ANTHROPOMETRY AND RETROSPECTIVE MORTALITY SURVEY
Final Report

ZALINGEI LOCALITY, CENTRAL DARFUR OF SUDAN

MARCH 2022

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ACRONYM

AAH:-	Action Against Hunger
CDR:-	Crude Death Rate
CI	Confidence Interval
CMR	Crude Mortality Rate
ENA	Emergency Nutrition Assessment
EPI	Extended Program of Immunization
FSL	Food Security and Livelihood
GAM	Global Acute Malnutrition
HAZ	Height for Age Z score
INGO	International Nongovernmental Organization
IPC	Integrated Phased based classification
MUAC	Mid Upper Aram Circumference
RNG	Random Number Generation
S3M	Simple Spatial Survey Method
SAM	Sever Acute Malnutrition
SMART	Standardized Monitoring and assessment of transit and Relief
SMOH	Sudan Minster of Health
SPSS	Statistical Package for social science
U5DR	Under-five children Death rate
UNICEF	United Nation Child's Fund
WASH	Water Hayegen Sanitation
WAZ	Weight for Age Z score
WHO	World Health Organization
WHZ	Weight for Height Z score

EXECUTIVE SUMMARY

Introduction: Action Against Hunger (AAH) has been implementing key humanitarian interventions in the Republic of Sudan since 2018, with programing in; integrated health and nutrition services through strengthening the health system, supporting the CMAM program, Water sanitation and Hygiene (WASH), food security and livelihood (FSL). Action Against Hunger conducted integrated nutrition SMART survey in March 2022 in Central Darfur state, Zalingie locality to assess the nutrition status among children 6 – 59 months, and the women of childbearing age (15 – 49) years among other indicators.

Objective: The overall objective of the SMART survey was to determine the nutritional status of children 6-59 months of age and maternal nutrition status and the mortality rate among U5 children and the general population in Zalingei Locality Central Darfur State of Sudan.

Methodology: A Cross-sectional community-based study design using a two-stage cluster sampling technique was employed. The **first stage** of the survey involved assigning 39 randomly selected clusters using ENA for SMART software (Jan. 11th, 2020 version), based on the Probability to Population Size (PPS) method. The **second stage** involved the random selection of 582 households (39 clusters*15 households per cluster) using the RNG PLUS mobile application.

Malnutrition*:* a total of 432 children were included in the sample to collect anthropometric measurements (Weight, Height, and MUAC). In this survey, the prevalence of Global Acute Malnutrition (GAM) among children aged 6-59 months using Weight for Height < -2 Z-score and/or Oedema was found to be **12.7 % (9.9 - 16.3 95% C.I.).** The prevalence of Severe Acute Malnutrition (SAM) using Weight for Height < -3 Z-score or Oedema was **2.1% (1.1- 4.1 95% CI).** The combined GAM rate based on weight-for-height and MUAC was 12.7 %(10.0 - 16.1 95% C.I.). The survey finding indicated a critical and persistent high level of acute malnutrition, based on the UNICEF malnutrition threshold cut-off (Dec 2018).

Morbidity and Immunization: The survey findings indicated that 59.3% (54.4 -63.1 95% C.I.) of children reported illness two weeks before the assessment, fever (48.4%) and cough (48%) was the most reported symptom of illnesses across the locality followed by diarrhea (14.8%) and other few diseases like skin and eye infection. The coverage of measles immunizations was 77.5% (73.3-81.6 95% C.I.) which is below the Sphere (>95%) and WHO (>80%) recommended coverage level.

Mortality: based on a 93-day recall period, CDR and U5DR were 0.38 (0.18-0.79)/10,000/day and 0.22 (0.03-1.70)/10,000/day respectively. The CDR reported in this survey was found to be at a low level and the CDR and U5DR were also below the WHO threshold of 1 person/10,000/days and 2 person/10,000/day for CDR and U5DR respectively.

