such children as compared to those that were exclusively breastfed up to six months (Ambadekar & Zodpey, 2017). Bringing the situation to the Indian subcontinent, Gupta et al. (2022) report that 39.2% of malnourished children in Western India had a history of pre-lacteal feeding, which was significantly associated with undernutrition (OR 2.48, 95% CI =1.18-5.21, p=0.01). The situation is no different when it comes to the Vadodara District of Gujarat State, where the prevalence of wasting among children in the peri-tribal areas who had received pre-lacteal feeds was 43.1%, a strong indication that exclusive breastfeeding was not practiced for these children (Ravi, 2022). While the campaign for exclusive breastfeeding is still being promoted, pre-lacteal feeding still exists leading to adverse effects on the child. The study targets the area of pre-lacteal feeding to identify the possible causes and various mitigating efforts to promote child well-being in Vadodara District.

Source of drinking water

Water, sanitation and hygiene are all underlying causes of malnutrition, that if not catered for will eventually lead to nutritional deficiencies through the immediate causes. Frozanfar et.al (2016),

found that children from households that had been consuming water from unprotected water sources were twice more likely to be wasted than those who had been consuming water form protected sources (OR=1.89; 95% CI, 1.26–2.83). Nevertheless, a study in Ethiopia by Gizaw, Woldu & Bitew (2018) report that households that get their water from unprotected sources were 3.78 times more likely to have wasted children (AOR = 3.78, 95% CI = (1.07, 13.34)). This situation is mirrored in India where Ambadekar & Zodpey (2017) observed that the incorporation of water purification practices decreased the chances of the child developing SAM, with children in families that did not treat water being twice as likely to be malnourished than those who did the treatment. The relationship between clean water and good nutrition is clear, such that untreated water leads to the development of water borne diseases that in the long run affect the health and nutrition of the individual, especially children. While various government reports, notably NFHS-5 and ICDS reports, have indicated the presence of childhood malnutrition in Vadodara, the study scrutinizes whether these cases can be attributed to water and sanitation issues or whether other causalities are at play.

Frequency of food intake:

The general consensus is that food intake, consequently leads to better nutrition, with malnutrition being as a result of poor nutrient intake caused by either dietary or physiological problems. This relationship is more keen when it comes to cases of acute malnutrition among children. Frozanfar et al. (2016) note that children who had three or less meals in a day were three times more likely to be acutely malnourished (OR=3.01; 95% CI, 1.21–7.46). This situation is further echoed by Ambadekar & Zodpey (2017) who conducted a case-control study in rural India and reported that giving less than 3 meals per day, other than breastmilk, increased the risk of SAM by around 36 times (OR=36.5; 95% CI, 15.4-86.8). However, while food intake is key in solving the issue of malnutrition among children, quality of the food plays a bigger role than the quantity, hence the development of dietary diversity scores. Sethy et al. (2017) reports about this predicament by noting that there was no association between the frequency of feeding with malnutrition in Odisha. As initially reported, Odisha is among the top poorest states in India, and this finding can be attributed to the lack of quality foods, coupled with the low socioeconomic status leading to low dietary diversity scores. All in all, the general consensus still stands, that food intake consequently leads to better nutrition, with children whose food intake frequency is more than 3 times a day being 55% less likely to develop SAM (Hossain et al., 2020). While the government has tried to

mitigate the issue of food intake by incorporating feeding to the Anganwadi Centers, most of the children receive only one midday meal, but is this adequate since the matter of home feeding is left to chance? This study targets to uncover a pattern, if any, relating to frequency of feeding and the development of malnutrition among children residing in Vadodara Urban area.

Gender

Gender disparities exist in all forms in the modern society, and despite the efforts to bridge these gaps, devastating repercussions have ensued across all walks of life, including childhood malnutrition. Various studies have shown that there is a statistical significance when in come to malnutrition based on gender while other studies indicate that there is no association between gender and nutritional status. However, some studies have reported that male children are at a greater risk of malnutrition while others report that being female is a risk factor (Phengxay et.al, 2007; Veghari, 2007; Sanghvi et.al, 2001). It has been reported that the actual reasoning behind this may be different social and cultural factors and no the gender itself that is affecting the nutrition status of children. In some communities, the male child is highly preferred and valued and hence they get better care including quality feeding practices and quality nutrition unlike the female children.

A study conducted in Northern Ethiopia found that wasting was more prevalent in males (52.1%) than in females (47.9%) (Kelati et.al, 2014). In the same year, a study conducted by Manyike et.al, (2014) revealed similar findings in Nigeria where the prevalence of malnutrition was found to be higher among boys (10.1%) compared to girls (9.2%). However, in case of severe wasting, the prevalence was higher in females (4.8%) as opposed to 4.1% males. 7.5% male children were found to be SAM as opposed to 6.0% females in a study carried out in Afghanistan (Frozanfar et.al, 2016). In a study conducted in Jamaica, 57% of children mapped as severely wasted were male (Thompson et.al, 2017). All these findings were further backed up by a study conducted in North-Western Uganda where it was found that the prevalence of acute malnutrition was higher in boys (7.7%) than in girls (3.9%) and they attributed this to higher growth rate in boys requiring more nutrients that are not supplied by the existing diets (Legason & Dricile, 2018). Boys were reported to be more likely to have SAM (OR=1.24; 95% CI. 1.20-1.28) (Fagbamigbe, Kandala & Uthman, 2020).

Other studies showed that wasting was more prevalent in girls than in boys. Tsedeke, Tefera & Debebe (2016) in their study in Hawassa Zuria, found that female children were more likely to be

wasted than male children (31.10% female vs 24.20% male). In a study conducted in the nomadic population of Hadaleala district, Afar region, Northeast Ethiopia, female children were found to be more malnourished (60%) than males (40%) (Gizaw, Woldu & Bitew, 2018). The findings of these studies were similar to that of a study conducted by Hossain et.al (2020) in Nepal which revealed that male children were at a lower risk of becoming SAM (AOR ¼ 0.50, 95% CI ¼ 0.27–0.92). This was thought to be as a result of the female children being at more risk of health disparities compared to the boys, and also the fact that boys are given more attention and care.

The differences in gender across countries and cultures as observed in the various studies may be due to behavioural patterns (Tesfai, Ratnayake & Myatt, 2013) or a slight anthropometric advantage by females or a preferential treatment of females due to their high value placed on their agricultural labor (Cronk, 1989). There is also a possibility that it is due to favouritism towards girls and the fact that boys are influenced by environmental stress than girls (Leslie, Ciemins & Essama, 1997 ; Sunguya, 2006).

On the flip side of the forementioned studies, some researchers came to a conclusion that there was no difference, statistically between the two genders. In a study conducted in two countries in Africa, Burundi and DRC, the prevalence of wasting was found not to be significantly different between male and female children ($p>0.05$, 12.1% and 12.3%) (Ekesa, Blomme & Garming, 2011). Mohamed & Hussein (2014), found no association between gender and nutritional status in a study they conducted in a rural area of northern Sudan (OR= 0.058 p=0.19). Another study conducted in Odisha found no statistical significance between gender and nutritional status (Sethy et.al, 2017).

Recent illnesses

When a child falls ill, there nutrient intake is compromised and hence they are vulnerable to being malnourished especially if the illness is prolonged and/or chronic. Several studies have revealed that there is an association between recent illness and malnutrition such as the study carried out in Bangladesh that showed the prevalence of severe wasting was the lowest among children who had not had any respiratory illness (0.8%) (Rahman, Chowdhury & Hossain, 2009). Another study conducted in Afghanistan revealed that children who had had a recent history of diarrhea were twice as prone to being acutely malnourished than those who had not suffered diarrhea (OR=1.57; 95% CI, 1.10–2.27). The thought behind this was the fact that when experiencing diarrhea or any sort of illness, children tend to eat less and their ability to absorb nutrients is diminished (Frozanfar

et.al, 2016). A similar study conducted by Ambadekar and Zodpey (2017) reported a strong association of five or more episodes of illness within the previous year with SAM (OR=7.6 95% CI, 3.6-16.3) while another study conducted in Ethiopia revealed that acute malnutrition was found to be 2.72 times more likely to be higher among children who had diarrheal disease [AOR = 2.72, 95% CI = (1.15,6.40)] (Gizaw, Woldu & Bitew, 2018). A study conducted in Nepal found that children who had had episodes of diarrhea in the last one month of the study were more likely to be SAM (AOR ¼ 1.75, 95% CI ¼ 0.92–3.39) (Hossain et.al, 2020).

Hand washing practices

It is known that hand washing is vital to ensure once health status and poor hand washing practices may lead to illness which may result into malnutrition. In a study conducted in Faryab, Afghanistan, there was found to be significant association between acute malnutrition and washing hands with soap especially after changing a child's diaper or cleaning their backside (OR=1.67; 95% CI, 1.19-2.34), before feeding the child (OR=1.73; 95% CI, 1.21-2.48) and after disposal of garbage (OR=2.11; 95% CI, 1.26-3.54), however the significance was lost after adjusted regression analysis was done (Frozanfar et.al, 2016). In a study conducted in Odisha, 67% of malnourished children's mothers had inadequate hygienic practices showing an association between hygiene practices and nutritional status (X^2=8.0265, p=0.004609) (Sethy et.al, 2017). Another study conducted in Northeast Ethiopia revealed that children whose mothers washed their hands with soap before food preparation and feeding were less likely to be malnourished as this practice reduced likelihood of wasting by 79% [AOR = 0.21, 95% CI = (0.05, 0.81)] (Gizaw, Woldu & Bitew, 2018). Hossain et.al, (2020) report that mothers' handwashing practices, especially using soap before feeding their children, can reduce 70% of the odds of malnutrition to the children in a study conducted in Nepal.

Family income

Family income plays a major role in ensuring food security at household level and with food security comes proper nutrition status and lack of which results to malnutrition of family members, more so, children under 5 years. Children born to unskilled fathers were found to be more likely malnourished compared to those whose fathers were skilled in a study conducted in Bangladesh ($p<0.001$). This was attributed to the probable cause that unskilled workers are usually illiterate and may have unsteady income (Rahman, Chowdhury & Hossain, 2009). A study in Afghanistan showed that children coming from households with an income of less than 250 USD per month

were more likely to be malnourished (OR=1.66; 95% CI, 1.04–2.27). This was attributed to the probable fact that with low income comes low purchasing power and hence a limitation on food items therefore leading to child wasting (Frozanfar et.al, 2016). A similar study carried out in South Ethiopia found that the risk of wasting was significantly higher among children from the lowest households' wealth index (AOR=4.41[95% CI: 2.94-8.45]). Those children coming from families that were categorized in the low SES were 4.4 more likely to be wasted compared to those from high SES. This may be due to the fact that low income may limit purchasing power. The study also linked low income with illness and revealed that children from low-income households were more likely to fall ill due to inadequate personal and environmental hygiene, and in the long run, these children become wasted (Tsedeke, Tefera & Debebe, 2016). In a study conducted by Ambadekar & Zodpey (2017) it was reported that children coming from families holding a BPL card were 2 times more likely to be SAM compared to their counterparts (95% CI, 1.5-2.7) and it was reported, in another study, that children who came from the poorest households were 39% more likely to have severe wasting than those from the richest households (OR= 1.39; 95% CI, 1.28-1.49) (Fagbamigbe, Kandala & Uthman, 2020).

Age

During the first 2 years of a child's life, adequate nutrition is vital to ensure proper growth and development of the child. There are the various guidelines on proper feeding practices and these practices have been divided age-wise because, as a child grows, their nutrient requirements change over time hence. With this in mind, if feeding practices are poor at any point in time then the child will become malnourished. Several studies have shown that there is a difference in prevalence of malnutrition on the basis of age. With regards to the age group 6-24 months, several studies show that prevalence is highest in this age group and the probable reason behind this may be inappropriate complementary feeding practices observed by the caregivers. Such studies include a study conducted in Bangladesh showed that percentage of severe wasting was highest among children aged 12-21 months, coming in at 2.7% (Rahman, Chowdhury & Hossain, 2009). Similar findings were reported in a study conducted in Nigeria showed that prevalence of acute malnutrition was highest among 1- and 2-year-olds (12.4% and 12.8%, respectively) and least among the 4-year-olds (4.7%, p=0.14) (Manyike et.al, 2014). A study carried out in Nepal found out that children in the age of 6-24 months had a higher likelihood of being severely malnourished as compared to those within the age group of 25-59 months (AOR ¼ 2.57, 95% CI ¼ 1.30–5.22)

(Hossain et.al, 2020). The study revealed that the prevalence of SAM within this age group may have been as a result of poor dietary habits, including the transition from breastfeeding to introduction of complementary foods and also low frequency of feeding. The same sentiments were shared by Legason & Dricile (2018) in a study they conducted in Uganda that revealed that SAM was more common among children aged 6-17 months (1.2%) and the prevalence decreased with age.

Other studies found that children above 23 months were more susceptible to malnutrition than children below 23 months. A study conducted in Mai-Aini Eritrean Refugees' Camp, Northern Ethiopia, revealed that the highest prevalence of wasting (7.6%) was in children aged 24-35 months and the lowest was in children 6-11 months. Also, the study reported that children in the age group 36-47 months were 2.9 times more likely to be wasted than those in the 48-59 months age group (Kelati et.al, 2014). Another study conducted in South Ethiopia revealed that the highest prevalence of acute malnutrition was found in children aged 36-47 months (36.5%) (Tsedeke, Tefera & Debebe, 2016) while similar findings were reported in a study conducted in Berhampur, Odisha that revealed that more underweight children belonged to the age group 37-60 months (49.3%) (Sethy et.al, 2017).

Minimum dietary diversity

Food is basically the fundamental source of nutrients to the body but when food is not diversified and the child given meals from the vast food groups, then the child does not receive adequate nutrients and in turn becomes malnourished. Children 6-23 months are recommended to consume foods from at least 5 of the 8 food groups defined by WHO and UNICEF. In a study conducted by Ekesa, Blomme & Garming (2011), 48% of children in DRC had low dietary diversity and only 7% had consumed high diversified diets in 24 hours preceeding the survey. The findings were almost similar in Burundi with 42% of children consuming low diversified diets and only 29% of the children having highly diversified diets. On finding the relationship between minimum dietary diversity and nutritional status, Ekesa, Blomme & Garming (2011) found that there was more to malnutrition than just diet, as there was a poor relationship between the two variables ($p>0.05$, $r^2=0.030$, $r^2 =0.051$). In a study conducted in Burkina Faso, greater dietary diversity was significantly associated with increased HAZ among children (SD 0.14, 95% CI 0.04 to 0.25). However, there was no association between dietary diversity and wasting or MUAC but there was found to be an association between dietary diversity and underweight in children less than 36

months of age (95% CI 0.04 to 0.35; p=0.02) (Sié et.al, 2018). Another study conducted in Niger, it was found that a child's age was significantly associated with higher dietary diversity (OR=0.241; 95% CI, 0.048-0.076) and in turn lower risk of wasting and this was attributed to the fact that as children grow older, their ability to eat a variety of foods increases (Egbuonye et.al, 2021).

However, a study conducted in Hawassa Zuria, South Ethiopia found no association between dietary diversity score with prevalence of wasting in the area (Tsedeke, Tefera & Debebe, 2016).

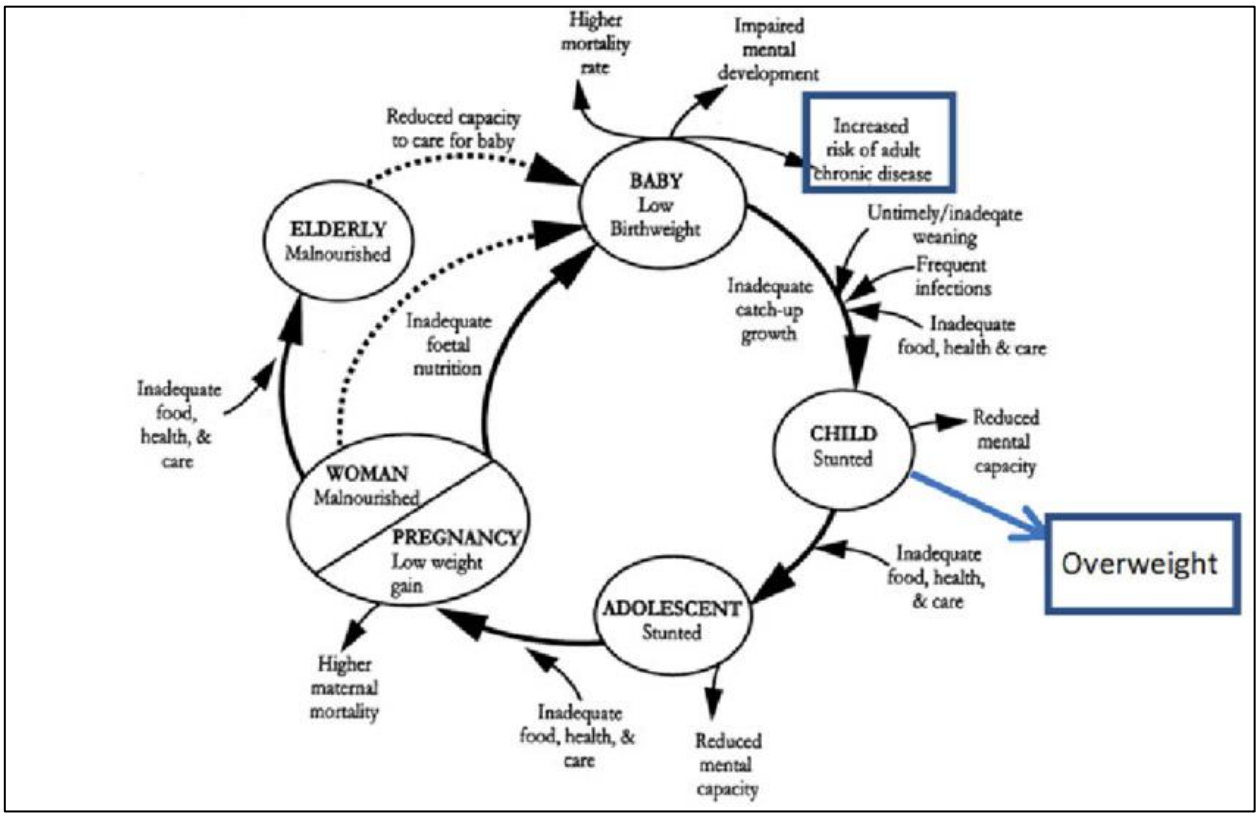
Immunization

Illness and disease vectors surround us each and every minute of our lives and to reduce the severity of infection, vaccinations are given to prevent these diseases from affecting a human being. Children all over the world have set schedules for their vaccinations right from birth to at least 18 months and beyond. These vaccines help the children not to contract illness as their immunity is very weak and becomes strong as they grow up. Some studies have shown that there is an association between immunization and nutritional status of children. A study conducted by Rahman, Chowdhury & Hossain (2009) on Bangladeshi children revealed that children who had not been given the measles vaccination had a higher prevalence rate of SAM than those who had received the vaccination ($p<0.05$). Ambadekar and Zodpey, 2017, report an increased risk of SAM 4-fold in children without age-appropriate vaccination (OR=3.9, 95% CI, 2.2-6.8) while Gizaw, Woldu & Bitew, (2018), in their study conducted in Ethiopia, reported that children who had been vaccinated were 85% less likely to be malnourished as compared to those who had not received vaccination.

When all these risk factors come into play, a child is predisposed to being malnourished and this change in nutritional states, for childhood, affects their growth and development as they end up becoming malnourished adolescents and adults. The intergenerational cycle of malnutrition, (Figure 2.3), depicts how the risk factors affect a person's nutritional status at any point in time. For example, when a child is born with low birth weight, then they are at risk of impaired mental development and they have inadequacies in catch-up growth. These infants later become malnourished children who are prone to frequent infections reduced mental capacity and as the grow into adolescence, they become stunted and wasted teenagers who later on become malnourished parents. A malnourished lady has a high chance of giving birth to a malnourished child and the cycle continues.

As seen from the review of literature, the prevalence of acute malnutrition in high amongst the population worldwide but the highest prevalence is seen in low- and middle-income countries. The causative factors for acute malnutrition need to be studied and therefore, the current study was planned in Baroda, as amongst the urban slums of Baroda. This was because there is paucity of data pertaining to the same and hence, it is imperative to screen the acute malnourished children and study the risk factors associated with the occurrence of the same so as to be able to manage acute malnutrition at the population level efficiently and effectively.

Figure 2. 7 Intergenerational cycle of malnutrition



(Source: UN Subcommittee on the Nutrition Fourth Report on the World Nutrition Situation)

METHODS AND MATERIALS

METHODS AND MATERIALS

Acute malnutrition is one of the major public health concerns and its leading causes are food insecurity, inadequate diet, poor health and hygiene practices, inadequate maternal and child care practices. Therefore, the study was designed to determine the prevalence of severe acute malnutrition in children 0-59 months residing in Urban Baroda, Gujarat State, and the association between socio-economic status, morbidity profile, immunization status, WASH practices, minimum dietary diversity and IYCF practices of the children and severe acute malnutrition. For the study, the scientific and systematic methodology was planned.

RESEARCH DESIGN

The research design used was a quantitative approach and it was a one-time, community-based, cross-sectional survey involving children 0-59 months registered in AWCs of Urban Baroda, Gujarat.

LOCATION OF THE STUDY

The study was conducted in Urban Baroda, Gujarat. Vadodara, previously known as Baroda (a term used interchangeably in this research), the third largest city and one of the Districts in Gujarat state. The district has a total area of 7,546 km^2. There are 25 towns and 1,537 villages in this district with a population of 4,165,626 people, according to the 2011 national census. Of these, 2,065,771 people reside in the urban area, of which children aged 0-6 years are 211,053 (NNMB Urban Survey Data, 2016).

Urban Baroda has a total of 439 AWCs which are divided into 4 zones, East, West, North and South, each with 86,126, 103 and 124 AWCs respectively.

STUDY POPULATION

The study population consisted of children, both male and female, aged 0-59 months registered in various AWCs of Urban Baroda.

SAMPLING AND SAMPLE SIZE

The sampling frame consisted of children 0-59 months registered in selected AWCs in Urban Baroda. The study area was purposely selected for being within close proximity but the AWCs were randomly selected from a list of AWCs provided by the Vadodara District Municipality.

Of the 439 AWCs, 36 AWCs (9 from each zone), were selected and all children registered in these AWCs who fit the inclusion criteria were screened, i.e, their anthropometric measurements were taken.