A Summary of Key Survey Findings

Table 1: The summary of key survey findings, March 2022

Anthropometry - Children 6-59 months based on WHO 2006 reference		
Index	**Indicator**	**%**
WHZ- scores	Prevalence of global malnutrition (<-2 z-score and/or oedema)	(54) 12.7 % (9.9 - 16.3 95% C.I.)
	Prevalence of moderate malnutrition	(45) 10.6 %

	(<-2 z-score and >=-3 z-score, no oedema)	(8.3 - 13.4 95% C.I.)
	Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(9) 2.1% (1.1- 4.1 95% CI)
MUAC	Prevalence of global malnutrition (< 125 mm and/or oedema)	(11) 2.5 % (1.5 - 4.2 95% C.I.)
	Prevalence of moderate malnutrition (< 1205mm and >= 115 mm, no oedema)	(8) 1.9 % (1.0 - 3.4 95% C.I.)
	Prevalence of severe malnutrition (< 115 mm and/or oedema)	(3) 0.7 % (0.2 - 2.1 95% C.I.)
WAZ- scores	Prevalence of underweight (<-2 z-score)	(121) 28.3 % (24.3 - 32.6 95% C.I.)
	Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	(88) 20.6 % (17.1 - 24.5 95% C.I.)
	Prevalence of severe underweight (<-3 z-score)	(33) 7.7 % (5.0 - 11.8 95% C.I.)
HAZ-scores	Prevalence of stunting (<-2 z-score)	(160) 38.0 % (32.0 - 44.4 95% C.I.)
	Prevalence of moderate stunting (<-2 z-score and >=-3 z-score)	(104) 24.7 % (20.3 - 29.8 95% C.I.)
	Prevalence of severe stunting (<-3 z-score)	(56) 13.3% (9.7-18.0 95% CI)
Retrospective Mortality - 93 days recall period		
Mortality	CMR Deaths/10,000 people/day	(n= 10) 0.38 (0.18-0.79)
	U5 MR Deaths/10,000 children U5/day	(n= 1) 0.22 (0.03-1.70)
	Child morbidity and vaccination status	
Measles vaccination	Measles with EPI card + mother confirmation (N=424)	(n= 329) 77.5% (73.3-81.6 95% C.I.)
	Measles with EPI card	(n= 210) 40.5% (44.8-54.7 95% C.I.)
Reported illness (n= 256)		
Types of illness	Fever	(n= 124) 48.4%(42.2-42.2 95% CI)
	Cough/ARI	(n= 123) 48% (41.8-53.5 95% CI)
	Diarrhoea	(n= 38) 14.8% (10.5-19.1 95% CI)
	Other illnesses	(n= 47) 18.3% (13.7-23.4 95% CI)
Health seeking behavior		
Treatment sought	None sought	(n= 205) 80.1%
	Government Health facility	(n= 37) 14.5%
	Traditional healer	(n= 5) 2%
	Pharmacy/private clinic	(n= 9) 3.5%

1. INTRODUCTION

Malnutrition rates in Sudan have not improved in the last 30 years, and worse, the number of stunted and wasted children has increased since 1987, particularly in Sudan's conflict-torn Darfur region and the eastern states. Sudan has one of the world's highest rates of malnutrition among children. Malnutrition affects 2.7 million children under the age of five, with more than half a million suffering from severe acute malnutrition. These children are at risk of serious illness, developmental delays, and death if they do not receive treatment (UNICEF Sudan 2020). Sudan's national prevalence rate of global acute malnutrition (GAM) is 14.1% (13.9-14.3 95% CI). Wasting affects three million children under the age of five (too thin for their height). SAM affected 574,000 children, who are 11 times more likely to die than healthy children.

Between April and May 2021, an estimated 7.3 million Sudanese (16 percent of the total population) were experiencing severe acute food insecurity (IPC Phase 3 or higher) and required immediate action. Approximately 5.5 million of these people were classified as being in Crisis (IPC Phase 3), while approximately 1.8 million were classified as being critically food insecure and were classified as being in Emergency (IPC Phase 4). Red Sea State's most affected localities (Halaib and Jubayt-el-maaadin) were classified as Emergency (IPC Phase 4). An increase in localized conflicts resulted in population displacement combined with economic deterioration, resulted in higher-than-usual levels of acute food insecurity. As a result, North Darfur has the highest prevalence of people in Crisis (IPC Phase 3) or worse (25 percent), followed by West Darfur (22 percent), North Kordofan (20 percent), South Kordofan (20 percent), Gedarif (19 percent), and Central, East, and South Darfur states, which range from 17 to 18 percent. 1.3 million people will be in IPC Phase 4 (Emergency) during the second projection period (October 2021 to February 2022), corresponding to the harvest season, with 4.6 million people in Crisis (IPC Phase 3) or worse, and over 15 million people in Stressed (IPC Phase 2). There has been no progress in reducing anemia among women of reproductive age, with 36.5 percent of women aged 15 to 49 years affected. In the meantime, there is insufficient data to assess Sudan's progress toward meeting the low birth weight target, and there is insufficient prevalence data.

1

[1] *Sudan IPC Acute Food Security Analysis April 2021 – February 2022*

2. SURVEY OBJECTIVES

2.1. Main Objectives

The overall objective of the SMART survey was to determine children 6-59 months of age and maternal nutrition status and mortality rate among U5 children and the general population in Zalingei Locality of Central Darfur State of Sudan.

2.2. Specific Objectives

i. To estimate the prevalence of acute malnutrition, stunting, and underweight among children aged 6-59 months.
ii. To estimate retrospective crude mortality rates (CMR) and under-five mortality rates (U5MR) using 93 days recall period.
iii. To assess 2 weeks retrospective childhood morbidity rates among children 6-59 months.
iv. To understand the health-seeking behavior of the caretakers of children 6-59 months.
v. To assess the coverage of measles vaccination in children 9-59 months age group.
vi. To assess the key infant and young child feeding indicators among children 0 – 23 months.
vii. To estimate the nutritional status of pregnant and lactating women through MUAC measurement.
viii. To outline recommendations on actions to guide and support the nutrition program in Central Darfur Zalingei Locality.

3. SURVEY METHODOLOGY

3.1. Survey Design

The SMART survey applied a cross-sectional study design involving a two-stage cluster sampling approach based on probability proportional to population size as per the SMART Methodology guidance. The first stage of sampling deal with the selection of clusters from the updated list of the villages found in the locality and the second stage constituted simple random sampling techniques to select households in each sampled cluster.

3.2. Study Area

The survey was conducted in Zalingei Locality, Central Darfur State of Sudan, and covered all the population settlement geographical areas (225 villages) within the Zalingei locality.

3.3. Study Period

This nutrition SMART survey was conducted from the 20th to 27th of March 2022. The survey was carried out during the dry season when the community is largely engaged in farm land preparation activities. The following figure shows the seasonal calendar of the survey locality.

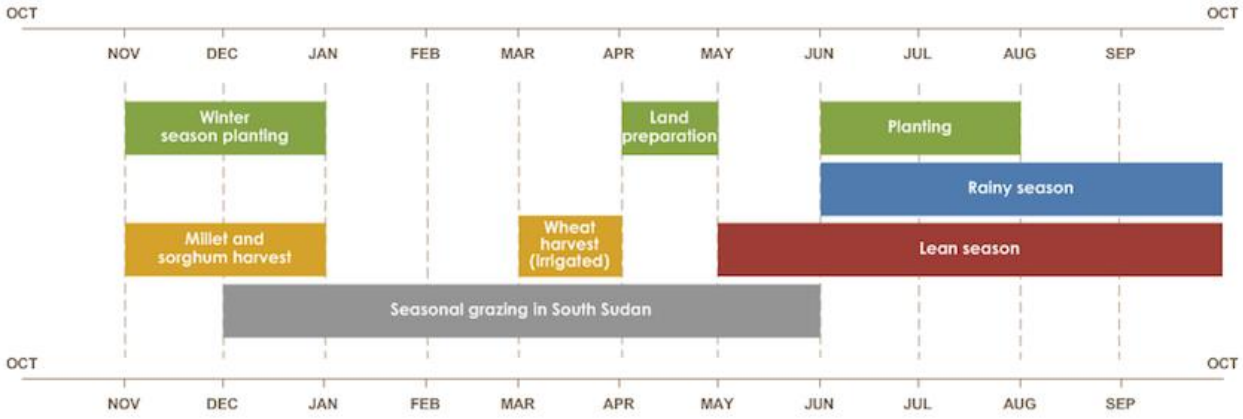

Figure 1: Zalingei Locality Seasonal Calendar

3.4. Target Population

The target population for this survey was children aged 6 – 59 months for the anthropometric measurements, while the entire population in the sampled households in selected clusters was targeted for the mortality survey. Caregivers of children aged 0-59 months were also targeted to provide the relevant information for the health and nutrition sections of the survey questionnaire.