On the basis of the prevalence of wasting in Vadodara District (NFHS-5, , 2019-21), the sample size of the present study has been calculated by adopting the formula: $n = Z\ 2\ \alpha / 2 \times PQ/ \Sigma\ 2$

Where, P = Prevalence of wasting = 12.65% = 0.1265

Q = 1 – P = 0.8735

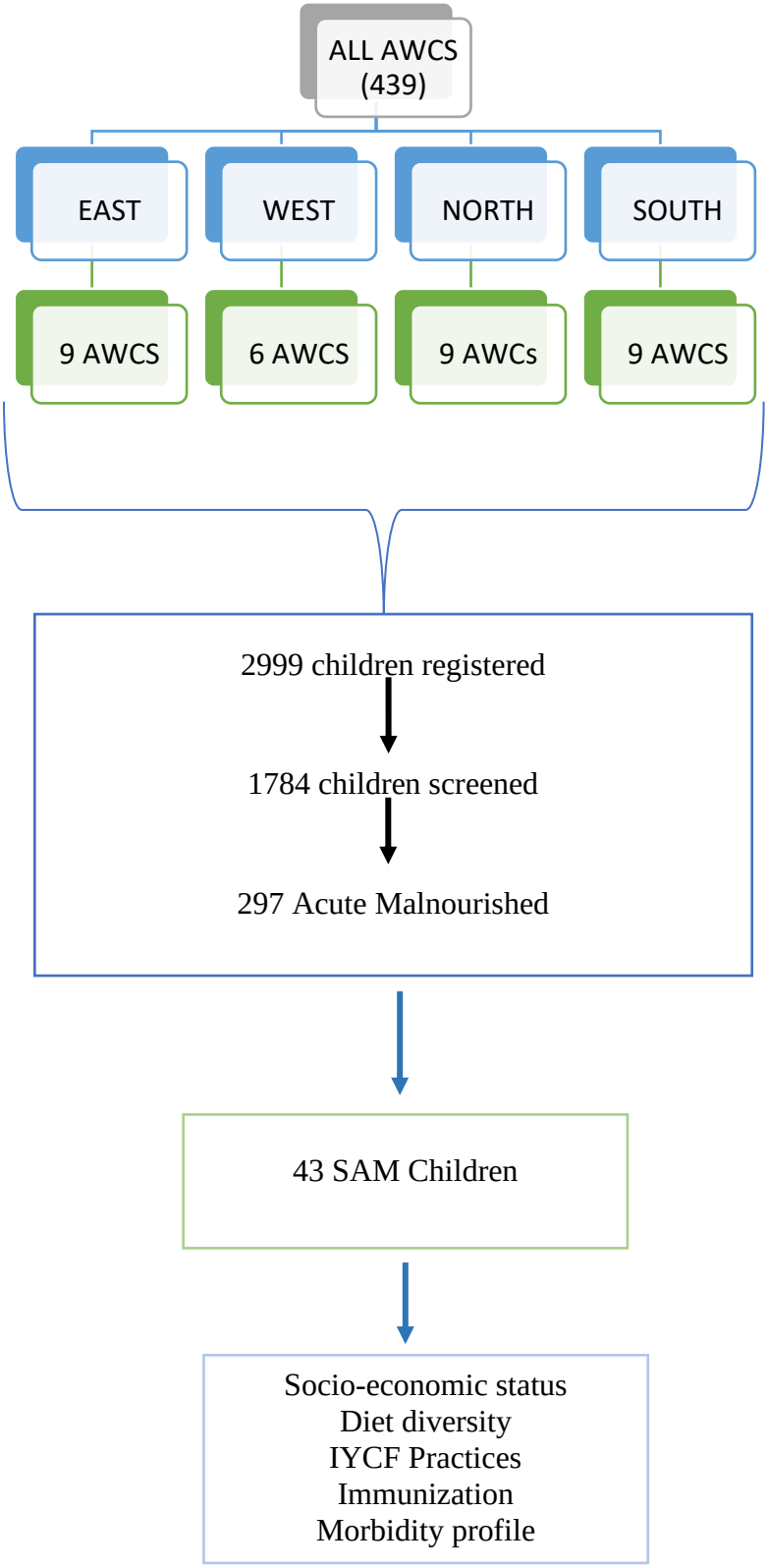
α = level of Significance (type 1 error) Z2 α / 2 = 4

Σ = Allowable error 5%

Then n = 4 x 0.1265 x 0.8735 / 0.0025 = 177

10% non-response rate = 177+18 = 195 ≈200

Figure 3. 8 Study outline flow chart



Purposive non-probability sampling technique was employed for this study as, despite all children in the selected AWCs being screened, only those who were found to be severely wasted were taken into consideration as the sample population.

INCLUSION CRITERIA

All children 0-59 months registered in the selected AWCs were included and those that were found to be SAM were followed up for the last part of the study. Confirmation of registration was done by ensuring that the children were in the respective registers prepared by the AWWs.

EXCLUSION CRITERIA

Children who were experiencing acute/chronic illnesses for the past 15 days of the study period were excluded. Also, those whose parents did not consent to participation or were later found to be of normal nutritional status or MAM were excluded from the study.

TOOLS AND METHODS

Several methods of data collection were used in this study including: anthropometric assessment, a research questionnaire and dietary quality questionnaire. Data collection was done using an interview-based approach in the local language, either Gujarati or Hindi, to ensure that the respondents understood the questions as intended by the researcher, and also to improve accuracy in terms of completely filling up the questionnaires. The responses were collected using the ODK platform.

ANTHROPOMETRIC ASSESSMENT

Anthropometry is the measurement of the human body and usually comprises a series of non-invasive, inexpensive and easy to perform methods of estimating body composition using parameters such as weight, height/length and in children 6-59 months, MUAC.

Weight: A digital 3-in-1 weighing scale (baby, child and adult weighing scale) was used to measure the body weight of the children. The weight was taken without shoes, socks, heavy clothing including sweaters and jackets, belts and watches. For the infants, their weight was taken while they lay down or sat on the weighing scale's tray while for the young children who could stand, their weight was taken after they comfortably stood erect on the scale with their arms hanging loosely and them facing forward. Only after the display was fixed was the weight displayed

recorded to the nearest 0.1kg. For every subject, the machine had to be adjusted to zero (0.00) before weighing the next subject.

Height: this was taken for the children who were above 2 years of age by the use of a portable stadiometer. The child was asked to stand on the base with no shoes on, upright against the middle of the stadiometer. The child's head, shoulders, buttocks, knees and heels were held against the stadiometer by the mother/AWW. The slider was then taken down upto the top of the child's head, compressing the hair and the reading taken by the investigator as indicated by the arrow on the slider, to the nearest 0.1 cm.

Length: This was taken for children below 24 months. The infantometer was placed on the floor and the child was lay along the middle of the infantometer. The AWW/mother was at the fixed side of the board and held the child's head in position, firmly as it touched the headboard with the hair compressed. Then, the investigator placed their hands on the child's legs, gently stretching the child and then kept one hand on the thighs to prevent flexion. While positioning the child's legs, the sliding foot-plate was pushed firmly against the bottom of the child's feet and their length was read at the mark where the foot-plate was perpendicular to the board, to the nearest 0.1 cm.

MUAC: MUAC is an alternative way to measure "thinness" (alternative to weight-for-height). It is especially used for children six months old to five years old. The AWW was requested to assist to remove any clothing covering the child's left arm. Then, the investigator calculated the midpoint of the child's left upper arm by first locating the tip of the child's shoulder (acromion process) with their fingertips. Once that was located, the child's elbow was bent to make a right angle. The MUAC tape was then placed at zero, which is indicated by two arrows, on the tip of the shoulder and pulled straight down past the tip of the elbow. The number at the tip of the elbow was read to the nearest centimeter and then divided by two to estimate the midpoint and a mark was made at the midpoint with a pen on the arm.

The child's arm was then straightened and the tape wrapped around the arm at the midpoint, ensuring that it is flat around the skin. After proper positioning with the correct tension, the reading was taken from the small window to the nearest 0.1 cm.

WHZ: The weight-for-height z-score was read by taking the child's height and then, using the WHO growth charts, the corresponding weight of the child along the height row was estimated and classified as SAM (≤-3), MAM (≥-3 - ≤-2) or normal (>-2) using the z-scores.

HAZ: The height-for-age z-score was read by taking the child's age and then, using the WHO growth charts, the corresponding height of the child along the age row was estimated and classified as severely stunted (≤-3), stunted (≥-3 - ≤-2) or normal (>-2) using the z-scores.

WAZ: The weight-for-age z-score was read by taking the child's age and then, using the WHO growth charts, the corresponding weight of the child along the age row was estimated and classified as severely underweight (≤-3), underweight (≥-3 - ≤-2) or normal (>-2) using the z-scores.

Also, the latest available anthropometric measurements for those children at the AWC level was recorded together with the name of the AWC.

DIETARY ASSESSMENT

For dietary assessment, the Diet Quality Questionnaire was used. The DQQ is a standardized tool to collect indicators of dietary adequacy, including the minimum dietary diversity for women (MDD-W) indicator (Martin-Prevel et.al, 2017) and All-5, as well as indicators of protection of health against noncommunicable diseases (NCDs), including NCD-Protect, NCD-Risk, and the global dietary recommendations score (GDR) (Herforth et.al, 2020). The DQQ was developed to enable population-level diet quality monitoring. It can be used to assess dietary patterns and trends in the general population; separate companion questionnaires are designed for infants and young children under age 2 years, which were used for this study.

RESEARCH QUESTIONNAIRE

In a community-based study, it was necessary and possible to obtain information by asking questions. Socio-economic and demographic data, WASH practices, knowledge on supplementary nutrition, immunization status and morbidity profile were collected by using a semi-structured researcher administered questionnaire. Socio-economic status was based on the educational levels, occupation and income of the interviewed person as well as the household head, as characterized in the KUPPUSWAMY scale.

VALIDITY

In this study, validation of the instrument (questionnaire) was done to ensure that the content and the format of the questionnaire were consistent with the study variables. In this case face validation, content and construction of the questionnaire were assessed by a technical committee from the Food and Nutrition Department, MSU Baroda. Comments from the experts were incorporated into

the instruments before being used in the field. No pre testing was done as the questionnaire used was derived from a set of standardized questionnaires.

RELIABILITY

For this study, reliability of the instruments and tools was done by calibration and standardization of the measuring instruments (stadiometer, infantometer, MUAC tape and the weighing scale) was done. The test-retest reliability approach was employed.

ETHICAL CONSIDERATIONS

The researcher obtained an introductory letter from the department before carrying out the study. This facilitated the acquisition of a permission letter from the Municipal Corporation authorizing the carrying out of the research among the children of Vadodara District. The researcher also sought permission from the block administrators and supervisors to be allowed to carry out the study in the AWCs. Individuals' informed consent was obtained before interviewing them and this was after explaining to them the purpose of the study and how the results from the study will be used. Both the information letter and consent form were in Gujarati. They were also assured of strict confidentiality of all the information collected in the study.

DATA ANALYSIS

Following the collection of data using the ODK platform, the spreadsheets were downloaded from KOBO. Thereafter, both descriptive and inferential analyses of the data was undertaken using the Statistical Package for Social Sciences version 20 computer software. Percentage, frequency distribution, mean and standard deviation was used under descriptive analysis while independent t- test, chi- square test and ANOVA was used to indicate the relationship between the various variables.

RESULTS AND DISCUSSION

RESULTS AND DISCUSSIONS

Undernutrition and wasting contribute to nearly 50% of deaths among children under 5 years of age and these deaths mostly occur in low- and middle-income countries (WHO, 2023). This study is to investigate the prevalence of severe acute malnutrition, the most severe form of wasting and look into the associating factors so as to understand better the probable causes and determinants to severe wasting. The findings of this study, in line to the forementioned objectives, are presented and discussed in this chapter.

SCREENING FOR SEVERE ACUTE MALNUTRITION

During the study period, there were a total of 439 Anganwadi centres in Urban Baroda. Among these, 36 were randomly selected for the study. These AWCs fell in the 4 zones of Urban Baroda, i.e., East, West, North and South. Details of these AWCs are given in Table 4.1.

Out of the 2,999 children registered in these AWCs, 2740 were enrolled for the study as the rest, 257, were above 59 months. Out of the 2740 children considered, only 1784 were measured and the rest, even after 3 consecutive visits, were not measured for various reasons as illustrated below.

The highest number of children who were not measured were recorded as “Didn’t come” and this was due to various reasons but majority were because the parents/caregivers refused to bring their children for measuring, in 1 AWC the AWW refused to call the children for measurement and in another AWC, the AWW was new and did not really know who the registered children were. Majority of those who were reported to be in the villages were children below 6 months, especially between 0-2 months, because, as it is in Indian culture, once a mother gives birth to her child, she goes to stay with her mother so as to be taken care of.

Out of the 1784 children who were screened, 918 (51.5%) and 866 (48.5%) were boys and girls, respectively. Majority of these children belonged to the age category, 7-35 months with the lowest turnup being those below 6 months (9.8%).

The mean weight, height and MUAC of the children were segregated based on gender and age categories as is in Table 4.2 and Table 4.3. The mean weight of boys was 10.56kg and that of girls was 10.24kg. This indicates that boys weigh more than girls and the difference is statistically significant. With regards to height, the mean height of boys was 83.2cm while that of girls was 82.7cm, showing that boys were relatively taller than girls. There was gradual increase in mean height, weight and MUAC with increase in age regardless of gender.

Table 4. 25: AWCs in Urban Baroda Considered for the Study

	ZONE	NAME OF AWC	CHILDREN REGISTERED IN THE AWCs (0-6 YEARS)				
			TOTAL (2999)	BOYS (1557)		GIRLS (1442)	
			N	N	N%	n	N%
1	EAST	Warsiya 08	93	52	55.91	41	44.09
2		Sawad 04	93	51	54.84	42	45.16
3		Kishanwadi 04	59	39	66.10	20	33.90
4		Kishanwadi 05	78	37	47.44	41	52.56
5		Sudamapuri 01	101	50	49.50	51	50.50
6		Sudamapuri 06	79	50	63.29	29	36.71
7		Ramdevnagar 02	72	36	50.00	36	50.00
8		Ramdevnagar 03	127	69	54.33	58	45.67
9		Vemali 01	64	33	51.56	31	48.44
10	WEST	Jetalpur 01	79	41	51.90	38	48.10
11		Tandalja 02	96	55	57.29	41	42.71
12		Tandalja 03	113	58	51.33	55	48.67
13		Tandalja 06	166	105	63.25	61	36.75
14		Tandalja 09	66	31	46.97	35	53.03
15		Diwalipura 05	94	47	50.00	47	50.00
16	NORTH	Ektanagar 03	78	39	50.00	39	50.00

17		Navayad 06	108	52	48.15	56	51.85
18		Navayad 09	108	56	51.85	52	48.15
19		Karelibaug 06	88	47	53.41	41	46.59
20		Channi 01	57	25	43.86	32	56.14
21		Channi 02	87	41	47.13	46	52.87
22		Navapura 10	85	40	47.06	45	52.94
23		Shiabaug 02	108	52	48.15	56	51.85
24		Shiabaug 01	91	34	37.36	57	62.64
25	SOUTH	Gajarwadi 10	90	40	44.44	50	55.56
26		Danteshwer 02	120	50	41.67	70	58.33
27		Danteshwer 03	86	39	45.35	47	54.65
28		Maneja 05	89	50	56.18	39	43.82
29		Maneja 04	108	67	62.04	41	37.96
30		Manjalpur 10	77	40	51.95	37	48.05
31		Vadsar 02	120	65	54.17	55	45.83
32		Vadsar 04	71	39	54.93	32	45.07
33		Tarsali 07	46	26	56.52	20	43.48

Figure 4. 23: Reasons for Children not being Measured

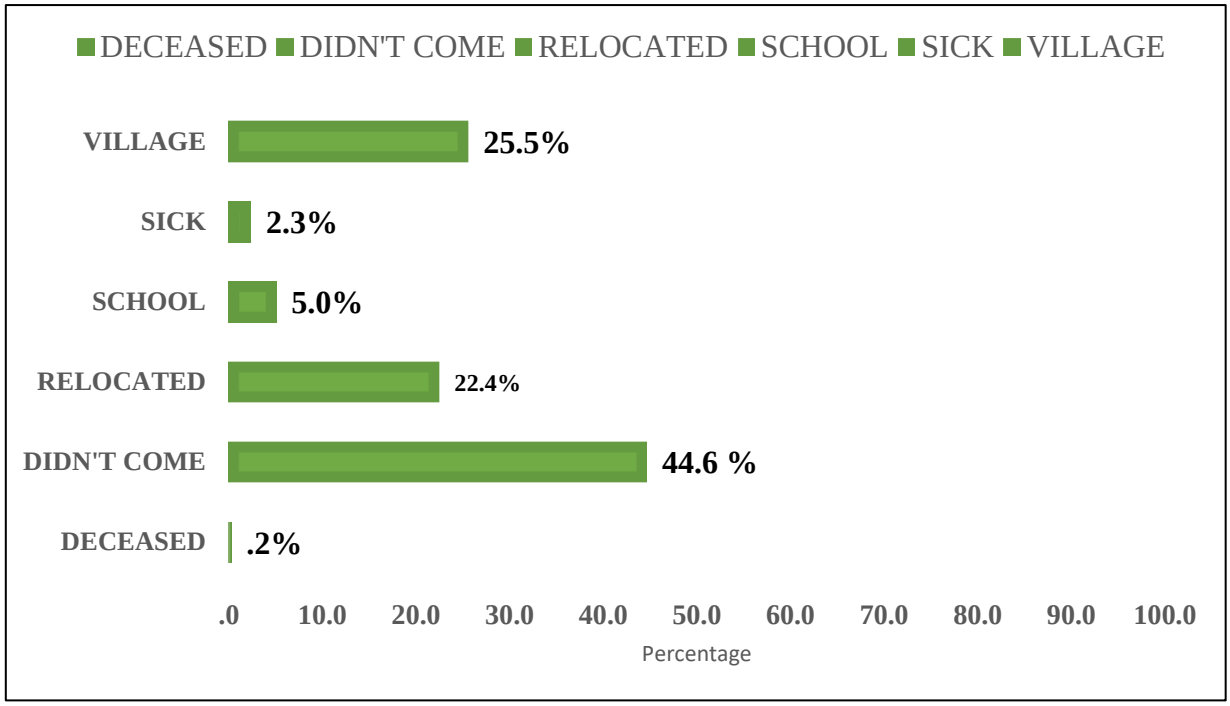


Figure 4. 24: Age Distribution of the Children Screened

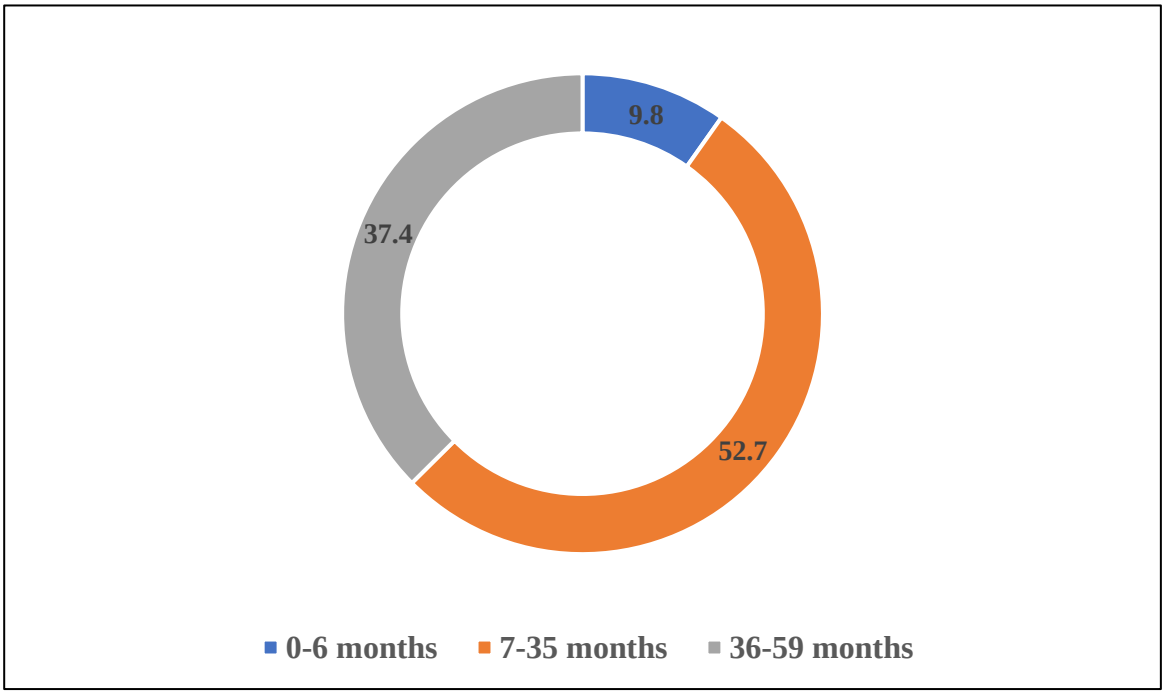


Table 4. 26: Anthropometric Means Gender Wise

	GENDER						
	MALE (N=918)		FEMALE (N=866)		TOTAL (N=1784)		t- value (p value)
	Mean	S.D	Mean	S.D	Mean	S.D	
WEIGHT	10.6	2.9	10.2	2.9	10.4	2.9	2.307(0.021)*
HEIGHT	83.2	13.1	82.7	12.7	83.0	12.9	0.943(0.346)
MUAC	13.8	1.0	13.7	1.0	13.8	1.0	2.46(0.014)*

Table 4. 27: Anthropometric Means Age Wise

	AGE CATEGORIES								
	0-6 MONTHS (N=175)		7-35 MONTHS (N=941)		36-59 MONTHS (N=668)		TOTAL (N=1784)		F value (p value)
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	
WEIGHT	5.5	1.2	9.5	1.8	13.0	1.7	10.4	2.9	118.452(0.000)***
HEIGHT	59.6	4.4	78.3	7.5	95.6	5.4	83.0	12.9	330.628(0.000)***
MUAC	0.0	0.0	13.5	1.0	14.1	0.9	13.8	1.7	

RESULTS AND DISCUSSIONS

PREVALENCE OF MALNUTRITION

Using the anthropometric measurements obtained from screening the children, the prevalence of not only severe acute malnutrition, but also underweight and stunting was calculated using the WHO 2007 standards. The prevalence was reported using Z-scores for the indices, i.e.,

i. Weight-for-height (WHZ), an indicator of wasting,
ii. Weight-for-age (WAZ), an indicator of underweight, and,
iii. Height-for-age (HAZ), an indicator of stunting.

These indicators are depicted, age and gender-wise, in tables 4.4 – 4.9 The mean Z-scores had for both genders as well as throughout the age groups, for all 3 indices. The girls had WHZ, WAZ and HAZ of -0.84±0.97, -1.37±1.04 and -1.35±1.12, respectively, while the boys had WHZ, WAZ and HAZ of -0.95±1.03, -1.41±1.03 and -1.36±1.25, respectively. The overall mean±SD for WHZ, WAZ and HAZ were -0.9±1, -1.39±1.04 and -1.36±1.19, respectively. The data indicates that both boys and girls had lower weight and lower height as compared to WHO 2007 growth standards. These observations indicate that the children are not able to keep the pace of growth, and early preventive care is strongly recommended for their optimal growth.

Using the gender-wise illustration for the 3 indices, it is evident that boys were more malnourished compared to the female counterparts.

Weight-for-height (WHZ)

The prevalence of severe wasting among children 0-59 months registered in AWCs of Urban Baroda was found to be 2.2%. Prevalence of moderate wasting, at risk of wasting and overweight was found to be 10.3%, 33.2% and 0.4%, respectively. 51.5% of the children were found to have normal weight-for-height z-scores while 2.4% were found to be at possible risk for overweight (Figure 4.3).

Children 0-6 months had the height prevalence of SAM at 5.1% while children 36-59 months had the highest prevalence of MAM and being at risk of wasting at 12.3% and 37.3%, respectively (Table 4.4). While comparing the z-scores against the WHO 2007 standards, there was seen to be an increase in the prevalence of wasting with increase in age (Figure 4.4).

Boys were found to be more malnourished compared to girls. The prevalence of wasting in boys was 2.8% for severe wasting and 12.1% for moderate wasting, as compared to girls with 1.6% of them being SAM, 8.3% MAM, 34.9% at risk of wasting and 0.1% overweight (Table 4.5). The

data also indicates that both boys and girls had lower weight for height z-scores compared to WHO 2007 growth standards (Figure 4.5).