3.5. Sampling Determination

The sample size was calculated using the ENA for SMART software based on the most recent population parameters for each cluster as demonstrated in the following table below.

Table 2: Estimated sample sizes for the Anthropometry survey, March 2022

Parameter	Values used	Rationale
Estimated prevalence %	15.29	Sudan 2018 S3M II Report. Point Prevalence of Zalingei Locality used. GAM 15.29 (11.84-20.58).
±desired precision %	4	SMART Methodology Guide
Design effect	1.5	SMART Methodology Guide (default)
Average household size	6	Based on SMOH recommendation for Zalingei
% of children under-five	17	National EPI Estimate
% of non-response households	5	Anticipated nonresponse rate
Children to be included	**508**	Determined by ENA SMART Software based on the above-given parameters
Households to be included	**582**	Determined by ENA SMART Software based on the above-given parameters

[2]

Table 3: Estimated sample size for the retrospective mortality survey, March 2022

Parameter	Values used	Rationale
The estimated death rate per 10000/day	1.18	The lower confidence interval value of the October 2020 Mortality survey by IMC in East Jabel Mara Locality of South Darfur (1.99% (1.18-3.31 95% CI)) was taken with the assumption of relatively reduced mortality rates due to efforts contributed by the INGOs in the survey area.
±desired precision per 10000/day	0.5	SMART Methodology Guide 2017
Design effect	1.5	SMART Methodology Guide
Recall period in days	93	The default value is used. To be adjusted during training
Average household size	6	Based on SMOH recommendation for Zalingei
% of non-response households	5	Anticipated nonresponse rate
Population to be included	**3184**	Determined by ENA SMART Software based on the above-given parameters
Households to be included	**559**	Determined by ENA SMART Software based on the above-given parameters

As the two indicators always produce different household samples, the larger of the two calculations, i.e. **582** was used as the final sample size for both mortality and anthropometric surveys.

[3]

[2] *Simple Spatial Survey Method (S3M-II), 2018*

[3] *SMART Survey Methodology guiding note 2017*

3.6. Sampling Procedure

The survey employed two-stage cluster sampling techniques based on the probability proportional to population size (PPS) approach. The first stage was the selection of clusters (villages/blocks) and the selection of the household was carried out in the second stage of the sampling process using a simple random sampling technique.

3.6.1. Estimating the Number of required clusters

To estimate the required number of clusters, the estimated number of households that can be visited by one team in a day was calculated. As detailed in Table 4, it was estimated that a total of 15 households could be visited and surveyed in a day by each team. Therefore, the total number of households estimated as a sample (582 HH) was divided by 15 to estimate the total number of required clusters, which was 39.

Table 4: Calculation of estimated household to be visited per day

SN	Events	Time allocated
1	Time per day for field work from 7:30 to 5:30	600 minute
2	Average travel time to reach each cluster (one-way): 45 minutes	45*2=90minute
3	Duration for initial introduction and selection of first households	25 minute
5	Average time in the household	30 minute
6	Lunch break of	35 minute
7	Total time spent	90+25+5+35=150

Average working time in each household

= (Total time available-Total time spent)

= 450 minutes [600-150]

Number of households per cluster = working time in household /Time spent in household

= (450/30)

= **15 households**

3.6.2. First Stage: Selection of Clusters

In the first stage, clusters were selected using the probability proportional to population size (PPS) approach. The sampling frame in the first stage of sampling was prepared during the initial mapping process which was completed ahead of one week before the start of the data collection. The list of 225 villages (the smallest administrative unit) along with their updated population size was prepared at the field level in consultation with local community representatives, a nutrition focal person from the Ministry of Health, and AAH staff. Finally, using ENA for the SMART Jan. 11th, 2020 version, a total of 39 clusters were sampled from the 225 villages found in Zalingei Locality. During the actual data collection period, mapping and demarcation of each selected village/cluster were conducted with the help of the local administration, village elders, and other key informants.

3.6.3. Second stage Sampling: HH Selection

In the second stage of the sampling process, a simple random sampling technique was employed to select households from the updated list of households in the sampled clusters. Upon the immediate arrival of the survey team, the team leader introduced his/her team members and provided a brief explanation of the objective and methodology of the survey. After the team introduction, the local community guide developed a list of all active HHs found in each sampled cluster. Then fifteen households were randomly selected for the actual data collected from the complete list of households using the random number generator mounted on SMART phones/tablets. In clusters that have more than 250 households, the segmentation technique was applied to sample the household. In the case of absent households or eligible children during the first visit, the team carried out subsequent revisits until the end of the data collection period and household substitution was not allowed when the team experience such circumstances.