Figure 4. 25: Prevalence of Wasting among Children 0-59 Months in Urban Baroda

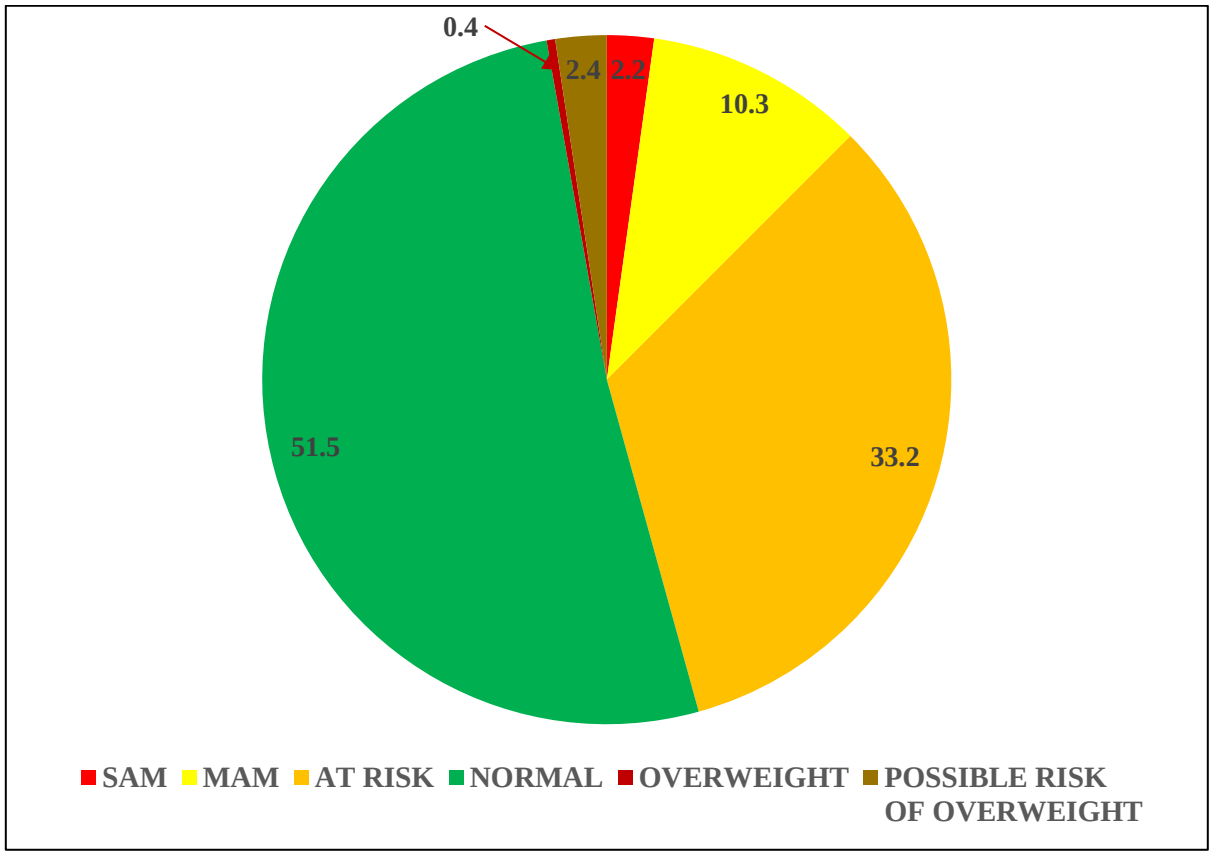


Table 4. 28: Prevalence of Wasting Age Wise

	AGE CATEGORIES								
	0-6 MONTHS (N=175)		7-35 MONTHS (N=941)		36-59 MONTHS (N=668)		TOTAL (N=1784)		Chi-square (p value)
	N	N%	N	N%	N	N%	N	N%	
SAM	9	5.1	19	2.0	12	1.8	40	2.2	54.380 (0.000)***
MAM	18	10.3	83	8.8	82	12.3	183	10.3	
AT RISK	36	20.6	308	32.7	249	37.3	593	33.2	
NORMAL	98	56.0	500	53.1	320	47.9	918	51.5	
POSSIBLE RISK OF OVERWEIGHT	12	6.9	27	2.9	4	0.6	43	2.4	
OVERWEIGHT	2	1.1	4	0.4	1	0.1	7	0.4	

Figure 4. 26: Age-Specific Mean WHZ (Z-Score)

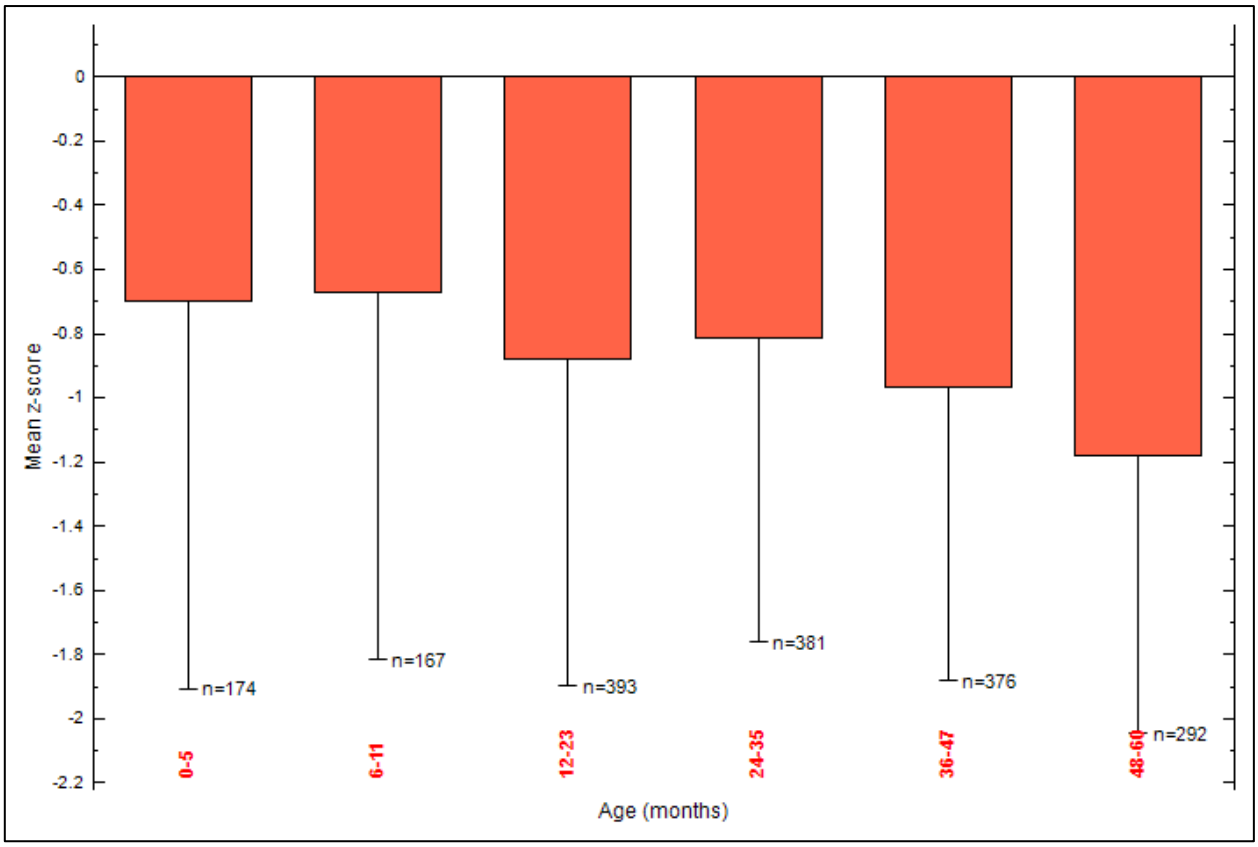
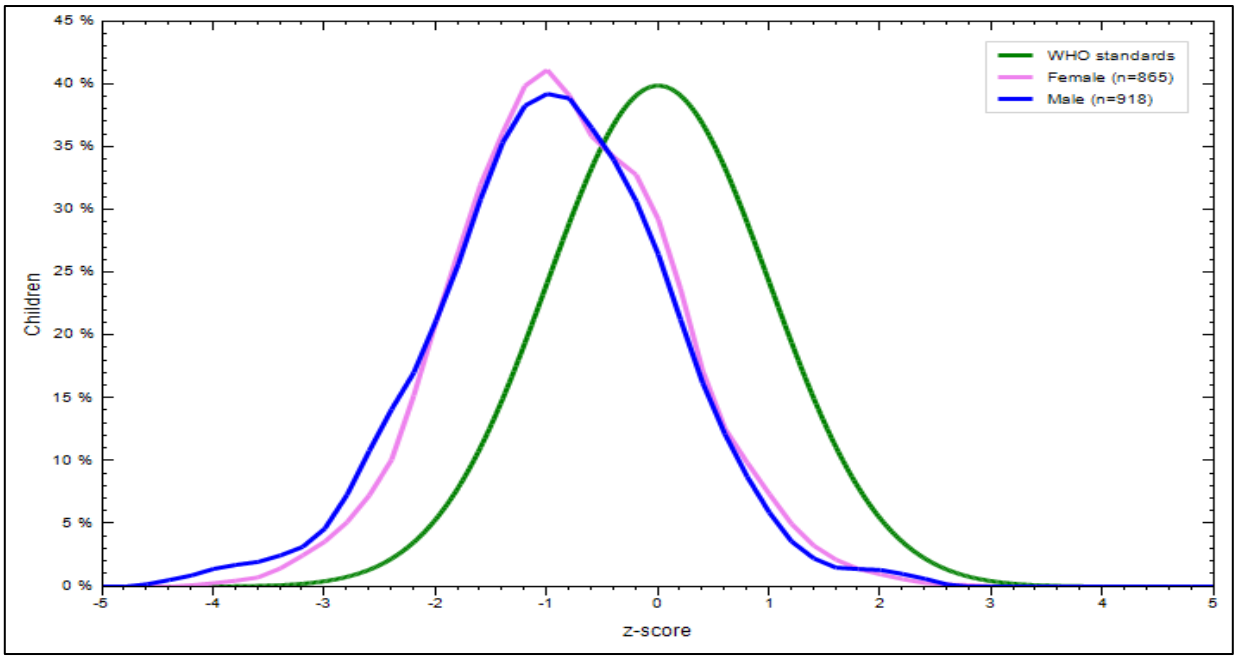


Table 4. 29: Prevalence of Wasting Gender Wise

	GENDER						
	MALE (N=918)		FEMALE (N=866)		TOTAL (N=1784)		Chi-square (p value)
	N	N%	N	N%	N	N%	
SAM	26	2.8	14	1.6	40	2.2	17.353 (0.004)**
MAM	111	12.1	72	8.3	183	10.3	
AT RISK	291	31.7	302	34.9	593	33.2	
NORMAL	468	51.0	450	52.0	918	51.5	

POSSIBLE RISK OF OVERWEIGHT	16	1.7	27	3.1	43	2.4	
OVERWEIGHT	6	0.7	1	0.1	7	0.4	

Figure 4. 27: Gender-Specific WHZ (Z-Score)



Weight-for-age (WAZ)

The prevalence of severe underweight among children was found to be 5.3%. Prevalence of moderately underweight, at risk of being underweight and at risk of being overweight was found to be 21.9%, 37.8% and 1.1%, respectively. 34.0% of the children were found to have normal weight-for-age z-scores (Figure 4.6).

Children 36-59 months had the highest prevalence of underweight as 6.0% and 26.9% were severely and moderately underweight, respectively, while 40% were at risk of being underweight. 51.4% of the children with normal WAZ were aged 0-6 months and the highest prevalence of possible risk of overweight being in the same age group (Table 4.6). While comparing the z-scores against the WHO 2007 standards, there was seen to be an increase in the prevalence of underweight with increase in age (Figure 4.7).

Boys were found to be severely underweight compared to girls. The prevalence of severe underweight in males was 5.6% while in females it was 5.1%. However, girls had a higher prevalence of moderately underweight at 22.1% and possibly being overweight 1.3% (Table 4.7). The data also indicates that both boys and girls had lower weight for age z-scores compared to WHO 2007 growth standards (Figure 4.8).

Height-for-age (HAZ)

The prevalence of severe stunting was found to be 7.7%. Prevalence of moderate stunting and risk of stunting was found to be 19.8% and 35.8%, respectively. 36.7% of the children were found to have normal height-for-age z-scores (Figure 4.9).

Children aged 7-35 months had the highest prevalence of severe stunting (9.6%). Children falling under the age group of 36-59 months had the highest prevalence of moderate stunting and those who were at risk of stunting, at 22.5% and 42.1%, respectively (Table 4.8). In comparison to the WHO 2007 standards, there was seen to be an increase in the prevalence of stunting with increase in age but, this peaked at 24-35 months and then the prevalence decreased with increase of age thereafter (Figure 4.10).

Boys were found to be severely stunted compared to girls. The prevalence of severe stunting in boys was 8.8% while in girls it was 6.1%. However, girls had a higher prevalence of moderate stunting and being at risk of stunting at 21.2% and 36.8%, respectively (Table 4.9). The data also indicates that both boys and girls had lower height for age z-scores compared to WHO 2007 growth standards (Figure 4.11).

Figure 4. 28: Prevalence of Underweight among Children 0-59 Months in Urban Baroda

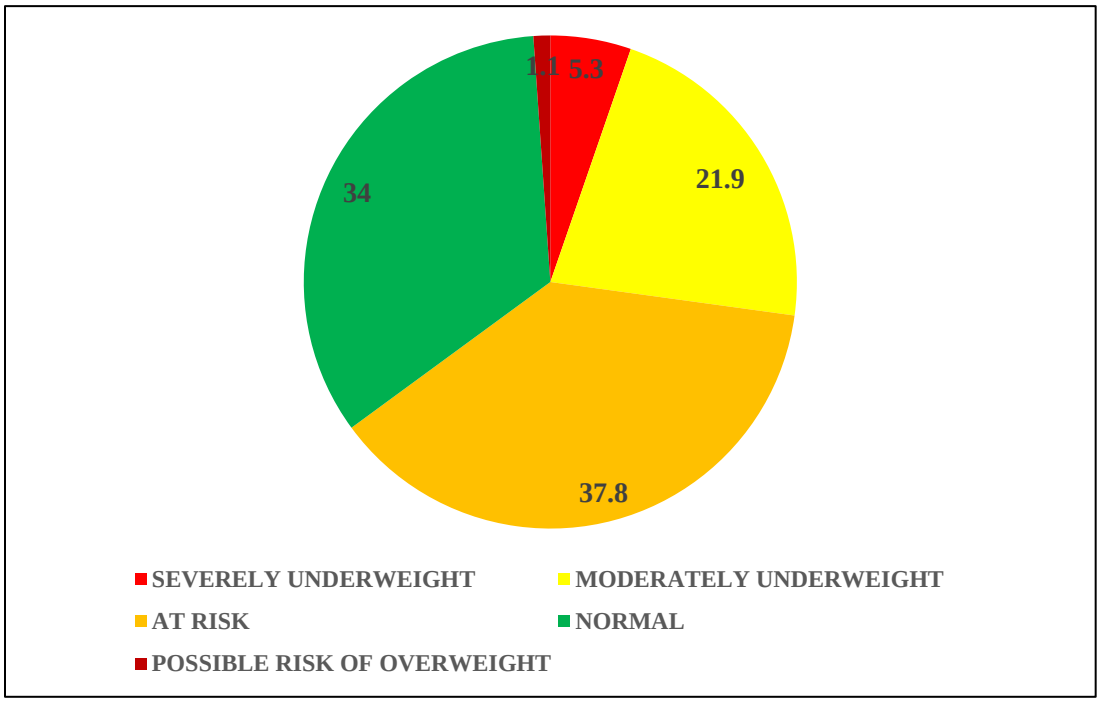


Table 4. 30: Prevalence of Underweight Age Wise

	AGE CATEGORIES								
	0-6 MONTHS (N=175)		7-35 MONTHS (N=941)		36-59 MONTHS (N=668)		TOTAL (N=1784)		Chi-square (p value)
	N	N%	N	N%	N	N%	N	N%	
SEVERELY UNDERWEIGHT	6	3.4	49	5.2	40	6.0	95	5.3	60.315 (0.000)***
MODERATELY UNDERWEIGHT	20	11.4	190	20.2	180	26.9	390	21.9	
AT RISK	54	30.9	353	37.5	267	40.0	674	37.8	
NORMAL	90	51.4	336	35.7	180	26.9	606	34.0	

POSSIBLE RISK OF OVERWEIGHT	5	2.9	13	1.4	1	0.1	19	1.1	

Figure 4. 29: Age-specific Mean WAZ (Z-score)

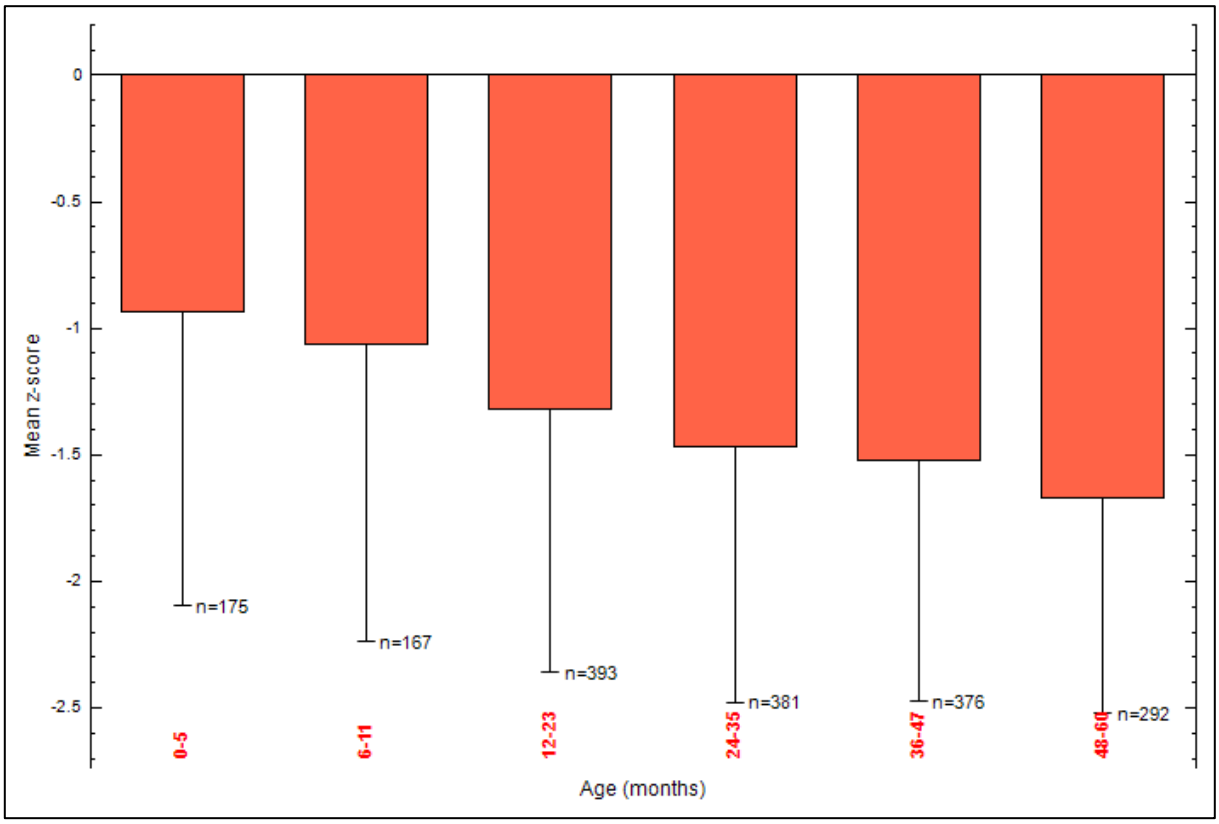


Table 4. 31: Prevalence of Underweight Gender Wise

	GENDER						
	MALE (N=918)		FEMALE (N=866)		TOTAL (N=1784)		Chi-square (p value)
	N	N%	N	N%	N	N%	
SEVERELY UNDERWEIGHT	51	5.6	44	5.1	95	5.3	0.891 (0.926)
MODERATELY UNDERWEIGHT	199	21.7	191	22.1	390	21.9	
AT RISK	348	37.9	326	37.6	674	37.8	
NORMAL	312	34.0	294	33.9	606	34.0	
POSSIBLE RISK OF OVERWEIGHT	8	0.9	11	1.3	19	1.1	

Figure 4. 30: Gender-Specific WAZ (Z-Score)

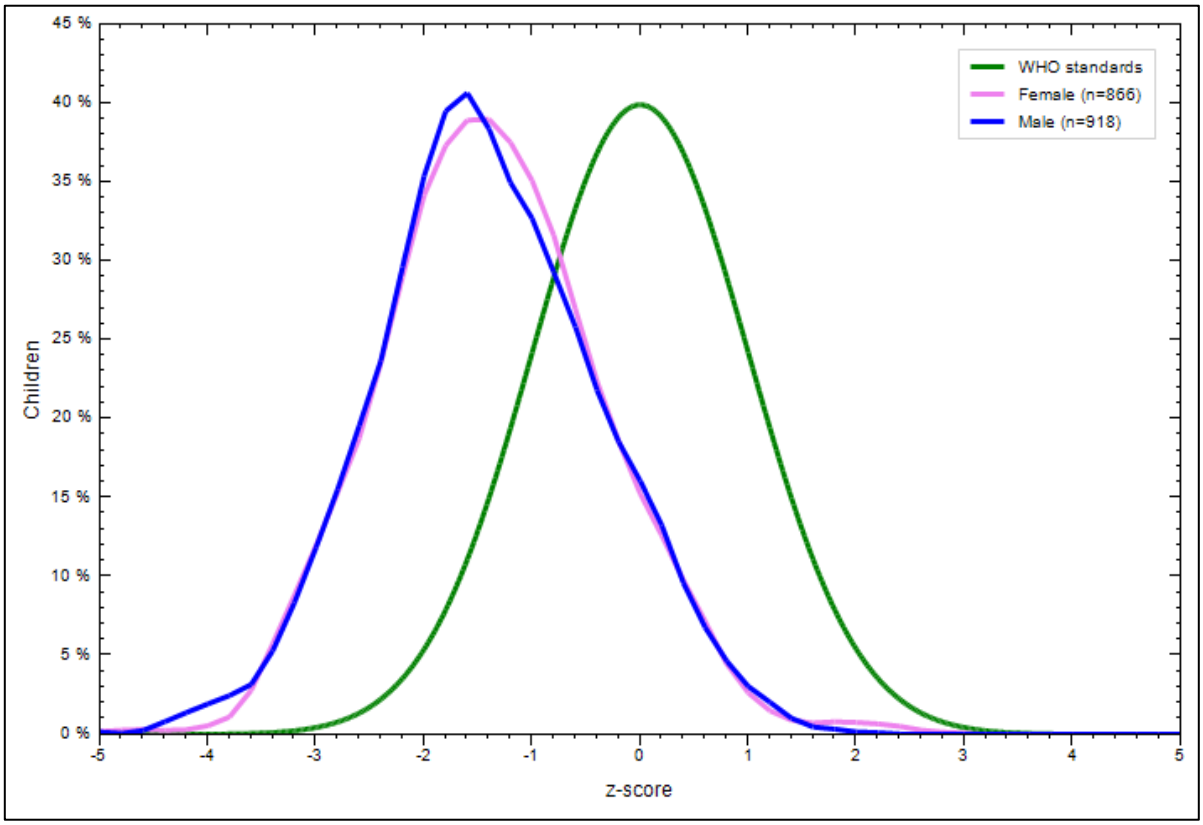


Figure 4. 31: Prevalence of Stunting among Children 0-59 Months in Urban Baroda

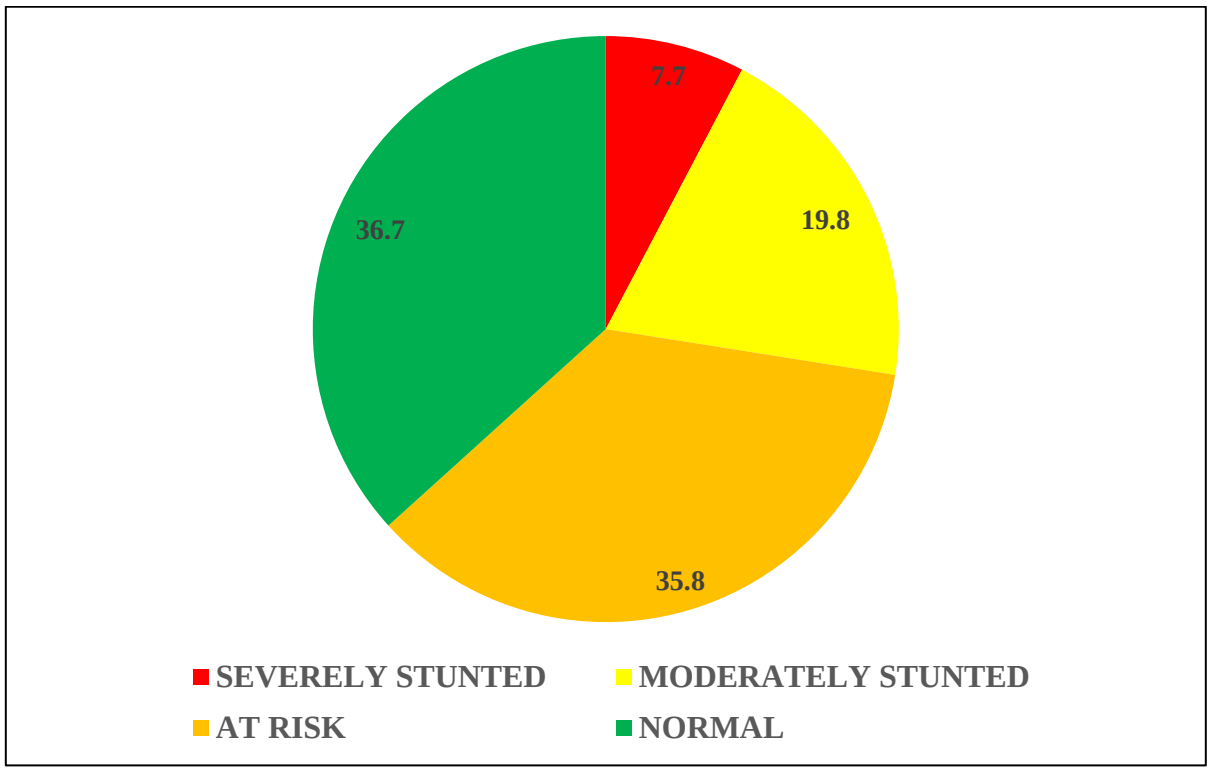


Table 4. 32: Prevalence of Stunting Age-Wise

	AGE CATEGORIES								
	0-6 MONTHS (N=175)		7-35 MONTHS (N=941)		36-59 MONTHS (N=668)		TOTAL (N=1784)		Chi-square (p value)
	N	N%	N	N%	N	N%	N	N%	
SEVERELY STUNTED	5	2.9	90	9.6	42	6.3	137	7.7	112.753 (0.000)***
MODERATELY STUNTED	9	5.1	195	20.7	150	22.5	354	19.8	
AT RISK	39	22.3	318	33.8	281	42.1	638	35.8	
NORMAL	122	69.7	338	35.9	195	29.2	655	36.7	

Figure 4. 32: Age-Specific Mean HAZ (Z-Score)

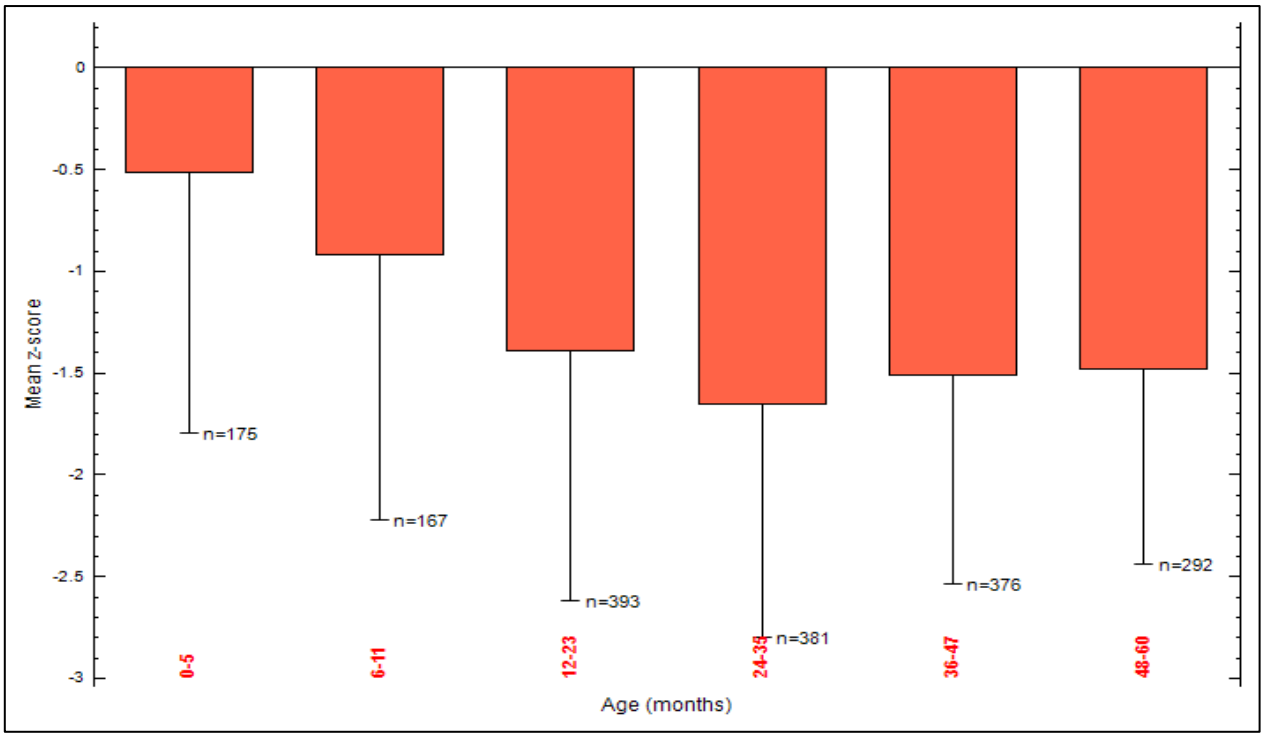
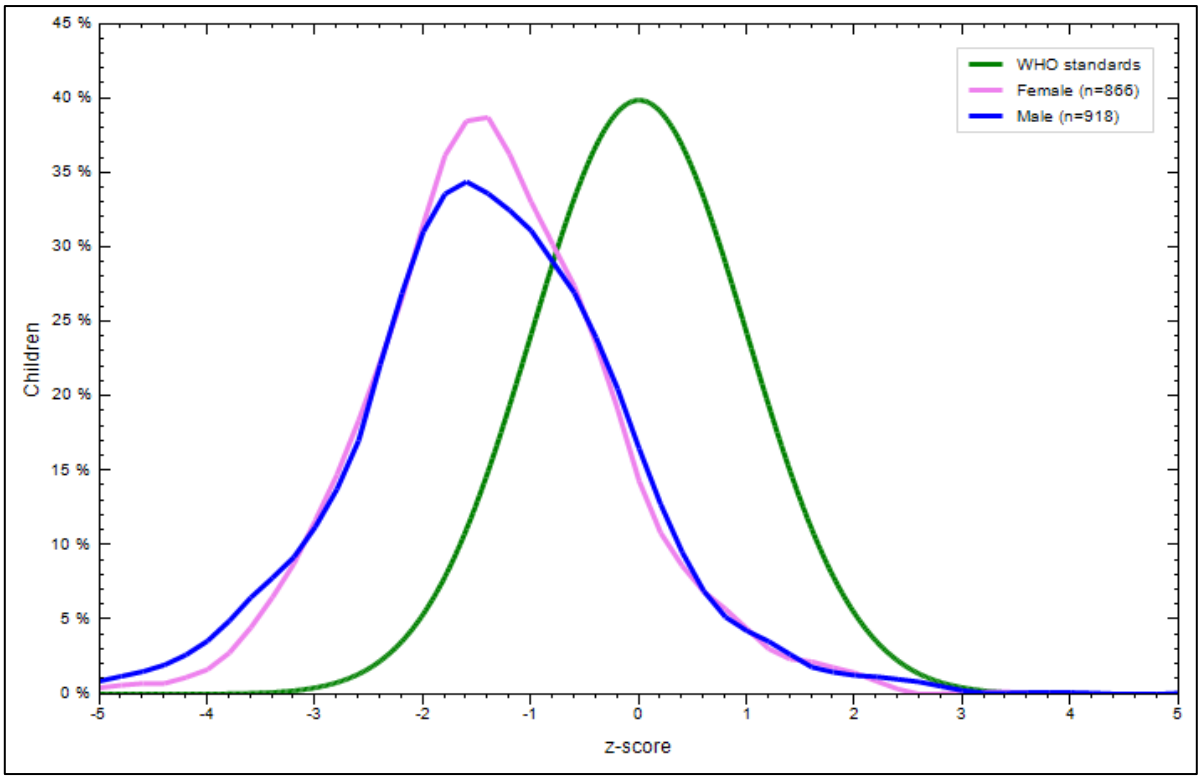


Table 4. 33: Prevalence of Stunting Gender Wise

	GENDER						
	MALE (N=918)		FEMALE (N=866)		TOTAL (N=1784)		Chi-square (p value)
	n	N%	n	N%	n	N%	
SEVERELY STUNTED	83	9.0	54	6.2	137	7.7	6.014 (0.111)
MODERATELY STUNTED	174	19.0	180	20.8	354	19.8	
AT RISK	319	34.7	319	36.8	638	35.8	
NORMAL	342	37.3	313	37.3	655	36.7	

Figure 4. 33: Gender-Specific HAZ (Z-Score)



Mid-Upper Arm Circumference

For MUAC measurements, only 1604 children were measured. Children below 6 months were not measured and 6 children above 6 months. Out of the 1603 children, 89.8% had a normal MUAC (≥12.5cm), 9.0 % were moderately underweight (MUAC between 11.5cm and <12.5cm) and 1.2% were categorized as SAM because they had a MUAC of ≤11.5cm (Figure 4.12).

With regards to gender, male children had better nutritional status on the basis of MUAC than females (Table 4.10) and there was increase in MUAC with increase in age (Table 4.11).

ANTHROPOMETRIC DATA IN THE AWCs

The study also focused into looking at the data available in the AWCs. This was to compare the study findings with the recorded data/data available in the AWCs and check if the prevalence for malnutrition was any different.

The recorded mean anthropometrics are showed in Table 4.12 and displayed against the measured anthropometrics. It is clear that there are differences in the values and they could be many reasons for these discrepancies, including, and not limited to, the fact that some of the scales in the AWCs are not calibrated hence giving wrong readings and some of the measurements, such as height, is not taken every month.

MUAC was not measured in the centres yet there were MUAC tapes present.

Figure 4. 34: Prevalence of Wasting among Children 0-59 Months in Urban Baroda on the Basis of MUAC

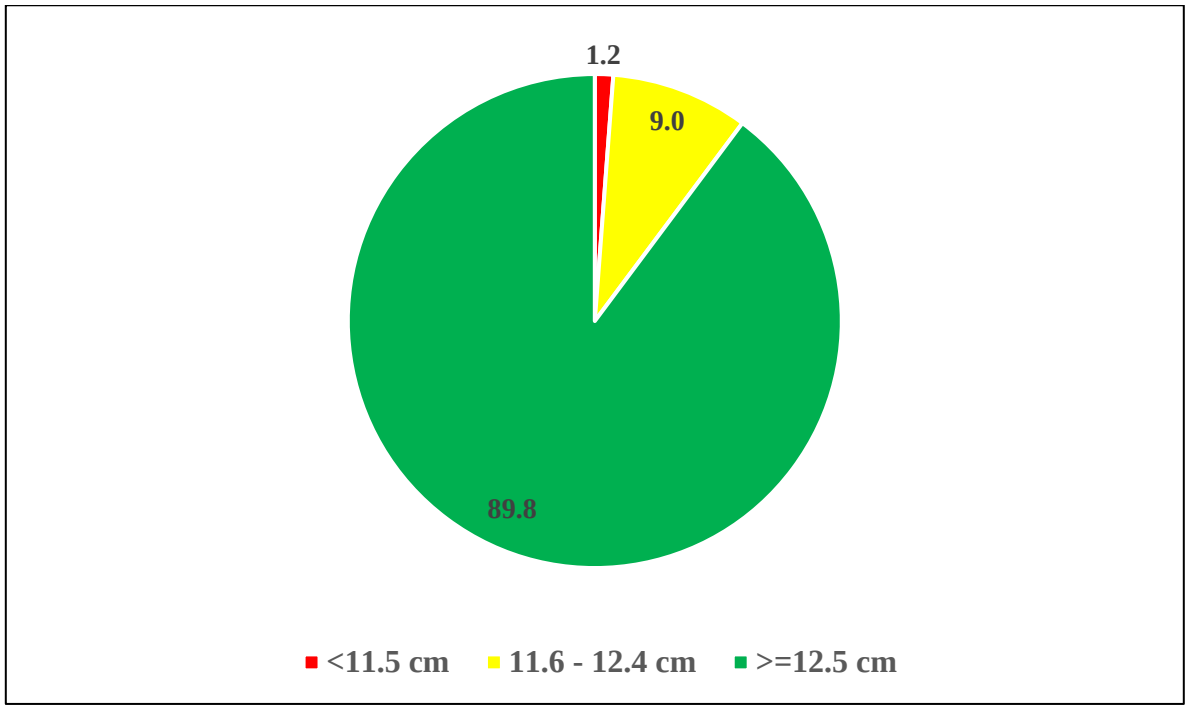


Table 4. 34: Prevalence of Wasting on the Basis of MUAC Gender Wise

	GENDER						
	MALE (N=814)		FEMALE (N=790)		TOTAL (N=1604)		Chi-square (p value)
	N	N%	N	N%	N	N%	
MUAC < 11.5cm (SAM)	6	0.7	13	1.5	19	1.2	4.4752 (0.107)
MUAC between 11.5 - < 12.5 cm (MAM)	66	8.1	78	9.9	144	9.0	
MUAC ≥ 12.5 cm	742	91.1	699	88.5	1441	89.8	

Table 4. 35: Prevalence of Wasting on the Basis of MUAC Age Wise

	AGE CATEGORIES								
	0-6 MONTHS (N=0)		7-35 MONTHS (N=940)		36-59 MONTHS (N=664)		TOTAL (N=1603)		Chi-square (p value)
	n	N%	n	N%	n	N%	n	N%	
MUAC < 11.5cm (SAM)	0	0.0	18	1.9	1	0.2	19	1.2	1788.983 (0.000)***
MUAC between 11.5 - < 12.5 cm (MAM)	0	0.0	121	12.9	23	3.6	144	9.0	
MUAC ≥ 12.5 cm	0	0.0	801	85.2	640	96.4	1441	89.8	

Table 4. 36: AWC Anthropometric Mean Vs Measured Anthropometric Mean Age Wise

	AGE CATEGORIES							
	0-6 MONTHS (N=175)		7-35 MONTHS (N=941)		36-59 MONTHS (N=668)		TOTAL (N=1784)	
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D
RECORDED WEIGHT (Kg)	4.8	1.3	9.4	1.8	12.8	1.4	10.1	2.8
MEASURED WEIGHT (Kg)	5.5	1.2	9.5	1.8	13.0	1.7	10.4	2.9
RECORDED HEIGHT (cm)	53.9	7.3	74.5	10.8	94.1	7.9	79.2	15.5
MEASURED HEIGHT (cm)	59.6	4.4	78.3	7.5	95.6	5.4	83.0	12.9

Table 4. 37: AWC Anthropometric Mean Vs Measured Anthropometric Mean Gender Wise

	GENDER					
	MALE (N=918)		FEMALE (N=866)		TOTAL (N=1784)	
	Mean	S.D	Mean	S.D	Mean	S.D
RECORDED WEIGHT (Kg)	10.18	2.94	10.05	2.73	10.11	2.84
MEASURED WEIGHT (Kg)	10.56	2.91	10.24	2.86	10.40	2.89
RECORDED HEIGHT (cm)	79.09	15.55	79.29	15.45	79.19	15.50
MEASURED HEIGHT (cm)	83.24	13.09	82.67	12.73	82.96	12.92

Figure 4. 35: Comparison of AWC WHZ and Measured WHZ

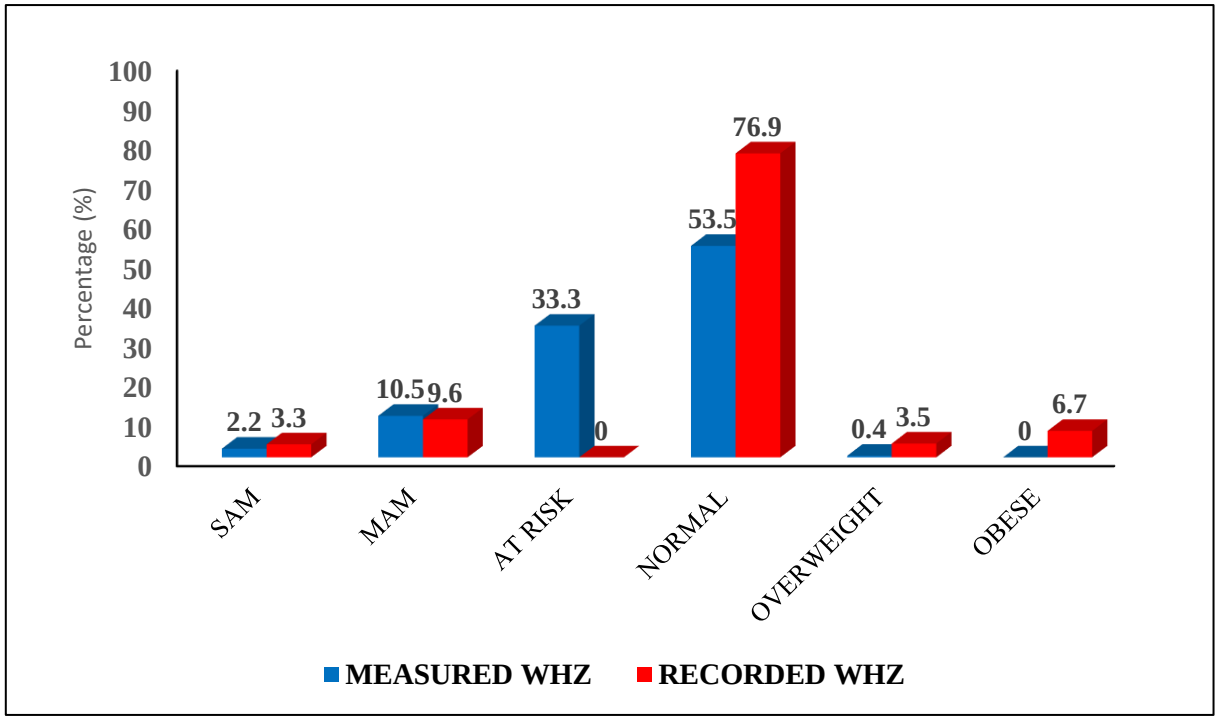


Figure 4. 36: Comparison of AWC WAZ and Measured WAZ

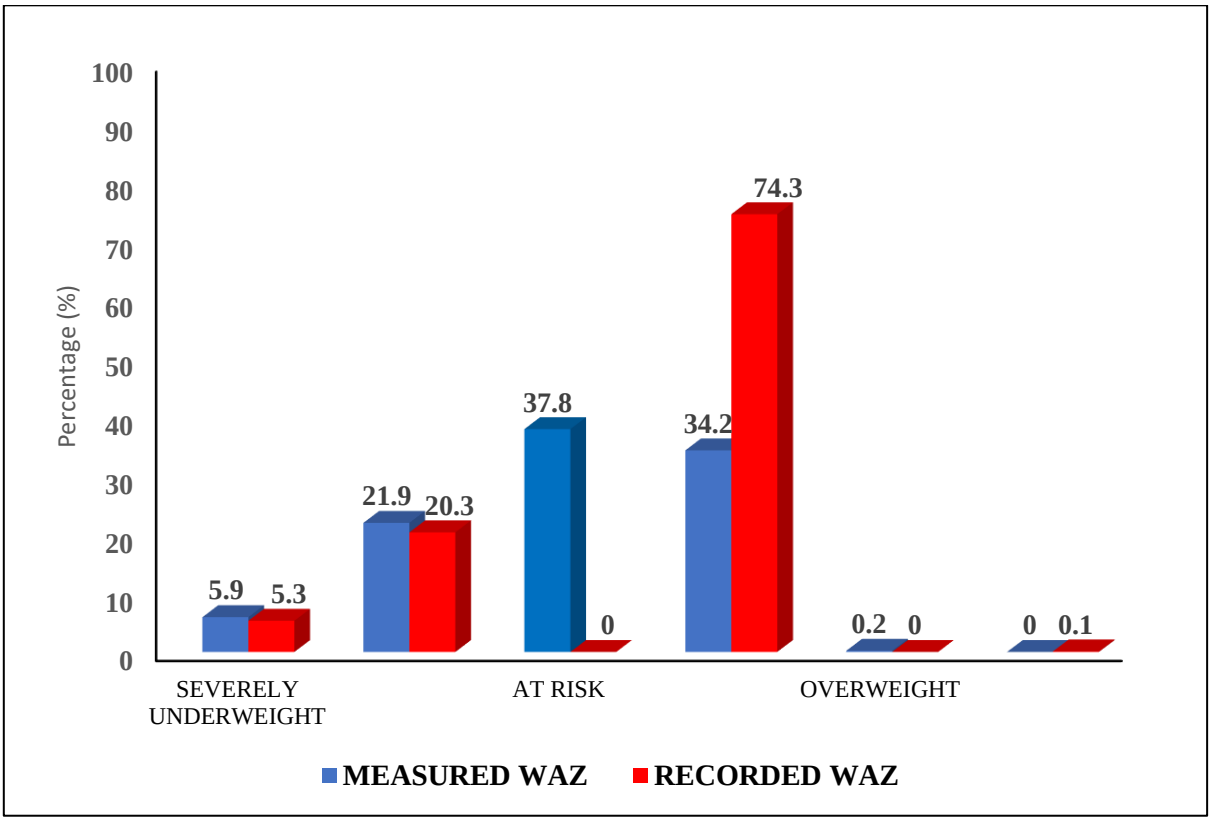
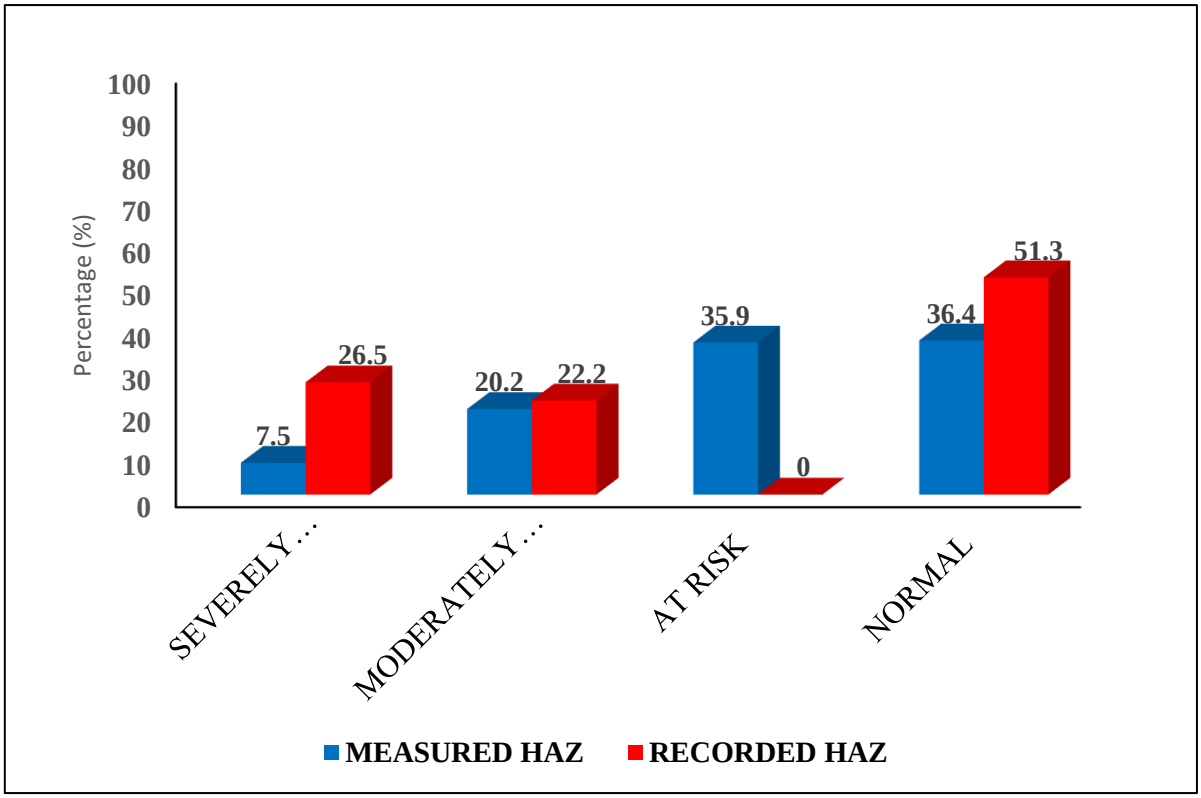


Figure 4. 37: Comparison of AWC HAZ And Measured HAZ



PREVELANCE OF MALNUTRITION IN THE 4 ZONES

Looking into the prevalence of malnutrition zone-wise, East zone had the highest prevalence of malnutrition, i.e., there was 2.9% severe wasting, 12.1% moderate wasting, 7.2% severe underweight, 9.1% severe stunting and 23.3% moderate stunting. South zone had majority of the children who were at risk of malnutrition in terms of wasting, and stunting while children from North zone had better nutritional status of all the four zones. However, prevalence of overweight and overnutrition was higher in North zone (Figure 4.16 – Figure 4.18).