3.6.4. Case Definition and Inclusion Criteria

- **Household:** In this survey, a household was defined as a group of people who live together and share a common cooking pot.
    - Polygamous families were counted as one household as long as they were living together and sharing a common cooking pot.
    - Polygamous families or any other families living in the same house but not sharing a common cooking pot were counted as separate households in the household list.
    - Households with only an institutional population i.e. students, and employees living together without family members were not counted and excluded from selection.
- **Children:** All children in the selected households aged 6-59 months were included in the survey. Where possible, age was validated with a recorded birth date on an immunization card, birth registration card, or any other valid card. If the birth date was not available and the exact age was not recalled by the caretaker, a local calendar of events (see Appendix -) for the last five years was used to help find the most accurate age for the child.
- **Pregnant and Lactating Women:** A woman having visible pregnancy and Lactating mother having a child less than 6 months old were included in the survey.

3.6.5. Anthropometric Indicators and Measurements

SEX: Sex was recorded as male or female.

WEIGHT: Children were weighed with/without clothes. If a child was measured with clothes then 'y' was recorded and if without clothes then 'n' was recorded in the questionnaire. Weight was measured to the nearest 100 grams using the SECA scale. Scales were checked for accuracy before and after each day's measurements using standard weight (2 kg). Average weight for clothes i.e. 200 gm was removed when relevant.

Scales were placed on a flat surface and calibrated to zero before each measurement. For younger children who cannot stand alone and for children who did not cooperate, the indirect weighing technique was used to weight the children (e.g. double weighing).

HEIGHT: Children's height was measured to the nearest 0.1 cm. Children aged less than 24 months or less than 87 cm were measured lying down on a horizontal measuring board. Children aged more than 24 months or 87 cm were measured standing up. If these principles could not be followed (i.e. disabled or sick child aged 24 or more months but unable to stand) the child was measured in an alternative manner, a note was written on the questionnaire and a correction factor was used.

OEDEMA: Children were assessed for oedema by a field team member applying three-second moderate thumb pressure to the anterior surface of both feet. If, after the pressure was released, an indentation remained on each foot, the child was recorded as having oedema. No cases of oedema were found during the survey.

MID UPPER ARM CIRCUMFERENCE (MUAC): MUAC was measured at the mid-point of the left upper arm and measured in millimeters for both children and mothers of reproductive age groups.

3.7. Survey Team composition, Training, and Data Management

3.7.1. Survey Teams

Six survey teams were organized for this survey. Each team is composed of five individuals which include two measurers, one interviewer, one team leader, and one additional community mobilizer to guide the team during the data collection period. The team members were a mix of both males and females recruited from the local communities. The Survey Manager was responsible to led all the survey implementation processes & two individuals who are trained in the SMART survey and one experienced professional served as a team supervisor during this SMART survey.

3.7.2. Survey Training

The survey teams were trained for five days (15th to 19th March 2022). The training covered various topics including anthropometric measurements, sampling of households, data collection tools, digital data collection, data quality checks, and standardization exercises among other training themes. The training of the survey team was facilitated by the survey consultant and 2 trained SMART Survey Managers. A standardization test was conducted in the Zalingie Hospital. A standardization test was carried out on the 3rd day of the training by the AHH Zalingei field office in coordination with the state MOH representatives on 12 children in the age group 6 -59 months. These children were accompanied by their parents or caregivers and strict Covid-19 measures were followed during the process. The standardization test results were analyzed and used to provide constructive feedback for the survey teams. Standardization test results of accuracy and precision of measurements are annexed at the end of this report. The SMART survey enumerator training modules were mainly used to facilitate the training sessions. Additionally, the tool was pilot tested as part of the training activity before starting the actual field data collection.

The field test was conducted in a non-sampled village area with each team completing three questionnaires and at least five household visits following the systematic random sampling technique. The test was carefully supervised and provided an opportunity to correct any errors and clarify any issues prior to the initiation of the survey.