Figure 4. 38: Zone-Wise Prevalence of Wasting

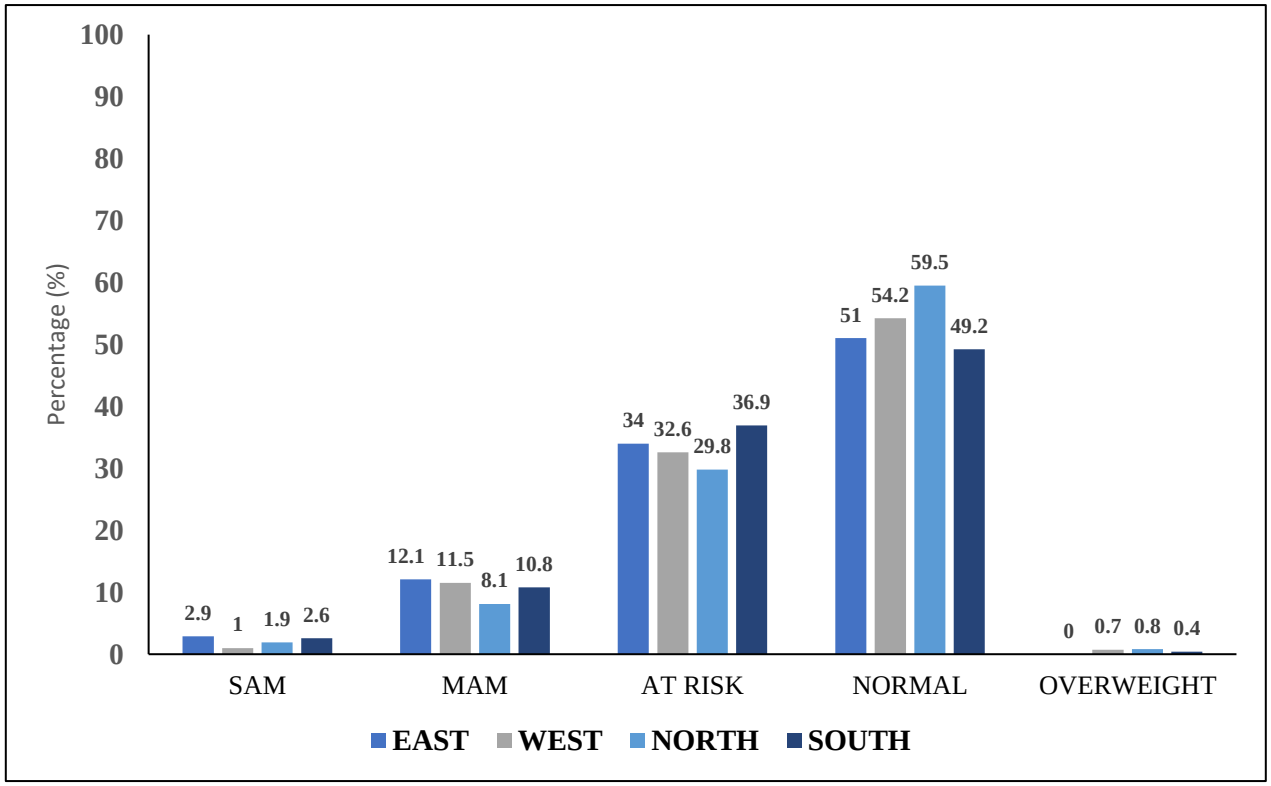


Figure 4. 39: Zone-Wise Prevalence of Underweight

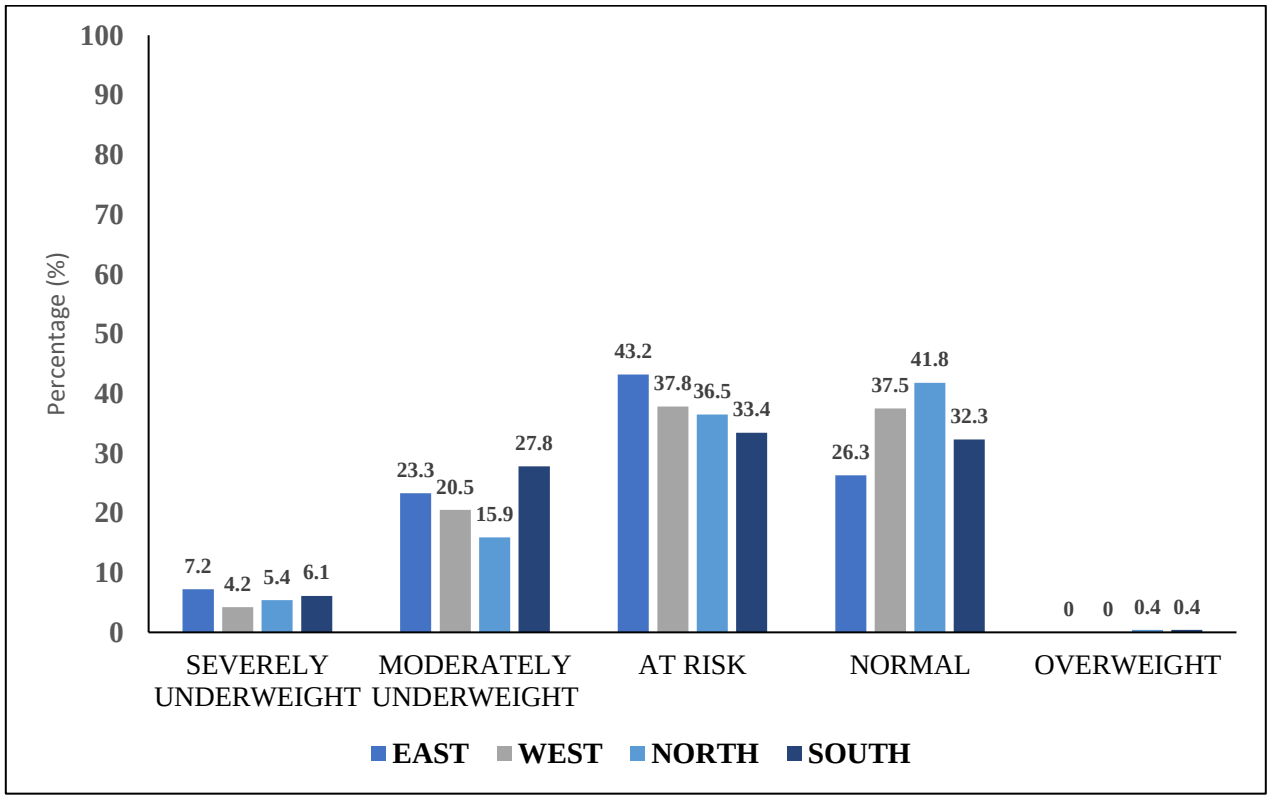
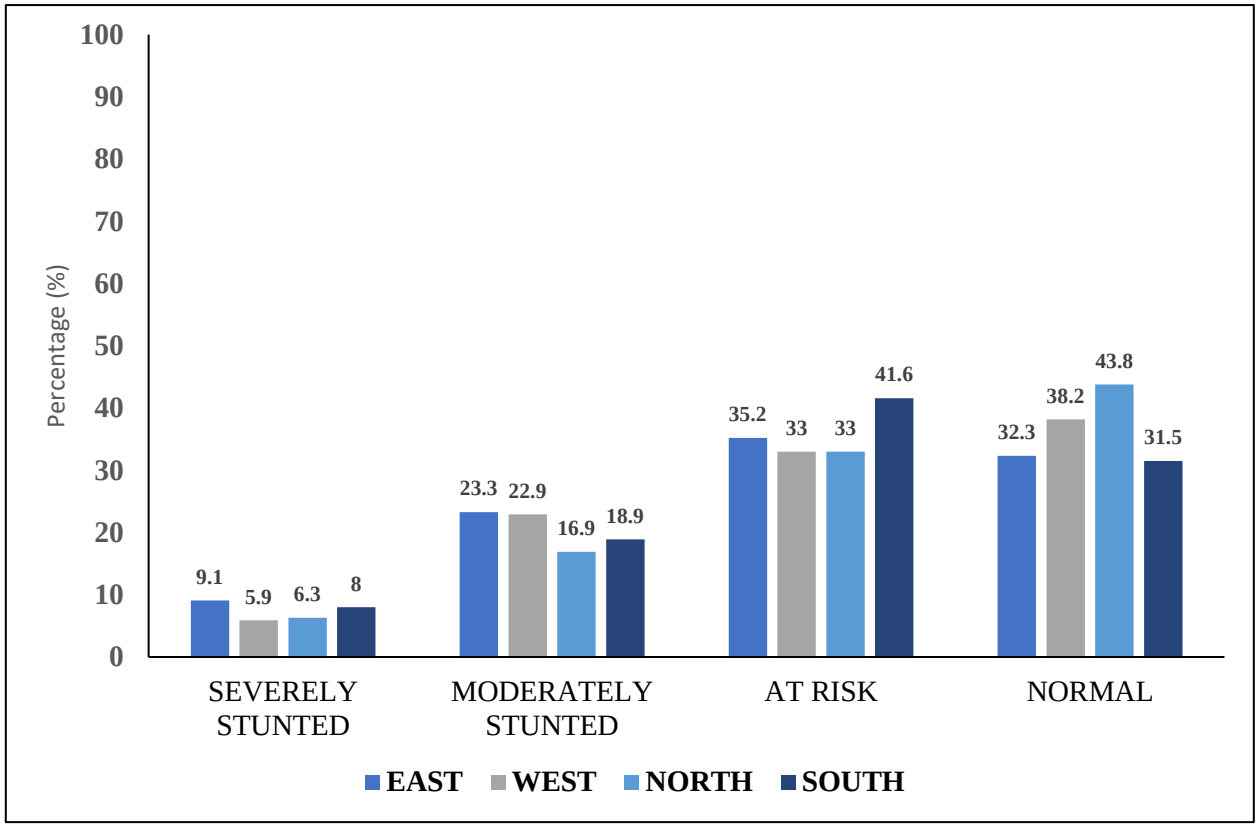


Figure 4. 40: Zone-Wise Prevalence of Stunting



ASSOCIATING FACTORS

Out of 50 children who had been identified as SAM, 43 were assessed to investigate the associating factors for severe wasting. The other 7 children could not be found for this as they had either relocated from the AWC area or had gone to the village and did not return within the data collection period of the study.

As mentioned earlier, various aspects were investigated such as the family socio-economic status, WASH practices, supplementary nutrition, immunization status, morbidity profile and IYCF practices.

SOCIO-ECONOMIC STATUS

Under this factor, indices including the mother's age, her education level, the religion and caste of the family, the household head's education level, their occupation and monthly income were taken into consideration.

Children who were identified as SAM were born to mothers with a mean age of 27 years, the youngest mother being 22 years and the oldest 40 years old (27.63±4.624) majority of the mothers were 24 years old. These mothers had an average of 2 children, with some mothers having up to 4 children.

Of the 43 children there were 23 boys (53.5%) and 20 girls (46.5%), of whom, 18.6% were aged 0-6 months, 53.5% were 7-35 months and 27.9% were 36-59 months. The SAM children had a mean age of 23 months, the youngest SAM child being 1 month old and the oldest 58 months old. Out of the 43 children, 4 were 6 months old, this age having the highest frequency of SAM children (9.1%). These children had a mean birth weight of 2.4358±0.46453 kgs, with the lowest birth weight being a child born prematurely at 7 months with 1000gms and the heaviest child weighing 3.5kgs at birth. Majority of them were the 2nd born among their siblings (1.70±0.803).

Most of the children came from families that practiced Hinduism (72.1%) and only 1 child came from a Christian family. With regards to caste, 32.6% of the children came from families belonging to OBC group and 20.9% came from families belonging to SC group. 41.9 % of these children were living in nuclear type of families. 67.4% of the families from which these children were from owned the houses that they lived in while 33.6% were renting the houses.

When looking at the education level of the mothers, 55.8% of them had a middle school certificate and 2 of them (4.7%) were illiterate. For the household heads, similar to the mothers, majority had a middle school certificate (44.2%). However, household heads were more educated compared to the mothers as a number of household heads had a diploma or were graduates whereas, no other had a higher education level past high school. Household heads were also more in number in terms of being illiterate as compared to the mothers (9.3% household heads Vs 4.7% mothers) (Figure 4.19).

53.5% of the household heads were skilled workers and shop/market workers followed by 12 heads (27.9%) having an elementary occupation and working in manual jobs (Figure 4.20). The average monthly income was about 10,500 rupees (10465.15±4,682.027) with the lowest earning being 1,000 rupees for some of the elementary workers and the highest income being 29,000 rupees for the technician/associate professional. With regards to the Kuppuswamy Scale (Gunjan, 2022), the socioeconomic status scale, 67.4% of the children came from upper lower class (IV) families and 1 child came from a lower class (V) family (Table 4.14 – 4.15).

Table 4. 38: Mean Socio-Economic Status and Child Profile Indices on the Basis of Gender

	GENDER				
	MALE (N=23)		FEMALE (N=20)		t-value (p value)
	Mean	S.D	Mean	S.D	
AGE OF MOTHER (YEARS)	27.65	5.39	27.60	3.96	0.036 (0.971)
NUMBER OF CHILDREN	1.78	.74	1.95	.83	-0.703 (0.486)
TOTAL MONTHLY INCOME OF FAMILY (RUPEES)	9478.26	3776.36	11600.00	5423.15	-1.504 (0.140)
AGE OF THE CHILD (MONTHS)	27.48	17.98	19.40	17.75	-1.478 (0.147)
BIRTH ORDER OF THE CHILD	1.57	.79	1.85	.81	-1.165 (0.251)
BIRTH WEIGHT OF THE CHILD (KG)	2.38	.40	2.50	.53	-0.889 (0.379)

Table 4. 39: Socio-Economic Status Indices on the Basis of Gender

	GENDER						
	MALE (N=23)		FEMALE (N=20)		TOTAL (N=43)		Chi-square (p value)
	N	N%	N	N%	N	N%	
RELIGION							
HINDU	18	78.3	13	65.0	31	72.1	1.696 (0.428)
MUSLIM	5	21.7	6	30.0	11	25.6	
CHRISTIAN	0	0.0	1	5.0	1	2.3	
CASTE							
SCHEDULED CASTE	3	13.0	6	30.0	9	20.9	3.379 (0.337)
SCHEDULED TRIBE	5	21.7	5	25.0	10	23.3	
OTHER BACKWARD CLASS	10	43.5	4	20.0	14	32.6	
GENERAL	5	21.7	5	25.0	10	23.3	
TYPE OF FAMILY							
NUCLEAR	10	43.5	8	40.0	18	41.9	0.090 (0.956)
JOINT	7	30.4	6	30.0	13	30.2	
EXTENDED	6	26.1	6	30.0	12	27.9	
FAMILY OWNS HOUSE							
NO	6	26.1	8	40.0	14	32.6	

YES	17	73.9	12	60.0	29	67.4	0.943 (0.331)
MOTHER'S EDUCATION LEVEL							
ILLITERATE	2	8.7	0	0.0	2	4.7	3.005 (0.391)
PRIMARY SCHOOL CERTIFICATE	2	8.7	3	15.0	5	11.6	
MIDDLE SCHOOL CERTIFICATE	14	60.9	10	50.0	24	55.8	
HIGH SCHOOL CERTIFICATE	5	21.7	7	35.0	12	27.9	
HOUSEHOLD HEAD'S EDUCATION LEVEL							
ILLITERATE	1	4.3	3	15.0	4	9.3	7.942 (0.159)
PRIMARY SCHOOL CERTIFICATE	1	4.3	4	20.0	5	11.6	
MIDDLE SCHOOL CERTIFICATE	13	56.5	6	30.0	19	44.2	
HIGH SCHOOL CERTIFICATE	4	17.4	6	30.0	10	23.3	
INTERMEDIATE OR DIPLOMA	2	8.7	0	0.0	2	4.7	
GRADUATE	2	8.7	1	5.0	3	7.0	
OCCUPATION OF THE HOUSEHOLD HEAD							
ELEMENTARY OCCUPATION	5	21.7	7	35.0	12	27.9	6.955 (0.138)

PLANT & MACHINE OPERATORS AND ASSEMBLERS	1	4.3	5	25.0	6	14.0	
CRAFT & RELATED TRADE WORKERS	1	4.3	0	0.0	1	2.3	
SKILLED WORKERS AND SHOP & MARKET SALE WORKERS	15	65.2	8	40.0	24	53.5	
TECHNICIANS AND ASSOCIATE PROFESSIONALS	1	4.3	0	0.0	1	2.3	
INCOME LEVEL CATEGORIES							
LOWER CLASS (V)	0	0.0	1	5.0	1	2.3	
UPPER LOWER CLASS (IV)	14	60.9	15	75.0	29	67.4	
LOWER MIDDLE CLASS (III)	9	39.1	4	20.0	13	30.2	

Figure 4. 41: Education Level of Mothers and Household Heads with SAM Children

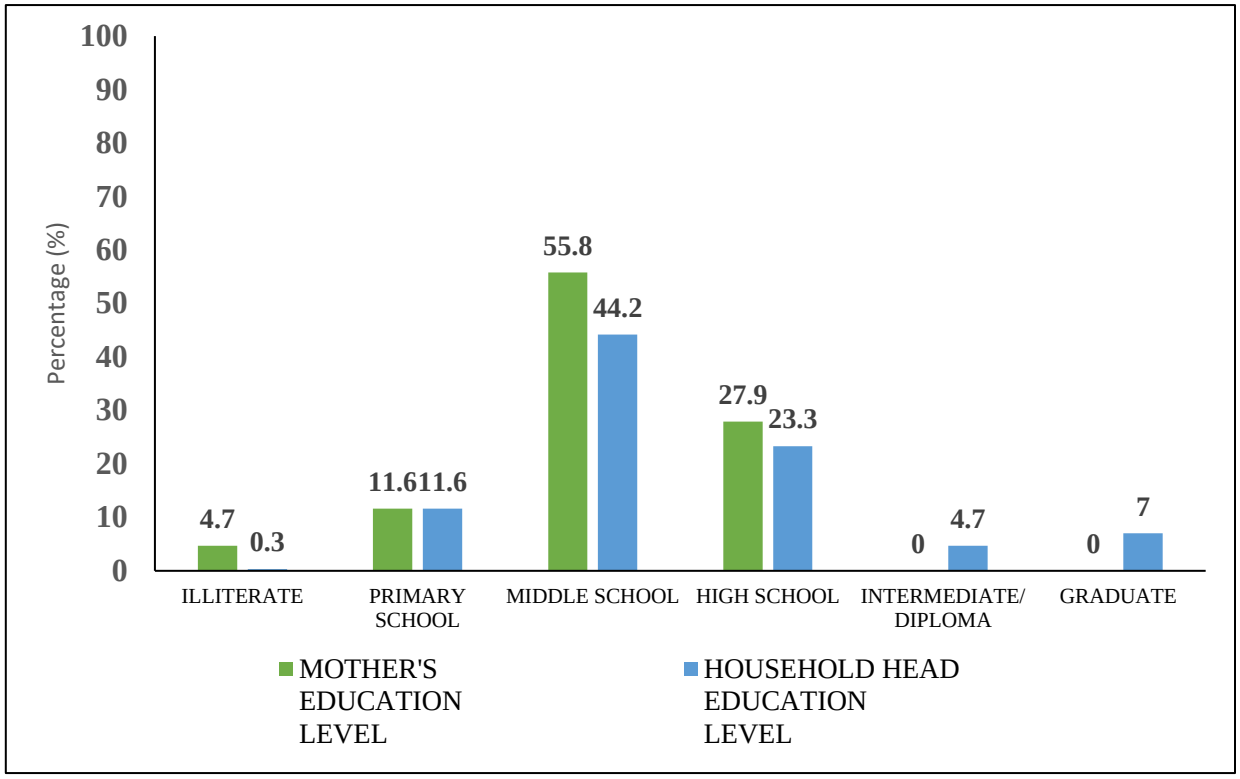


Figure 4. 42: Occupation of Household Heads

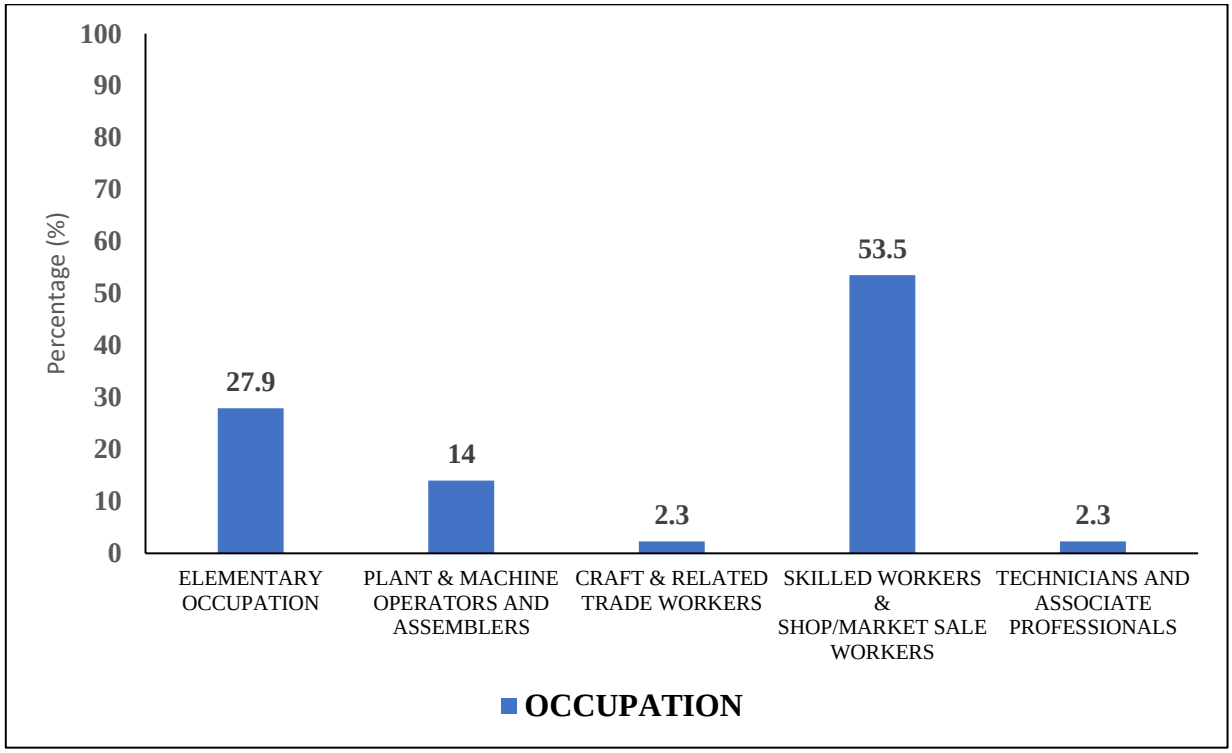
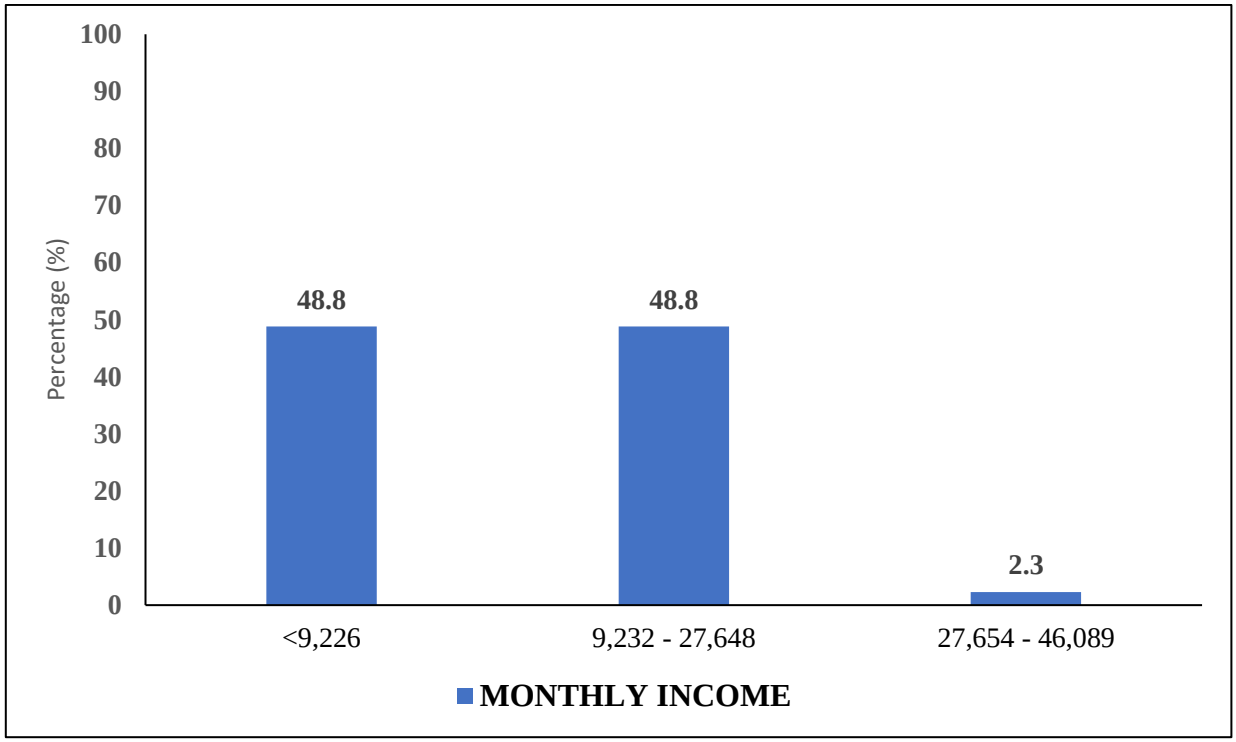


Figure 4. 43: Monthly Income Ranges for Households according to Kuppuswamy



WATER, SANITATION AND HYGIENE PRACTICES

All the families had access to piped water and 86.0% of the respondents stated that they take measures to make the water safe for drinking, including, boiling (18.9%), straining with a clothe (70.3%), use of a water filter (10.8%). 14.0% reported that they consumed the water as is (direct from the tap).

All families used LPG as a fuel source to cook their food. Once complementary food was cooked, 55.8% respondents stated that they did not store the remaining food as either all was completed in one sitting or the remaining food was discarded and fresh food cooked for the next meal. 37.2% and 7.08% of the respondents reported storing complementary food for 2-3 hours and more than 4 hours, respectively.

95.3% of the homes and a home toilet facility while 4.7% of the homes shared a community toilet facility. When it came to hand washing practices, all respondents stated that their family members washed their hands with soap at various times throughout the day, i.e., after visiting the toilet (97.7%), before cooking and before eating (95.3%), after cleaning the baby's back side (2.3%) and before feeding the baby (16.3%). It is evident that when it came to hand washing practices when taking care of the child, the practices were poor.

72.1% of the respondents stated that they cut their vegetables before washing while 27.9% of them first washed their vegetables then cut. The practice of washing vegetables after cutting is a wrong practice as water soluble vitamins are lost in the discarded water and also, it is unhygienic was dirt penetrates into the vegetables (Table 4.16).

Table 4. 40: Wash Practices Indicators Gender Wise

	GENDER						
	MALE (N=23)		FEMALE (N=20)		TOTAL (N=43)		Chi-square (p value)
	N	N%	N	N%	N	N%	
SOURCE OF DRINKING WATER							
PIPED WATER	23	100	20	100	43	100	
WATER SAFETY							
YES	20	87	17	85	37	86.0	0.034 (0.853)
NO	3	13	3	15	6	13.0	
WATER SAFETY MEASURES							
BOIL	6	30	1	5.9	7	18.9	4.976 (0.083)
STRAIN THROUGH A CLOTH	11	55	15	88.2	26	70.3	
USE WATER FILTER	3	15	1	5.9	4	10.8	
TYPE OF FUEL USED							
LGP/NATURAL GAS	23	100	20	100	43	100	
TYPE OF TOILET FACILITY							
HOME TOILET	22	95.7	19	95.0	41	95.3	0.010 (0.919)
COMMUNITY TOILET	1	4.3	1	5.0	2	4.7	

HOUSEHOLD HAND WASHING PRACTICES							
FAMILY MEMBERS WASH HANDS WITH SOAP	23	100	20	100	43	100	
AFTER USING THE TOILET	22	95.7	20	100	42	97.7	0.890 (0.345)
BEFORE COOKING	21	91.3	20	100	41	95.3	1.824 (0.177)
BEFORE EATING	22	95.7	19	95	41	95.3	0.010 (0.919)
AFTER CLEANING BABY'S BACKSIDE	1	4.3	0	0	1	2.3	0.890 (0.345)
BEFORE FEEDING BABY	6	26.1	1	5.0	7	16.3	3.490 (0.062)
HOW LONG IS COMPLEMEMNTARY FOOD STORED							
DOESN'T STORE	15	65.2	9	45.0	24	55.8	4.312 (0.116)
FOR 2-3 HOURS	8	34.8	8	40	16	37.2	
MORE THAN 4 HOURS	0	0	3	15.0	3	7.0	
WHEN VEGETABLES ARE CUT							
BEFORE WASHING	16	69.6	15	75.0	31	72.1	0.157 (0.692)

AFTER WASHING	7	30.4	5	25.0	13	27.9	

SUPPLEMENTARY NUTRITION

Only 65.1% of the SAM children were receiving Bal Shakti from the AWCs. The remaining children did not receive Bal Shakti for the reasons depicted in Figure 4.22

As illustrated, children below 6 months were not receiving the packets as they are meant for children above 6 months of age, instead their mother received Matru Shakti. This indicates that there is no supplementation for these children even though they are severely wasted. Three children were newly registered to the AWCs and hence they had not received the packets yet. Children who are above 3 years primarily do not receive Bal Shakti as it is in the policy but instead receive hot cooked meals in the AWCs or in school, for those who attend school. However, the 4.7% of children who did not receive the packets were above 3 years but not attending school neither did they receive HCM from the AWCs. 9.3% received HCM from the AWCs and despite them being wasted, they were not receiving the THR, let alone double the portion as is it recommended.

For those children who received the supplement, all children received the packets once a month, and only 1 respondent reported that they did not receive the packets regularly. Those who received the packets received 7 (85.7%) packets each month, others 5 packets (3.6%) while the rest (10.7%) received 10 packets monthly.

60.7% of these children consumed the packets regularly in various forms, i.e, as a porridge (71.4%), in form of roti/thepla/chapati (3.6%) and in form of shiro/halwa/sukdhi/lapsi (35.7%). The other children (39.3%) did not consume the packets regularly as they did not like the taste. 22 children (78.6%) purportedly consumed the packets by themselves, while 14.3% shared the packets with their siblings and 7.1% shared the packets with other family members.

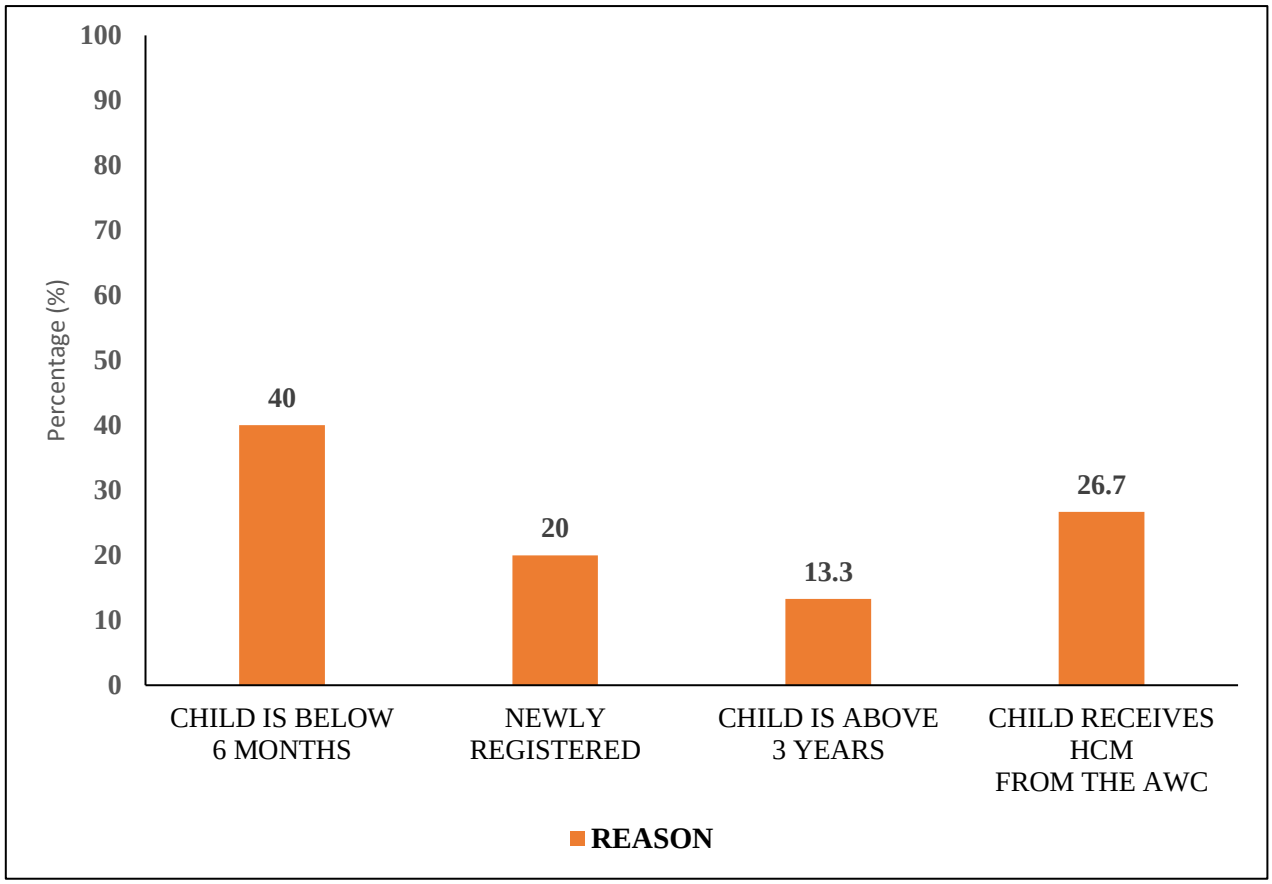
46.4% of the respondents reported that they saw some benefits of giving their children Bal Shakti while 54.6% saw no benefit. Those who saw benefits reported benefits such as weight gain in the children, they reported that the children were more active and happier and that the children fed well and were satisfied after consuming the supplements (Table 4.17).

Table 4. 41: Responses with Regards to Supplementary Nutrition Based on Gender of the Child

	GENDER						
	MALE (N=23)		FEMALE (N=20)		TOTAL (N=43)		Chi-square (p value)
	N	N%	N	N%	N	N%	
GET BAL SHAKTI							
NO	9	39.1	6	30.0	15	34.9	0.393 (0.531)
YES	14	60.9	14	70.0	28	65.1	
REASON FOR NOT RECEIVING BALSHAKTI							
CHILD IS BELOW 6 MONTHS SO MOTHER RECEIVES MATRUSHAKTI	3	13	3	15	6	14.0	0.034 (0.853)
CHILD IS NEWLY REGISTERED IN THE AWC	2	8.7	1	5	3	7.0	0.225 (0.635)
CHILD IS ABOVE 3 YEARS	1	4.3	1	5	2	4.7	0.010 (0.919)
CHILD RECEIVES HCM IN AWC	3	13	1	5.0	4	9.3	0.820 (0.365)
HOW OFTEN DO YOU GET BAL SHAKTI							
ONCE A MONTH	14	100	14	100	28	65.9	
RECEIVE BAL SHAKTI REGULARLY	14	100	13	92.9	27	96.4	1.037 (0.309)
CHILD CONSUME BAL SHAKTI REGULARLY	8	57.1	9	64.3	17	60.7	0.150 (0.699)

HOW PACKETS ARE CONSUMED							
SOLELY BY CHILD	11	78.6	11	78.6	22	78.6	3.000 (0.223)
SHARED BY SIBLINGS	1	7.1	3	21.4	4	14.3	
SHARED BY OTHER FAMILY MEMBERS	2	14.3	0	0	2	7.1	
CHILD LIKES THE TASTE OF BAL SHAKTI	8	57.1	9	64.3	17	60.7	0.150 (0.699)
HOW PACKETS ARE PREPARED/CONSUMED							
PORRIDGE	8	57.1	12	85.7	20	71.4	2.800 (0.094)
ROTI/THEPLA	1	7.1	0	0	1	3.6	1.037 (0.309)
SHIRO/HALWA/SUKHDI/LAPSI	6	42.9	4	28.6	10	35.7	0.622 (0.430)
ANY BENEFIT OF CONSUMING BAL SHAKTI	7	50	6	42.9	13	46.4	0.144 (0.705)
PERCEIVED BENEFITS OF BAL SHAKTI							
WEIGHT GAIN	5	71.4	6	100	11	84.6	2.026 (0.155)
ACTIVE/HAPPY	2	28.6	0	0	2	15.4	2.026 (0.155)
SATIETY/CHILD EATS WELL	1	14.3	0	0	1	7.7	0.929 (0.335)

Figure 4. 44: Reasons for Child not Receiving Bal Shakti



IMMUNIZATION STATUS

42 out of the 43 children received BCG vaccine. The child who had not received the vaccine, together with all other vaccines, was not immunized because of her nutritional status, as reported by the caregiver. Majority of the children had received all the vaccines apart from vitamin A booster doses after the 3rd doses, only 17 received the 2nd – 9th dose. This could be due to the fact that the vaccines are given every 6 months at the AWCs and these are not recorded in the Mamta cards.

MORBIDITY PROFILE

Within the past 15 days of the interview 22.7% had fever, 9.1% had diarrhea, 9.1% had episodes of vomiting, 36.4% had ARI and 1 child had had measles. No child had malaria.

Table 4. 42: Immunization Status of SAM Children

	RECEIVED		NOT RECEIVED		NOT APPLICABLE	
	N	N%	N	N%	N	N%
BCG	42	97.7	1	2.3	0	0
HEPATITIS B	38	88.4	5	11.6	0	0
OPV 0	41	95.3	2	4.7	0	0
O/IPV 1,2&3	41	95.3	2	4.7	0	0
PENTA 1,2&3	41	95.3	2	4.7	0	0
ROTA 1,2&3	27	62.8	6	14.0	10	23.3
MEASLES/MMR 1st DOSE	29	67.4	4	9.3	10	23.3
VITAMIN A 1st DOSE	29	67.4	4	9.3	10	23.3
DPT BOOSTER	18	41.9	2	4.7	23	53.5
MEASLES/MMR 2nd DOSE	18	41.9	2	4.7	23	53.5
OPV BOOSTER	18	41.9	2	4.7	23	53.5
VITAMIN. A (2nd-9th DOSE)	17	39.5	4	9.3	22	51.2

Table 4. 43 Immunization Status of SAM Children Gender Wise

	GENDER						
	MALE (N=23)		FEMALE (N=20)		TOTAL (N=43)		Chi-square (p value)
	N	N%	N	N%	N	N%	
BCG	23	100	19	95.0	42	97.7	1.177 (0.278)
HEPATITIS B	21	91.3	17	85.0	38	88.4	0.414 (0.520)
OPV 0	22	95.7	19	95	41	95.3	0.010 (0.919)
O/IPV 1,2&3	22	95.3	19	95	41	95.3	0.010 (0.919)
PENTA 1,2&3	22	95.3	19	95	41	95.3	0.010 (0.919)
ROTA 1,2&3	13	56.5	14	70.0	27	62.8	1.435 (0.488)
MEASLES/MMR 1st DOSE	19	82.6	10	50.0	29	67.4	7.018 (0.030)
VITAMIN A 1st DOSE	19	82.6	10	50.0	29	67.4	7.018 (0.030)
DPT BOOSTER	12	52.2	6	30.0	18	41.9	4.902 (0.086)
MEASLES/MMR 2nd DOSE	12	52.2	6	30.0	18	41.9	4.902 (0.086)

OPV BOOSTER	12	52.2	6	30.0	18	41.9	4.902 (0.086)
VITAMIN. A (2nd-9th DOSE)	11	47.8	6	30.0	17	39.5	6.931 (0.031)

Table 4. 44: Morbidity Profile Age Wise

	AGE							
	0-6 months (N=8)		**7-35 months (N=23)**		**36-59 months (N=12)**		**TOTAL (N=43)**	
	N	**N%**	**N**	**N%**	**N**	**N%**	**N**	**N%**
FEVER	1	12.5	8	34.8	1	8.3	10	23.3
DIARRHEA	0	0	4	17.4	0	0	4	9.3
VOMITTING	0	0	4	17.4	0	0	4	9.3
ACUTE RESPIRATORY INFECTION	4	50	9	39.1	3	25	16	37.2
MEASLES/MUMPS	0	0	1	4.3	0	0	1	2.3

Table 4. 45: Morbidity Profile Gender Wise

	GENDER						
	MALE (N=23)		FEMALE (N=20)		TOTAL (N=43)		Chi-square (p value)
	N	N%	N	N%	N	N%	
FEVER	3	13	7	35	10	23.3	2.890 (0.089)
DIARRHEA	2	8.7	2	10.0	4	9.3	0.022 (0.883)
VOMITTING	3	13	1	5.0	4	9.3	0.820 (0.365)
ACUTE RESPIRATORY INFECTION	8	34.8	8	40.0	16	37.2	0.125 (0.724)
MEASLES/MUMPS	0	0	1	5.0	1	2.3	1.177 (0.278)

INFANT AND YOUNG CHILD FEEDING PRACTICES & DIETARY DIVESITY

The initial years of a child's life are important, an optimal nutrition during this period lowers morbidity and mortality and fosters better development. Hence, WHO and UNICEF recommends early initiation of breastfeeding within 1 hour of both, exclusive breastfeeding for the first 6 months of life and introduction of nutritionally adequate and safe complementary foods after 6 months. In the present study the information regarding Infant and young child feeding practices and the dietary diversity were collected and are depicted in Tables 4.22, 4.23 and 4.24. The salient observations of the same are as shown below:

Bottle feeding in children 0-23 months

19.2% of children between 0-23 months had been bottle fed in the last 24 hours.

Continued breastfeeding in children 12-23 months

There were 11 children who were in the age group of 12-23 months and 72.7% of these children were still being breastfed at this age.

Exclusive breastfeeding for the 1st 2 days after birth

62.8% of the children were exclusively breastfed in the first 2 days after birth. The others were given prelacteals such as water, infant formular and sugar water.

Early initiation of breastfeeding

Only 62.8% of the children were breastfed within the 1st hour of life. 11% were breast fed between the 2nd hour of life and 24 hours while 7% were within 2 days of birth. 1 child was breast fed after 3 days while another was breastfed 10 days after birth as she was born prematurely and was not breastfed.

Ever breastfed

All the SAM children were ever breastfed.

Minimum dietary diversity for children 6-23 months

According to gender, male children had a poor dietary diversity score compared to females (Table 4.23). 54.5% of children 6-23 months had low dietary diversity and only 45.5% had adequate dietary diversity scores, meaning they had eaten at least 5 out of the 8 food groups.

Sweet beverage consumption

13.6% of the SAM children had consumed sweet beverages in the past 24 hours, including, but not limited to, soft drink and fruit packet juices.

Zero vegetable or fruit consumption

30.4% of children 7-35 months and 8.3% of children 36-59 months had not eaten any fruit or vegetable the previous day. With regards to gender, boys seemed to consume more fruits and vegetables as compared to girls.

Unhealthy food consumption

53.5% of the children had consumed unhealthy foods in the past 24 hours. These foods included, potato chips, samosa, puri, instant noodles and other fast foods. Most of the consumption of these unhealthy foods was during the day as the children who were in the AWC brought these foods as snacks to eat during the time there.

Egg and/or flesh food consumption for children 6-23 months

No child aged 6-23 months had consumed eggs or flesh food the previous day. This may be due to the fact that majority of the children came from Hindu homes that consume vegetarian diets hence the low consumption of meat and eggs. However, even those from Muslim homes who consumed non-vegetarian diets had a low consumption of these foods.

Dietary Diversity

With respect to the dietary diversity, it was observed that the SAM children (64.1%) had low dietary diversity 35.9% had adequate dietary diversity. Gender wise comparison showed that boys had lower dietary diversity in comparison to girls whereas the age wise segregation revealed that both boys and girls had almost same low dietary diversity.

Table 4. 46: Feeding Practices Age Wise

	AGE CATEGORIES								
	0 - 6 months (N=8)		7 - 35 months (N=23)		36 - 59 months (N=12)		Total (N=43)		Chi-square (p value)
	N	N %	N	N %	N	N %	N	N %	
BREASFEEDING PRACTICES									
No. of children ever breastfed	8	100.0	23	100.0	12	100.0	43	100.0	
EBF in the first 2 days of life	5	62.5	17	73.9	5	41.7	27	62.8	5.201 (0.267)
Continued breastfeeding for children 12-23 months	0	0.0	8	72.7	0	0.0	8	72.7	
Bottle feeding for children 0-23 months	2	7.7	3	11.5	0	0.0	5	19.2	
FLUIDS									
Plain water	2	25.0	21	91.3	0	0.0	23	74.2	13.628 (0.000)***
Milk	3	37.5	14	60.9	8	66.7	25	58.1	1.829 (0.401)
Fruit juice	1	12.5	4	17.4	0	0.0	5	11.6	2.328 (0.312)
Soft drinks	0	0.0	0	0.0	1	8.3	1	2.3	2.645 (0.266)

Tea, coffee	0	0.0	10	43.5	8	66.7	18	41.9	8.819 (0.012)
Clear broth/soup	0	0.0	1	4.3	0	0.0	1	3.2	0.359 (0.549)
Curd, lassi, buttermilk, or raita	0	0.0	2	8.7	5	41.7	7	16.3	8.201 (0.017)
GRAINS, ROOTS, TUBERS AND PLANTAINS									
Rice, idli, dosa, poha, naan, kulcha, paratha, upma, Cerelac, or Farex	0	0.0	21	91.3	11	91.7	32	74.4	28.593 (0.000)***
Chapati, roti, dalia, roasted maize	0	0.0	18	78.3	10	83.3	28	65.1	18.436 (0.000)***
Pearl millet, finger millet, or ragi malt	0	0.0	2	8.7	2	16.7	4	9.3	1.602 (0.449)
Potato, sweet potato, turnip, arum root, tapioca, or raw banana	0	0.0	10	43.5	6	50.0	16	37.2	5.968 (0.051)*
PULSES (BEANS, PEAS, LENTILS), NUTS & SEEDS									
Daal, sambar, chickpeas, kidney beans, soya, or khichdi	0	0.0	21	91.3	10	83.3	31	72.1	25.640 (0.000)***

Peanuts, cashews, almonds, pistachios, walnuts, pumpkin seeds, or sunflower seeds	0	0.0	5	21.7	1	8.3	6	14.0	3.865 (0.425)
FLESH GOODS (MEAT, FISH POULTRY, ORGAN MEATS) & EGGS									
Eggs	0	0.0	1	4.3	0	0.0	1	2.3	0.890 (0.641)
Mutton, beef, or lamb	0	0.0	1	4.3	0	0.0	1	2.3	0.890 (0.641)
Chicken, duck, or turkey	0	0.0	1	4.3	3	25.0	4	9.3	4.994 (0.082)
VITAMIN A RICH FRUITS AND VEGETABLES									
Carrots, or pumpkin that is orange inside	0	0.0	1	4.3	0	0.0	1	2.3	0.890 (0.641)
Mustard leaves, spinach, radish leaves, cassava leaves, taro leaves, drumstick leaves, amaranth leaves, or wild greens/other greens	0	0.0	1	4.3	1	8.3	2	4.7	0.762 (0.683)
Ripe papaya, ripe mango, orange	0	0.0	1	4.3	0	0.0	1	2.3	0.890 (0.641)

musk melon, or apricots									
OTHER FRUITS AND VEGETABLES									
Tomatoes, eggplant, okra/lady finger, French beans, cauliflower, cabbage, or beetroot	0	0.0	10	43.5	4	33.3	14	32.6	5.114 (0.078)
Bitter gourd, bottle gourd, pointed gourd, ivy gourd, apple gourd, ridged gourd, or snake gourd	0	0.0	2	8.7	0	0.0	2	4.7	1.824 (0.402)
Cucumber, radish, capsicum, German turnip, or drumstick	0	0.0	1	4.3	0	0.0	1	2.3	0.890 (0.641)
Orange, tangerine, or grapefruit	0	0.0	3	13.0	1	8.3	4	9.3	1.215 (0.545)
Ripe banana, apple, pear, watermelon, guava, custard apple,	0	0.0	9	39.1	6	50.0	15	34.9	5.675 (0.059)

pomegranate, or pineapple									
Grapes, kiwi, peaches, jackfruit, chickoo, jamun, palmyra palm fruit, or other wild fruits	0	0.0	5	21.7	3	25.0	8	18.6	2.302 (0.316)
SWEETS									
Cakes, cream biscuits, biscuits, suji halwa / kesari bath, jalebi, or ladoo	2	25.0	17	73.9	7	58.3	26	60.5	5.972 (0.050)*
Other mithai, rice pudding, kulfi, ice cream, milkshake, toffees, or chocolates	0	0.0	10	43.5	8	66.7	18	41.9	8.819 (0.012)**
PROCESSED AND ULTRA FOODS									
Potato chips, namkeen or mixture	0	0.0	10	43.5	10	83.3	20	46.5	13.581 (0.001)***
Instant noodles such as Maggi noodles or Wai Wai	0	0.0	4	17.4	1	8.3	5	11.6	1.923 (0.382)

Samosa, pakora, puri, vada, mathri, kachori, murukku, or bonda	0	0.0	1	4.3	2	16.7	3	7.0	3.420 (0.490)

Table 4. 47: Dietary Diversity Scores of SAM Children Gender Wise

	GENDER OF THE CHILD						
	MALE (N=22)		**FEMALE (N=17)**		**TOTAL (N=39)**		**Chi-square (p value)**
	N	**N %**	**N**	**N %**	**N**	**N %**	
LOW DIETARY DIVERSITY (≤ 4)	15	65.2	10	58.8	25	64.1	1.799 (0.407)
ADEQUATE DIETARY DIVERSITY (>5)	7	30.4	7	41.2	14	35.9	

Table 4. 48: Dietary Diversity of SAM Children Age Wise

	AGE CATEGORIES						
	6-23 months (N=22)		24-59 months (N=17)		Total (N=39)		Chi-square (p value)
	N	N %	N	N %	N	N %	
LOW DIETARY DIVERSITY (≤ 4)	12	54.5	13	76.5	25	64.1	45.209 (0.000)***
ADEQUATE DIETARY DIVERSITY (>5)	10	45.5%	4	23.5	14	35.9	

From the study, it can be observed that all children below 6 months were being breastfeed and had not consumed any solid foods. However, 2 children were being given water because it was hot and the children were thirsty and 37.5% of under 6 months children were being given milk. 1 of the three children who was being given milk, was given sweetened milk (sugar was added to the milk). Only one child consumed soup/clear broth the previous day. 58.1% of the children had consumed milk (fresh/packaged/powdered) and no child consumed Bournevita/Horlicks/Boost, paneer/cheese, organ meats, sausages/salami, pork/wild meat, fish, insects or take out foods such as KFC.