3.7.3. Data Quality Assurance Processes

To ensure data quality a number of steps were taken: (i) a standardization test was carried out on the 3rd day of training and the results were satisfactory which ensures that the survey team had got appropriate skills and knowledge to carry on the survey implementation with an acceptable level of accuracy and precision. In addition, a local events calendar was developed by the survey teams which was used to estimate the age of the child with no formal date of the birth record. Moreover, at the end of each data collection day, anthropometric data were entered into ENA software and a plausibility check was generated. Daily feedback was provided to the survey teams based on results found from the daily plausibility check.

3.8. Supervision

The supervision of the data collection was the critical component of the data quality control measures. This was mainly conducted to reinforce the adherence of the survey team to the survey protocol. Supervision of the data collection activities was conducted on daily basis and continued until the end of the data collection period. The survey consultant together with AAH and SMOH staff has led the field-level technical support and supervision of the data collection process. The supervision exercises mainly focused on the household sampling, interview skills, and measurement and recording of anthropometric measurements

3.9. Data Management

Anthropometric Mortality, IYCF, and health-related data were collected through android enabled tablets mounted with Kobo to collect application software. The hard copy was used for anthropometric data records to back up the electronic version of the data. The teams uploaded the collected data to a central server (https://kobo.humanitarianresponse.info) on daily basis to allow the survey manager to download, review and analyze the data on daily bases.

3.10. Data Analysis

Anthropometric data was entered and analyzed using ENA for SMART software (version updated January 11, 2020) by Survey Managers.

The overall quality of the data was assessed across those quality measurement parameters: 1) missing/flagged data, 2) sex ratio, 3) age distribution, 4) digit preference for height, 5) digit preference for weight, 6) standard deviation (WHZ), 7) skewness, 8) kurtosis (WHZ), and 9) Poisson distribution (WHZ<-2). The assessment was made for overall and individual teams.

Apart from the daily spot-checking of data entry, all data were re-checked upon completion of data entry and before running the final analysis. Undernutrition rates were estimated using WHO 2006 growth reference data and presented in the result section.

SMART flags were set to exclude outliers from the anthropometric analysis. Boundaries for exclusion were set at +/- 3 standard deviations (SD) from the observed weight for height Z-score mean. The daily plausibility report review enabled re-checking of data entry for any children with a SMART flag.

3.10.1. Nutrition Indices and Classification

Table 5: Based on UNICEF standards nutritional indices and its definition used for the analysis of anthropometry (children aged 6-59months)

Indicator	Definition Criteria	Cut off point
Acute Malnutrition by WHZ	Global Acute Mlnutrtion	WHZ<-2 and /or Oedema
	Moderate Acute Malnutrtion	WHZ <-2 and >=-3
	Sever Acute Malnutrition	WHZ <-3 and/or Oedema
Stunting	Total Stunting	HAZ<-2
	Moderate Stunting	HAZ <-2 and >=-3
	Sever Stunting	HAZ<-3
Underweight	Total Underweight	HAZ<-2
	Moderate Underweight	HAZ <-2 and >=-3
	Sever Underweight	HAZ<-3
Acute Malnutrition by MUAC	Global Acute Mlnutrtion	<12.5CM and/or Oedema
	Moderate Acute Malnutrtion	≥11.5 and <12.5
	Sever Acute Malnutrition	≤ 11.5 and/or Oedema

Table 6: ***Based on UNICEF standards classification of acute malnutrition rates according to the public health significance for children aged 6-59 months***

Labels	Prevalence Threshold(%)		
	Wasting	Overweight	Stunting
Very Low	<2.5	<2.5	<2.5
Low	2.5-<5	2.5-<5	2.5-<10
Medium	5-<10	5-<10	10-<20
High	10-<15	10-<15	20-<30
Very High	≥15	≥15	≥30

Classification of acute malnutrition among PLW and global recommendations (by MUAC)

The MUAC cut-offs for women globally are MUAC <230 mm for global acute malnutrition, between 210 mm and 229 mm for moderate acute malnutrition, and <210 mm for severe acute malnutrition.

3.10.2. Retrospective Mortality Rate

The Crude Death Rate (CDR) and the Under 5 Mortality Rate (U5MR) are defined respectively as the number of people within the total population and the number of under-five children within the under-five population who discover a specified period. These death rates are expressed in relation to 10,000 persons (or under-five children) per day and are computed by ENA software.