DISCUSSION

Acute malnutrition is a severe form of undernutrition that can be life-threatening and is most common in developing countries and areas of extreme poverty. The consequences of acute malnutrition are far-reaching and can have a lasting impact on physical and cognitive development. Poor health and developmental delays in children can lead to fewer educational and employment opportunities and can hinder progress in breaking the cycle of poverty. Therefore, this research was intended to explore the prevalence of severe acute malnutrition, the most serious form of wasting, and to identify the associated factors which are contributing to it.

The study reveals that 2.2% of children under 5 years were suffering from severe wasting. 5.3% children suffered from severe wasting 7.7% from severe stunting. The prevalence of SAM among these children is almost half the prevalence in Vadodara District which stands at 5.2% (NFHS-5). However, this study gives similar findings to a study conducted by Bhadoria et.al (2017) which estimated the prevalence of SAM in North India to be at 2.2% a study conducted in Nepal revealed a prevalence of 7.5% for SAM (Dahal et.al., 2021). Another study conducted in peri-tribal areas of Vadodara revealed that the prevalence of wasting was at 8.9% (Ravi, 2022).

The mean anthropometric measurements of children in this study were almost similar as to study conducted in Sangli district of western Maharashta, where the mean weight of male children ranged from 6.4 ± 2.8 kg to 13.17 ± 0.35 kg and of females ranged from 6.76 ± 2.65 kg and 11.7 ± 2.6 kg for children under 5 years. Similarly, height of male children was between 63.85 ± 2.7 cm and 95.57 ± 3.6 cm while in females between 60.15 ± 4.5 cm and 90.46 ± 8.9 cm (Kriti et.al, 2013). The mean heights observed in this study were close to the findings in the present study.

The mean Z-scores had negative values for both genders as well as throughout the age groups, for all 3 indices with the overall mean±SD for WHZ, WAZ and HAZ being -0.9±1, -1.39±1.04 and -1.36±1.19, respectively. The data indicates that both boys and girls had lower weight and lower height as compared to WHO 2007 growth standards and these observations indicate that the children are not able to keep the pace of growth, and early preventive care is strongly recommended for their optimal growth.

The prevalence wasting, underweight and stunting and wasting on the basis of MUAC were statistically significant through the ages but only statistically significant on the basis of gender for wasting ($p<0.001$).

The study also focused into looking at the data available in the AWCs. This was to compare the study findings with the recorded data/data available in the AWCs and check if the prevalence for malnutrition was any different.

When the collected data was compared to data recorded in the AWCs, the study revealed that there were differences between the measurements and subsequently due to this the impact was observed on the z-scores as well. There could be various reasons for these discrepancies, but one difference or factor that could lead to these differences is use of scales which are not calibrated in the AWCs hence giving faulty readings. Another reason could be the fact that some measurements such as MUAC were not being taken, despite the fact that MUAC tapes were available in the AWCs and in some settings, height was not being monitored monthly and previous readings were repeated every month hence giving a false picture of the nutritional status of these children.

Using the gender-wise illustration for the 3 indices, it is evident that boys were more malnourished compared to the female counterparts. The same is found in a study carried out in Afghanistan where 7.5% male children were found to be SAM as opposed to 6.0% females (Frozanfar et.al, 2016). However, in some studies such as that conducted by Mohamed & Hussein (2014), found no association between gender and nutritional status in a study they conducted in a rural area of northern Sudan. Other studies reported that male children are at a greater risk of malnutrition while others report that being female is a risk factor (Phengxay et.al, 2007; Veghari, 2007; Sanghvi et.al, 2001). It has been reported that the actual reasoning behind this may be different social and cultural factors and no the gender itself that is affecting the nutrition status of children. In some communities, the male child is highly preferred and valued and hence they get better care including quality feeding practices and quality nutrition unlike the female children.

Once SAM children were identified, further interviews were conducted to try and establish the associated risk factors. The study reveals that Children who were identified as SAM were born to mothers with a mean age of 27 years, the youngest mother being 22 years and the oldest 40 years old. These findings are backed up by a study conducted in Guatemala and Peru showed that children born to young mothers (15-35 years) were found to be more likely to be SAM as compared to those whose mothers were between 35-49 years (Fagbamigbe, Kandala & Uthman, 2020).

The SAM children had a mean age of 23 months, the youngest SAM child being 1 month old and the oldest 58 months old. A study carried out in Nepal found out that children in the age of 6-24 months had a higher likelihood of being severely malnourished as compared to those within the

age group of 25-59 months (Hossain et.al, 2020). The study revealed that the prevalence of SAM within this age group may have been as a result of poor dietary habits, including the transition from breastfeeding to introduction of complementary foods and also low frequency of feeding.

Out of the 43 SAM children in this study, 4 were 6 months old, this age having the highest frequency of SAM children. There were similar findings in a study conducted in Surat City, Western India, where children within the age group of 6-39 months were found to be more likely to be SAM, accounting to 66.7% of all SAM (Gupta et.al, 2022).

Birth weight of the SAM children was noted and it was found that the mean birth weight was approximately 2.43kg, a value which is considered as low birth weight. A study conducted in India by Ambadekar & Zodpey (2017) revealed that low birth weight (<2.5kgs) was found to have an adverse association with wasting while another study conducted in Western India revealed that children who has low weight at birth were 4.85 times more likely to be severely malnourished compared to those children with normal birth weight (Gupta et.al, 2022).

Education level of the mothers was also considered and the study revealed that 55.8% of them had a middle school certificate and 4.7% were illiterate. For the household heads, similar to the mothers, majority had a middle school certificate (44.2%). A study conducted in Bangladesh suggested that a mother's education played an important role in reducing malnutrition as chronic malnutrition was found to be highest among children of illiterate mothers, 52.6% being stunted, 12.2% being wasted and 55.7% underweight. It also found out that children to fathers who had higher levels of education were less likely to be malnourished than those whose fathers were illiterate and this was attributed to the fact that fathers were most likely the decision makers for the family and hence with higher education came the ability to ensure that children had better nutrition. The risk of underweight among children born to fathers with at least primary and secondary education was 0.98 and 0.70 times lower, respectively, as compared to the children who had illiterate fathers (Rayhan & Khan, 2006).

53.5% of the household heads were skilled workers and shop/market workers and they were earning an average monthly income of approximately 10,500 rupees. With regards to the Kuppuswamy Scale (Gunjan, 2022), the socioeconomic status scale, 67.4% of the children came from upper lower class (IV) families and 1 child came from a lower class (V) family. A study in Afghanistan showed that children coming from households with an income of less than 250 USD per month were more likely to be malnourished and they attributed this to the probable fact that

with low income comes there would be low purchasing power, and hence a limitation on food items therefore leading to child wasting (Frozanfar et.al, 2016).

All the families had access to piped water and majority of the respondents stated that they take measures to make the water safe for drinking such as boiling and straining with a cloth. Frozanfar et.al (2016), found that children from households that had been consuming water from unprotected water sources were twice more likely to be wasted than those who had been consuming water form protected sources while another study conducted in India observed that employment water purification practices decreased chance of children being SAM and that children who came from families that did not treat water were twice as likely to be malnourished (Ambadekar & Zodpey 2017). These findings were supported by a study conducted in Ethiopia that revealed that it was 3.78 times more likely that households that collected drinking water from unprotected sources have wasted children (Gizaw, Woldu & Bitew, 2018).

All families used LPG as a fuel source to cook their food and this may be there reason why 55.8% reported that they did not store the remaining complementary food as they preferred making food fresh for every feed and cooking was simpler by use of gas.

With regards to sanitation, 95.3% of the respondents had home toilet facilities. This indicator was not significant in this study but in a study conducted among children aged 6–59 months of the nomadic population in Hadaleala district, Afar region, Northeast Ethiopia, it was reported that the likelihood of wasting was 5.24 times higher among those children who came from households that had no latrines compared to those who had the services (Gizaw, Woldu & Bitew, 2018). When it came to hand washing practices, all respondents stated that their family members washed their hands with soap at various times throughout the day but with when it came to child care practices such as after cleaning the baby's back side and before feeding the baby, it was evident that the practices were poor. Such findings were seen in a study conducted in Odisha, 67% of malnourished children's mothers had inadequate hygienic practices showing an association between hygiene practices and nutritional status (Sethy et.al, 2017) and in a study conducted in Northeast Ethiopia that children whose mothers washed their hands with soap before food preparation and feeding were less likely to be malnourished as this practice reduced likelihood of wasting by 79% (Gizaw, Woldu & Bitew, 2018).

Only 65.1% of the SAM children were receiving supplementary nutrition in the form of Bal Shakti from the AWCs. Children below 6 months received no supplementation for wasting. 4.7% of

children who did not receive the packets were above 3 years but not attending school neither did they receive HCM from the AWCs while 9.3% received HCM from the AWCs and despite them being wasted, they were not receiving the THR, let alone double the portion as is it recommended.

Mothers/caregivers prepared the rations in various forms such as porridge, roti and shiro/halwa/sukdhi/lapsi. 46.4% of the respondents reported that they saw some benefits of giving their children Bal Shakti such as weight gain in the children, they reported that the children were more active and happier and that the children fed well and were satisfied after consuming the supplements.

The current study revealed that 19.2% of children between 0-23 months had been bottle fed in the last 24 hours and that the 11 children who were in the age group of 12-23 months, only 72.7% of these children were still being breastfed. 62.8% of the children were exclusively breastfed in the first 2 days after birth. The others were given prelateals such as water, infant formula and sugar water. A study conducted by Ambadekar and Zodpey (2017) reported that giving of pre-lactate feeds increased the risk of the child being SAM 11 times more while a study carried out in Western India showed that 39.2% of undernourished children had a history of being introduced to pre-lactate foods which was significantly associated with under nutrition (Gupta et.al, 2022).

Only 62.8% of the children were breastfed within the 1st hour of life and all the SAM children were ever breastfed. In a study conducted in India, the risk of a child becoming SAM was found to reduce significantly if they were initiated into breastfeeding within 30 minutes of birth (Ambadekar & Zodpey 2017).

In terms of dietary diversity, male children had a poor dietary diversity score compared to females. 54.5% of children 6-23 months had low dietary diversity and only 45.5% had adequate dietary diversity scores, meaning they had eaten at least 5 out of the 8 food groups. This study also observed that the SAM children had relatively low dietary diversity. Such findings were reported in a study conducted in Niger, where it was found that a child's age was significantly associated with higher dietary diversity and in turn lower risk of wasting and this was attributed to the fact that as children grow older, their ability to eat a variety of foods increases (Egbuonye et.al, 2021). In a study conducted in Burkina Faso, greater dietary diversity was significantly associated with increased HAZ among children, however, there was no association between dietary diversity and wasting or MUAC but there was found to be an association between dietary diversity and underweight in children less than 36 months of age (Sié et.al, 2018).

13.6% of the SAM children had consumed sweet beverages in the past 24 hours, including, but not limited to, soft drink and fruit packet juices. The findings of this study found a significant association between consumption of sweet foods and drinks age wise. Similar findings could be seen in a study carried out in Surat City revealed that children with practices of eating sugary foods and snack such as wafers or candies often had high risk of having severe malnutrition than children who do not eat them at all or eat less frequently and they attributed the findings were attributed to the likelihood that there may be lack of intake of nutritious food which is required for child growth (Gupta et.al, 2022).

Therefore, it can be concluded from this chapter that there was a prevalence of 2.2% and 10.3% SAM and MAM among children under 5 years in urban slums of Baroda. The data suggests that both boys and girls have lower weights and heights than what is recommended by the World Health Organization's 2007 growth standards. This implies that the children are not reaching their growth potential and early intervention is highly recommended for them to maximize their growth potential. Drinking water and sanitation facility was found satisfactory. The study revealed that SAM children could be linked to bad dietary practices, such as going from breastfeeding to introducing solid foods, as well as a lack of regular meals. It was also observed that the SAM children had relatively low dietary diversity. It is important to ensure that everyone has access to adequate nutrition in order to prevent acute malnutrition and its associated consequences.

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

Malnutrition, specifically undernutrition, contributes to around 45% of deaths among children under 5 years of age. These deaths mostly occur in low- and middle-income countries (WHO, 2023). Undernourished children, particularly those with severe acute malnutrition, have a higher risk to succumb from common childhood illnesses such as diarrhea, pneumonia and malaria, as compared to relatively nourished children (WHO, 2022). The picture of acute malnutrition is no different when one looks into various countries. The national prevalence of stunting, wasting, severe wasting and underweight in India is at 35.5%, 19%, 7.7% and 32.1%, respectively (NFHS-5, 2019-21). Identification of the associated risk factors leading to acute malnutrition is of utmost importance for management of the same. However, there is a paucity of data with respect to the same in the Urban slums of Vadodara. Hence, a need is felt to carry out a study addressing the same.

The present study was carried out with the aim of mapping the prevalence of severe acute malnutrition in children 0-59 months residing in urban slums of Baroda and investigating the associating risk factors.

The study was conducted in the urban slums of Baroda. 33 out of the 439 AWCs in the four zones of urban Baroda were randomly selected and all registered children aged 0-59 months were to be included in the study, the summary of which is depicted below:

- Out of the 2,999 children registered in these AWCs, 2740 were considered for the study as the rest, 257, were above 59 months. The screening was done for 1784 children.
- Out of the 1784 children who were screened, 918 (51.5%) and 866 (48.5%) were boys and girls, respectively. Majority of these children belonged to the age category, 7-35 months with the lowest turnup being those below 6 months (9.8%).
- The mean weight of boys was 10.56kg and that of girls was 10.24kg while the mean height of boys was 83.2cm while that of girls was 82.7cm.
- The girls had WHZ, WAZ and HAZ of -0.84±0.97, -1.37±1.04 and -1.35±1.12, respectively, while the boys had WHZ, WAZ and HAZ of -0.95±1.03, -1.41±1.03 and -1.36±1.25, respectively.

Prevalence of Malnutrition

Wasting (Weight-for-height z-score)

- The prevalence of severe wasting was found to be 2.2%, prevalence of moderate wasting, at risk of wasting and overweight was found to be 10.3%, 33.2% and 0.4%, respectively.

- Children 0-6 months had the height prevalence of SAM at 5.1% while children 36-59 months had the highest prevalence of MAM and being at risk of wasting at 12.3% and 37.3%, respectively.
- Boys were found to be more malnourished compared to girls.

Underweight (Weight-for-age z-score)

- The prevalence of severe underweight was found to be 5.3% while the prevalence of moderately underweight, at risk of being underweight and at risk of being overweight was found to be 21.9%, 37.8% and 1.1%, respectively.
- Children 36-59 months had the highest prevalence of underweight as 6.0% and 26.9% were severely and moderately underweight, respectively, while 40% were at risk of being underweight.
- Boys were found to be severely underweight compared to girls.

Stunting (Height-for-age z-score)

- The prevalence of severe stunting was found to be 7.7%, prevalence of moderate stunting and risk of stunting was found to be 19.8% and 35.8%, respectively.
- Children aged 7-35 months had the highest prevalence of severe stunting (9.6%). Children falling under the age group of 36-59 months had the highest prevalence of moderate stunting and those who were at risk of stunting, at 22.5% and 42.1%, respectively.
- Males were found to be severely stunted compared to girls.

Mid Upper Arm Circumference (MUAC)

- 89.8% had a normal MUAC (≥12.5cm), 9.0 % were moderately underweight (MUAC between 11.5cm and 12.4cm) and 1.2% were categorized as SAM because they had a MUAC of ≤11.4cm.
- Male children had better nutritional status on the basis of MUAC than females.

Zone-wise prevalence of malnutrition

- East zone had the highest prevalence of malnutrition, i.e., there was 2.9% severe wasting, 12.1% moderate wasting, 7.2% severe underweight, 9.1% severe stunting and 23.3% moderate stunting.
- South zone had majority of the children who were at risk of malnutrition in terms of wasting, and stunting while children from North zone had better nutritional status of all the four zones.

Socio-economic status

- Children who were identified as SAM were born to mothers with a mean age of 27 years, the youngest mother being 22 years and the oldest 40 years old.
- The SAM children had a mean age of 23 months, the youngest SAM child being 1 month old and the oldest 58 months old.
- Out of the 43 children, 4 were 6 months old, this age having the highest frequency of SAM children (9.1%).
- These children had a mean birth weight of 2.4358±0.46453 kgs, with the lowest birth weight being a child born prematurely at 7 months with 1000gms and the heaviest child weighing 3.5kgs at birth. Majority of them were the 2nd born among their siblings (1.70±0.803).
- Most of the children came from families that practiced Hinduism (72.1%).
- 32.6% of the children came from families belonging to OBC group and 20.9% came from families belonging to SC group.
- 41.9 % of these children were living in nuclear type of families.
- 67.4% of the families from which these children were from owned the houses that they lived in while 33.6% were renting the houses.
- When looking at the education level of the mothers, 55.8% of them had a middle school certificate and 2 of them (4.7%) were illiterate.
- For the household heads, similar to the mothers, majority had a middle school certificate (44.2%).
- 53.5% of the household heads were skilled workers and shop/market workers followed by 12 heads (27.9%) having an elementary occupation and working in manual jobs.
- The average monthly income was about 10,500 rupees (10465.15±4,682.027) with the lowest earning being 1,000 rupees for some of the elementary workers and the highest income being 29,000 rupees for the technician/associate professional.
- With regards to the Kuppuswamy Scale, the socioeconomic status scale, 67.4% of the children came from upper lower class (IV) families.

Water, sanitation and hygiene practices.

- All the families had access to piped water.
- 86.0% of the respondents stated that they take measures to make the water safe for drinking, including, boiling, straining with a cloth, use of a water filter.

- All families used LPG as a fuel source to cook their food.
- Once complementary food was cooked, 55.8% respondents stated that they did not store the remaining food as either all was completed in one sitting or the remaining food was discarded and fresh food cooked for the next meal.
- 95.3% of the homes and a home toilet facility while 4.7% of the homes shared a community toilet facility.
- All respondents stated that their family members washed their hands with soap at various times throughout the day, including, after visiting the toilet and before cooking and before eating.
- 72.1% of the respondents stated that they cut their vegetables before washing while 27.9% of them first washed their vegetables then cut.

Supplementary nutrition

- Only 65.1% of the SAM children were receiving Bal Shakti from the AWCs.
- Children below 6 months were not receiving the packets as they are meant for children above 6 months of age, instead their mother received Matru Shakti.
- Children who are above 3 years primarily do not receive Bal Shakti as it is in the policy but instead receive hot cooked meals in the AWCs or in school, for those who attend school.
- For those children who received the supplement, all children received the packets once a month, and only 1 respondent reported that they do not receive the packets regularly.
- 60.7% of these children consumed the packets regularly in various forms, i.e, as a porridge, in form of roti/thepla/chapati and in form of shiro/halwa/sukdhi/lapsi.
- 78.6% purportedly consumed the packets by themselves, while 14.3% shared the packets with their siblings and 7.1% shared the packets with other family members.
- 46.4% of the respondents reported that they saw some benefits of giving their children Bal Shakti while 54.6% saw no benefit.

Immunization status

- 42 out of the 43 children received BCG vaccine. The child who had not received the vaccine, together with all other vaccines, was not immunized because of her nutritional status, as reported by the caregiver.
- Majority of the children had received all the vaccines apart from vitamin A booster doses after the 3^{rd} doses, only 17 received the 2^{nd} – 9^{th} dose.

Morbidity profile

- Within the past 15 days of the interview, few children had fallen in.
- 22.7% had fever, 9.1% had diarrhea, 9.1% had episodes of vomiting, 36.4% had ARI and 1 child had had measles.
- No child had malaria.

IYCF practices

- 19.2% of children between 0-23 months had been bottle fed in the last 24 hours.
- 72.7% of children 12-23 were still being breastfed at this age.
- 62.8% of the children were exclusively breastfed in the first 2 days after birth. The others were given pre lacteal's such as water, infant formular and sugar water.
- Only 62.8% of the children were breastfed within the 1st hour of life.
- All the SAM children were ever breastfed.
- Male children had a poor dietary diversity score compared to females.
- 54.5% of children 6-23 months had low dietary diversity and only 45.5% had adequate dietary diversity scores.
- 13.6% of the SAM children had consumed sweet beverages in the past 24 hours.
- 30.4% of children 7-35 months and 8.3% of children 36-59 months had not eaten any fruit or vegetable the previous day.
- 53.5% of the children had consumed unhealthy foods in the past 24 hours.
- No child aged 6-23 months had consumed eggs or flesh food the previous day.
- All children below 6 months were being breastfeed and had not consumed any solid foods.
- 58.1% of the children had consumed milk (fresh/packaged/powdered).
- No child consumed Bournevita/Horlicks/Boost, paneer/cheese, organ meats, sausages/salami, pork/wild meat, fish, insects or outside foods.

The results of the study indicate a higher prevalence of acute malnutrition among the children residing in the urban slums of Vadodara. The prevalence of severe wasting was found to be 2.2%. Severe underweight and severe stunting were found to be at 5.3% and 7.7%, respectively. Males were found to be more malnourished compared to girls. 9.1% of the children identified as SAM belonged to the age group of 0-6 months. 1.2% were categorized as SAM based on MUAC. 65.1% of the SAM children were receiving Bal Shakti from the AWCs and for those children below 6

months the mothers received the Matrushakti packets and those above 3 years get hot cooked meals in the AWC. Also, those children above three who are in the red and yellow zone receive double the ration from the AWC. However, a difference was observed in the anthropometric measurements taken by us and those reported by the AWW. Thus, those children falling in the yellow or red zone not necessarily falling in the same as per the data of the AWW, hence they would not have received the double ration. Also, those who received the packets received them regularly once a month and not all the packets were consumed solely by the child. Hence, from the conclusions drawn an urgent need is felt to train the AWW for screening and input of data into the software and continuous monitoring needs to be emphasized. Also, a need is felt to educate the families through SBCC approach so as to take care of the associating risk factors.

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ANNEXURES

ANNEXURE 1

Permission Letter from VMC, Vadodara

VADODARA MUNICIPAL CORPORATION
Health Department – Main Office,
Khaderao Market Building, Rajmahal Road,
Vadodara - 390 001.
Ph.-NO.: 0265-2433116 (Int.293).

H.O.W. No.8731/3 /2022-23.
Date : 14-10- 2022.

To,
Dr. Swati Dhruv [Asst. Professor],
Dept. of Food & Nutrition,
Faculty of Family & Community Sciences,
The M.S. University of Baroda,
Vadodara – 390 002.

Sub. ::- Permission to conduct research in Anganwadi Centres of Urban Baroda.
Ref ::- Your letter No. F.C.Sc./FND/....., Dt. 12/10/2022.

With reference to above cited subject & the matter stated in your letter, the students of Dept. of Food & Nutrition namely - Ms. Tanvi and Ms. Hazel are hereby permitted to conduct research in "ASSESMENT OF ACUTE MALNUTRITION AMONG CHILDREN 0-59 MONTHS IN URBAN BARODA" at the Anganwadi Centres of ICDS Project [Urban Block-I & II] of Vadodara Municipal Corporation during working hours 09=00 AM to 02=00 PM from 21st.. November to 31st.. March-2023.

More-over, pl. note that, the details carried out during this research study must be confidential, not to be published without our prior permission. Vadodara Municipal Corporation will not hold any responsibility for transportation or other expense incurred by you / by the students.

You are requested to submit the detailed study report to our office.

VADODARA MUNICIPAL CORPORATION HEALTH DEPT. VADODARA

Chief Health Officer
Vadodara Municipal Corporation

Copy to : for information & needful.

[1] Program Officer Shri, ICDS Project [Urban Block-I & II].
[2] CDPO Shri, ICDS Project [Urban Block-I & II].
[3] Dr. Shruti Kantawala, [Asst. Professor (CES)], Dept. of Food & Nutrition, Faculty of Family & Community Sciences, The M.S. University of Baroda, Vadodara – 390 002.

ANNEXURE 2

Ethical Compliance Certificate

Institutional Ethics
Committee for Human
Research
(IECHR)

FACULTY OF FAMILY AND COMMUNITY SCIENCES
THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA

Ethical Compliance Certificate 2022 – 2023

This is to certify that Ms. Hazel M. Mwango's study titled, "**Mapping the prevalence and associated factors of severe acute malnutrition among children 0-59 months in Urban slums of Baroda**" from Department of Foods and Nutrition has been approved by the Institutional Ethics Committee for Human Research (IECHR), Faculty of Family and Community Science, The Maharaja Sayajirao University of Baroda. The study has been allotted the ethical approval number **IECHR/FCSc/MSc/2022/33.**

Prof Mini Sheth
Member Secretary
IECHR

Prof Shagufa Kapadia
Chairperson
IECHR

ANNEXURE 3

Questionnaires

SCREENING TOOL

Date: _____

CHILD'S NAME: _____

DATE OF BIRTH: _____ **GENDER:** _____

MEASURED

WEIGHT (kg): _____ HEIGHT (cm): _____ MUAC (cm): _____

WHZ: _____ CLASSIFICATION: _____

EDEMA: ***Yes / No*** GRADE: _____

ANGANWARDI CENTRE NAME: _____

RECORDED

WEIGHT (kg): _____ HEIGHT (cm): _____ MUAC (cm): _____

WHZ: _____ WAZ: _____ HAZ: _____

QUESTIONNAIRE: ASSOCIATED FACTORS

IDENTIFICATION
ANGANWARDI CENTRE NAME: _____
NAME OF INTERVIEWEE: _____
NAME OF THE HOUSEHOLD HEAD: _____
ADDRESS OF HOUSEHOLD: _____
CONTACT NUMBER: _____
CHILD'S NAME: _____

SOCIO-ECONOMIC STATUS

1. How old are you? _____
2. How many children do you have? _____
3. What is your religion?

   1. Hindu 2. Muslim 3. Sikh
   4. Christian 5. Jain 6. Others

4. What is the caste of the household?

   1. Scheduled caste 2. Scheduled tribe
   3. Other backward class 4. General

5. What is the type of family?

   1. Nuclear 2. Joint 3. Extended

6. Does your family own the house you live in?

   1. Yes 2. No

7. What is your education level?

   1. Illiterate 2. Primary School Certificate
   3. Middle School Certificate 4. High School Certificate
   5. Intermediate or Diploma 6. Graduate
   7. Profession or Honors

8. What is the educational level of the household head?

   1. Illiterate 2. Primary School Certificate
   3. Middle School Certificate 4. High School Certificate
   5. Intermediate or Diploma 6. Graduate
   7. Profession or Honors

9. What is the occupation of the household head?

1. Unemployed
2. Elementary Occupation
3. Plant & Machine Operators and Assemblers
4. Craft & Related Trade Workers
5. Skilled Agricultural & Fishery Workers
6. Skilled Workers and Shop & Market Sales Workers
7. Clerks
8. Technicians and Associate Professionals
9. Professionals
10. Legislators, Senior Officials & Managers

10. What is the total monthly income of the family? _____

WATER, SANITATION AND HYGIENE

11. What is your source of drinking water?

1. Piped water
2. Ground water
3. Well water
4. Spring water

12. Do you do anything to the water to make it safer to drink?

1. Yes
2. No
3. Don't know

13. What do you usually do to make the water safer to drink?

1. Boil
2. Add bleach/chlorine
3. Strain through a cloth
4. Use water filter
5. Solar disinfection
6. Let it stand and settle
7. Cover the water container

14. What type of fuel do you use?

1. Electricity
2. LPG/natural gas
3. Biogas
4. Kerosene
5. Coal/lignite
6. Charcoal
7. Wood

15. What type of toilet facility do you have?

1. Home toilet
2. Community toilet
3. No facility

16. Do members of your household wash their hands with soap?

1. Yes
2. No

17. When do they wash their hands?

1. After using the toilet
2. Before cooking
3. Before eating
4. After cleaning baby's backside
5. Before feeding baby

18. For how long do you store cooked complementary foods?

1. Doesn't store
2. For 2 – 3 hours
3. More than 4 hours
4. More than 1 day

19. When do you cut the vegetables?

1. Before washing
2. After washing

CHILD PROFILE

20. What is the gender of the child?

1. Male 2. Female 3. Other gender

21. How old is (NAME)? _____

22. When was the child born? _____

23. What is the birth order of (NAME)? _____

24. What was the weight of (NAME) at birth? _____

SUPPLEMENTARY NUTRITION

25. Do you get Bal Shakti?

1. Yes 2. No
   If no, why? _____

26. How often do you get Bal Shakti?

1. Once a month 2. Twice a month 3. Thrice a month

27. How many packets are received in a month? _____

28. Do you receive it regularly?

1. Yes 2. No

29. Does your child consume it regularly?

1. Yes 2. No

30. How are the packets consumed?

1. Solely by child 2. Shared by siblings
3. Shared by other family members 4. Others

31. Does your child like the taste?

1. Yes 2. No

32. In which form do you give Bal Shakti? _____

33. Do you find any benefit in your child consuming Bal Shakti?

1. Yes 2. No
   If yes, what benefits? _____

IMMUNIZATION

NO	VACCINATION	YES/NO
34.	BCG	
35.	Hepatitis B	
36.	OPV 0	
37.	O/IPV 1,2 & 3	
38.	Penta 1,2 & 3	
39.	Rota 1,2 & 3	
40.	Measles/ MMR 1st dose	
41.	Vitamin A 1st dose	
42.	DPT booster	
43.	Measles/MMR 2nd dose	
44.	OPV booster	
45.	Vitamin A (2nd to 9th dose)	
45a.	Number of Vitamin A doses recorded _____	

MORBIDITY PROFILE

No	SYMPTOM/ DISEASE	PRESENCE IN THE LAST 15 DAYS (Y/N)
46.	Fever	
47.	Diarrhea	
48.	Vomiting	
49.	Acute Respiratory Infection (ARI)	
50.	Measles/mumps	
51.	Malaria	

IYCF PRACTICES & DIETARY DIVERSITY

If child is between 0-35 months use the table questions below. If between 36-59 months, use the later table of questions.

0-35 months

No.	QUESTION	YES or NO	DON'T KNOW (DK)
52.	Was (NAME) ever breastfed?		
53.	How long after birth was (NAME) first put to the breast?		
	If immediately, indicate "000"		
	If less than one hour, record "00" hours		
	If less than 24 hours, record hours		
	Otherwise, record days		
54.	In the first 2 days after delivery, was (NAME) given anything other than breastmilk to eat or drink – anything at all like water, infant formula, condensed milk, cinnamon water, or sugar water?		
55.	Was (NAME) breastfed yesterday during the day or at night?		
56.	Did (NAME) drink anything from a bottle with a nipple yesterday during the day or at night?		

Now I would like to ask you about liquids that [NAME] may have had yesterday during the day or at night. Please tell me about all drinks, whether [NAME] had them at home, or somewhere else. **Yesterday during the day or at night, did [NAME] have:**			
57.	Plain water?		
58.	Infant formula or baby milk such as Amul, Lactogen, or Dexolac?		
58a.	IF YES: How many times did (NAME) drink infant formula? (IF 7 OR MORE TIMES, RECORD '7').		
59.	Milk from animals, including fresh, packaged or powdered?		
59a.	IF YES: How many times did (NAME) drink milk? (IF 7 OR MORE TIMES, RECORD '7').		
59b.	IF YES: Was any of the milk a sweet or flavored type of milk?		
60.	Bournevita, Horlicks, or Boost?		
61.	Fruit juice, packet juice such as Rasna or Frooti, sugarcane juice, or nannari sarbath?		
62.	Soft drinks such as Sprite, Pepsi, Mirinda, or energy drinks?		
63.	Tea, coffee, or herbal drinks?		
63a.	IF YES: was the drink sweetened?		
64.	Clear broth or clear soup?		
65.	Any other liquids?		
65a.	IF YES: What was the liquid or what were the liquids?		
65b.	IF YES: Was the drink sweetened?		
Now I would like to ask you about foods that [NAME] had yesterday during the day or at night. I am interested in foods your child ate whether at home or somewhere else. Please think about snacks and small meals as well as main meals…. *I will ask you about different types of foods, and I would like to know whether your child ate the food even if it was combined with other foods. Please do not answer 'yes' for any food or ingredient used in a small amount to add flavor to a dish.* **Yesterday during the day or at night, did [NAME] eat:**			
66.	Curd, lassi, buttermilk, or raita?		
66a.	IF YES: How many times did (NAME) have curd, lassi, buttermilk, or raita?		
66b.	IF YES: Did (NAME) have any lassi or buttermilk to drink?		
66c.	IF YES: Was it a sweet type of drink? YES or NO DK		
	Yesterday, did (NAME) eat any of the following foods:		
67.	Rice, idli, dosa, poha, naan, kulcha, paratha, upma, Cerelac, or Farex?		
68.	Chapati, roti, dalia, roasted maize?		
69.	Pearl millet, finger millet, or ragi malt?		

70.	Potato, sweet potato, turnip, arum root, tapioca, or raw banana?		
71.	Daal, sambar, chickpeas, kidney beans, soya, or khichdi?		
	Yesterday, did (NAME) eat any of the following vegetables:		
72.	Carrots, or pumpkin that is orange inside?		
73.	Mustard leaves, spinach, radish leaves, cassava leaves, taro leaves, drumstick leaves, amaranth leaves, or wild greens/other greens?		
74.	Tomatoes, eggplant, okra/lady finger, French beans, cauliflower, cabbage, or beetroot?		
75.	Bitter gourd, bottle gourd, pointed gourd, ivy gourd, apple gourd, ridged gourd, or snake gourd?		
76.	Cucumber, radish, capsicum, German turnip, or drumstick?		
	Yesterday, did (NAME) eat any of the following fruits:		
77.	Ripe papaya, ripe mango, orange musk melon, or apricots?		
78.	Orange, tangerine, or grapefruit?		
79.	Ripe banana, apple, pear, watermelon, guava, custard apple, pomegranate, or pineapple?		
80.	Grapes, kiwi, peaches, jackfruit, chickoo, jamun, palmyra palm fruit, or other wild fruits?		
	Yesterday, did (NAME) eat any of the following sweets:		
81.	Cakes, cream biscuits, biscuits, suji halwa / kesari bath, jalebi, or ladoo?		
82.	Other mithai, rice pudding, kulfi, ice cream, milkshake, toffees, or chocolates?		
	Yesterday, did (NAME) eat any of the following foods of animal origin:		
83.	Eggs?		
84.	Paneer or cheese?		
85.	Liver or kidney?		
86.	Sausages or salami?		
87.	Mutton, beef, or lamb?		
88.	Pork or wild meat?		
89.	Chicken, duck, or turkey?		
90.	Fish, prawn, crab, or seafood?		
91.	Termites, ants, or locusts?		
	Yesterday, did (NAME) eat any of the following other foods:		
92.	Peanuts, cashews, almonds, pistachios, walnuts, pumpkin seeds, or sunflower seeds?		
93.	Potato chips, namkeen or mixture?		
94.	Instant noodles such as Maggi noodles or Wai Wai?		

95.	Samosa, pakora, puri, vada, mathri, kachori, murukku, or bonda?		
96.	Any other solid, semi-solid, or soft food?		
96a.	IF YES: What was the food?		
	Yesterday, did (NAME) eat food from any place like...		
97.	McDonald's, KFC, Pizza Hut, Domino's, Burger King, or other places that serve pizza or burgers?		
	Note for interviewer: *If not a single "yes" for foods is recorded, ask 98. If at least one "yes" for foods, skip to 99…*		
98.	Did (NAME) eat any solid, semi-solid, or soft food yesterday during the day or night?		
99.	How many times did [NAME] eat any solid, semi-solid or soft foods yesterday during the day or night? *If 7 or more times, record "7"*		

36-59 months

No.	QUESTION	YES / NO	DON'T KNOW (DK)
100.	Was (NAME) ever breastfed?		
101.	How long after birth was (NAME) first put to the breast?		
	If immediately, indicate "000"		
	If less than one hour, record "00" hours		
	If less than 24 hours, record hours		
	Otherwise, record days		
102.	In the first 2 days after delivery, was (NAME) given anything other than breastmilk to eat or drink – anything at all like water, infant formula, condensed milk, cinnamon water, or sugar water?		

Now I'd like to ask you some yes-or-no questions about foods and drinks that (NAME) consumed yesterday during the day or night, whether he/she had it at home or somewhere else.
First, I would like you to think about yesterday, from the time (NAME) woke up through the night. Think to yourself about the first thing they ate or drank after they woke up in the morning … Think about where they were when they had any food or drink in the middle of the day … Think about where they were when they had any evening meal … and any food or drink they may have had in the evening or late-night... and any other snacks or drinks they may have had between meals throughout the day or night.

I am interested in whether they had the food items I will mention even if they were combined with other foods. Please listen to the list of foods and drinks, and if they ate or drank ANY ONE OF THEM, say yes.		
	Yesterday, did (NAME) eat any of the following foods:	
103.	Rice, idli, dosa, poha, naan, kulcha, paratha, or upma?	
104.	Chapati, roti, dalia, or roasted maize?	
105.	Pearl millet or finger millet?	
106.	Potato, sweet potato, turnip, arum root, tapioca, or raw banana?	
107.	Daal, sambar, chickpeas, kidney beans, soya, or khichdi	
	Yesterday, did (NAME) eat any of the following vegetables:	
108.	Carrots, or pumpkin that is orange inside?	
109.	Mustard leaves, spinach, radish leaves, cassava leaves, taro leaves, drumstick leaves, amaranth leaves, or wild greens/other greens?	
110.	Tomatoes, eggplant, okra/lady finger, French beans, cauliflower, cabbage, or beetroot?	
111.	Bitter gourd, bottle gourd, pointed gourd, ivy gourd, apple gourd, ridged gourd, or snake gourd?	
112.	Cucumber, radish, capsicum, German turnip, or drumstick?	
	Yesterday, did (NAME) eat any of the following fruits:	
113.	Papaya, mango, orange musk melon, or apricots?	
114.	Orange, tangerine, or grapefruit?	
115.	Ripe banana, apple, pear, watermelon, guava, custard apple, pomegranate, or pineapple?	
116.	Grapes, kiwi, peaches, jackfruit, chickoo, jamun, palmyra palm fruit, or other wild fruits?	
	Yesterday, did (NAME) eat any of the following sweets:	
117.	Cakes, cream biscuits, biscuits, suji halwa / kesari bath, jalebi, or ladoo?	
118.	Other mithai, rice pudding, kulfi, ice cream, milkshake, toffees, or chocolates?	
	Yesterday, did (NAME) eat any of the following foods of animal origin:	
119.	Eggs?	
120.	Paneer or cheese?	
121.	Curd, lassi, buttermilk, or raita?	

122.	Sausages or salami?	
123.	Mutton, beef, lamb, or liver?	
124.	Pork or wild meat?	
125.	Chicken, duck, or turkey?	
126.	Fish, prawn, crab, or seafood?	
	Yesterday, did (NAME) eat any of the following other foods:	
127.	Peanuts, cashews, almonds, pistachios, walnuts, pumpkin seeds, or sunflower seeds	
128.	Potato chips, namkeen or mixture?	
129.	Instant noodles such as Maggi noodles or Wai Wai?	
130.	Samosa, pakora, puri, vada, mathri, kachori, murukku, or bonda?	
	Yesterday, did (NAME) have any of the following beverages:	
131.	Milk, flavored milk, chai with milk, or coffee with milk?	
132.	Tea with sugar, coffee with sugar, milk with sugar, flavored milk, Bournevita, Horlicks, or Boost?	
133.	Fruit juice, packet juice such as Rasna or Frooti, sugarcane juice, or nannari sarbath?	
134.	Soft drinks such as Sprite, Pepsi, Mirinda, or energy drinks?	
	Yesterday, did (NAME) get food from any place like...	
135.	McDonald's, KFC, Pizza Hut, Domino's, Burger King, or other places that serve pizza or burgers?	

ANNEXURE 4

Information Letter and Consent Form

INFORMATION LETTER

I, Hazel M. Mwango, a student of Sr. MSc. in Dept of Foods and Nutrition at The Maharaja Sayajirao University is carrying out research under the guidance of Dr. Swati Dhruv.

The proposed topic of my research is "Mapping the Prevalence and Associated Factors of Severe Acute Malnutrition Among Children 0-59 Months in Urban Slums of Baroda." This letter contains the information regarding the research.

Malnutrition refers to deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients. Many children are lacking to meet their nutritional requirements and have compromised physical growth because of faulty dietary practices, inappropriate knowledge, dislikes for particular food etc.

With the help of an interview, I will ask you some questions, answers of which will be noted. The questions will be regarding socio-economic status, diet diversity, feeding practices, immunization and morbidity profile of the child. If you do not want to answer certain questions or do not want to disclose certain information, then you are free to omit them.

The information given by you will be confidential and used only for study purpose.

At the end of the research, the results will be shared with you. By taking part in this research, no remuneration will be provided to child, neither would it harm child.

We thank you for your willingness and participation in this research.

By,

Hazel M. Mwango (+91 9624864593)

(Student)

Dr. Swati Dhruv

(Guide)

Department of Foods and Nutrition,

The Maharaja Sayajirao University of Baroda.

ANNEXURES

CONSENT FORM

I am there by ready to allow participation in this research. I have understood that in this interview, I will answer certain questions. I have read all the information regarding this research or the information has been read out to me. I have got an opportunity to ask questions regarding the same and I have got satisfactory answers to my questions.

Therefore, I willingly consent to participate.

NAME:_____

AGE: _____ **GENDER: _____**

MOBILE No.:_____

DATE: _____ **SIGNATURE: _____**

માહિતી પત્ર

હું, હેઝલ એમ. મવાન્ગો સિનિયર M.Sc.ની વિદ્યાર્થીની. મહારાજા સયાજીરાવ યુનિવર્સિટીમાં ખોરાક અને પોષણ વિભાગમાં ડૉ. સ્વાતિ ધ્રુવ ના માર્ગદર્શન હેઠળ સંશોધન કરી રહ્યા છે.

મારા સંશોધનનો પ્રસ્તાવિત વિષય છે "બરોડાની શહેરી ઝૂંપડપટ્ટીમાં 0-59 મહિનાના બાળકોમાં ગંભીર તીવ્ર કુપોષણના પ્રસાર અને સંબંધિત પરિબળોનું મેપિંગ." આ પત્રમાં સંશોધન સંબંધિત માહિતી છે.

કુપોષણ એ વ્યક્તિની ઉર્જા અથવા પોષક તત્વોના વપરાશમાં ઉણપ, અતિરેક અથવા અસંતુલનનો ઉલ્લેખ કરે છે. ઘણા બાળકો તેમની પોષણની જરૂરિયાતોને પહોંચી વળવામાં અભાવ હોય છે અને ખામીયુક્ત આહાર વ્યવહાર, અયોગ્ય જ્ઞાન, ચોક્કસ ખોરાક પ્રત્યે અણગમો વગેરેને કારણે શારીરિક વૃદ્ધિ સાથે ચેડાં કરે છે.

ઇન્ટરવ્યુની મદદથી, હું તમને કેટલાક પ્રશ્નો પૂછીશ, જેના જવાબો નોંધવામાં આવશે. પ્રશ્નો સામાજિક-આર્થિક સ્થિતિ, આહારની વિવિધતા, ખોરાક આપવાની પદ્ધતિઓ, રોગપ્રતિરક્ષા અને રોગિષ્ઠતા પ્રોફાઇલને લગતા હશે.

હું બાળકની ઊંચાઈ, વજન અને MUAC માપીશ. જો તમે અમુક પ્રશ્નોના જવાબ આપવા માંગતા નથી અથવા અમુક માહિતી જાહેર કરવા માંગતા નથી, તો તમે તેને છોડી દેવા માટે સ્વતંત્ર છો.

તમારા દ્વારા આપવામાં આવેલી માહિતી ગોપનીય રહેશે અને તેનો ઉપયોગ ફક્ત અભ્યાસ હેતુ માટે જ કરવામાં આવશે.

સંશોધનના અંતે, પરિણામો તમારી સાથે શેર કરવામાં આવશે. આ સંશોધનમાં ભાગ લેવાથી, બાળકને કોઈ મહેનતાણું આપવામાં આવશે નહીં, ન તો તેનાથી બાળકને નુકસાન થશે.

આ સંશોધનમાં તમારી ઈચ્છા અને સહભાગિતા બદલ અમે તમારો આભાર માનીએ છીએ.

દ્વારા,

(માર્ગદર્શન)

ડૉ. સ્વાતિ ધ્રુવ (+919898078988)

(વિદ્યાર્થી)

હેઝલ એમ. મવાન્ગો (+919624864593)

ખાદ્ય અને પોષણ વિભાગ,

મહારાજા સયાજીરાવ યુનિવર્સિટી ઓફ બરોડા.

હું મારા બાળકને આ સંશોધનમાં મંજૂરી આપવા તૈયાર છું. હું સમજી ગયો છું કે આ મુલાકાતમાં, મારે અમુક પ્રશ્નોના જવાબ આપવાના છે અને મારા બાળકની ઊંચાઈ, વજન અને MUAC માપ લેવાની મંજૂરી આપી છે. મેં આ સંશોધન સંબંધિત તમામ માહિતી વાંચી છે અથવા માહિતી મને વાંચવામાં આવી છે. મને આ અંગે પ્રશ્નો પૂછવાની તક મળી છે અને મને મારા પ્રશ્નોના સંતોષકારક જવાબો મળ્યા છે.

તેથી, હું સ્વેચ્છાએ ભાગ લેવા માટે સંમત છું.

નામ: ઉંમર:

જાતિ:

તારીખ:

મો નંબર:

માતાપિતાની સહી