The CDR is calculated using the formula:

CDR = [Number of deaths / (Total populati on/10,000) x ti me interval]

The total population is the population present at the mid-point of the time interval. It is computed as the total number of people present at the time of the survey in the household (current household members) + ½ total deaths + ½ persons present at the beginning of the recall period but gone at the time of the survey – ½ persons arriving during the recall period and present at the moment of the survey – ½ the number of births during the recall period. The time interval referred to as the recall period is the length of time within which the interviewees were asked to state if any deaths have occurred.

The U5MR is calculated using the formula:

U5MR = Number of deaths of children under-5 / [(Populati on of under-5/10,000) x time interval]

The total population of children under five is equivalent to the total number of children aged under fi ve year present at the time of the survey in the households + ½ total deaths of under-fi children + ½ under-five children present at the beginning of the recall period but gone at the ti me of the survey – ½ under-fi ve children arrived during the recall period and present at the ti me of the survey – ½ birth during the recall period. Stillbirths that occurred during the recall period were not recorded so were not counted.

Table 7: Cut off point for U5MR and CM

U5MR	CM	Classification
≥ 2 deaths per 10,000 children per day	≥ 1 death per 10,000 persons per day	Alert Rate
≥ 4 deaths per 10,000 children per day	≥ 2 deaths per 10,000 persons per day	Emergency rate

3.10.3. Other Multi-Sectorial Indicators used in the survey

Apart from nutritional and mortality rates, other indicators of IYCF, morbidity, and access to health care were considered under this survey.

Key Infant and Young Child Feeding (IYCF) indicators

The core indicators of IYCF i.e. 3Es (Early initiation of breastfeeding, exclusive breastfeeding, and

extended breastfeeding were assessed for children less than 24 months. Other indicators e.g. Introduction of complementary foods (solids, semi-solids, or soft foods), minimum dietary diversity, minimum meal frequency for both breastfed and non breastfed children, bottle-feeding, and introduction of infant formula milk was assessed.

For minimum dietary diversity, the proportion of children 6-23 months of age who received foods from four or more food groups were assessed. The seven food groups used for tabulation of this indicator were:

- Grains, roots, and tubers
- Legumes and nuts
- Dairy products (milk, yogurt, cheese)
- Flesh foods (meat, fish, poultry, and liver/organ meats)
- Eggs
- Vitamin-A rich fruits and vegetables
- Other fruits and vegetables
-

The cutoff of at least 4 of the above food groups was selected because it is associated with better diet intake for both breastfed and non-breastfed children.

For minimum meal frequency, the proportion of breasted and non-breasted children 6-23 months of age who receive solid, semi-solid, or soft foods (also including milk feeds for non-breastfed children) were measured. This indicator is intended as a proxy for energy intake from foods other than breast milk. Feeding frequency for breasted children includes only non-liquid food and for non-breastfed children, it includes both milk feeds and solid/semi-solid food.

Morbidity and Health seeking behavior indicators used in the survey

For all children under 6-59 months of age, with a recall period of 2 weeks, children suffering from different illnesses were assessed. The different illnesses were categorized as follows:

- Diarrhea (more than 3 loose stools/day)
- Fever
- Measles
- Difficulty in-breath/ARI
- Others (specify)

Also, for those children suffering from any illness, their health-seeking behavior was assessed. The categories under health-seeking practices were as follows:

1. No care/nothing (stayed at home)
2. Government health facilities/ Health Post/ Primary Health Care Centres
3. Health centers
4. Pharmacy
5. Private hospital/clinic
6. Religious/traditional healer
7. Others (specify)[4]

[4] *fao_guidelines_for_measuring_dietary_diversity_2010_october*

4. ETHICAL CONSIDERATION

Verbal consent was taken from each survey participant before starting any procedure and data collection activities. Community leaders were consulted in each step of the data collection process and they were also allowed to discuss and ask any questions about the survey. Moreover, the following points were described to each survey respondent/caregiver.

- The team ensured affirmation from caregivers that their children will not be at risk of harm while being measured and ensured the confidentiality of the information that they provide to the team.
- The team clearly explained to the participants that they do not get any kind of benefit for being participating in the survey
- The participants were informed about their right to withdraw from the assessment at any moment during the process.

5. SURVEY RESULT

5.1. Survey Sample and Non-Response

The survey covered all the 39 sampled clusters with an overall response rate of 86%. Market day, the mobile livelihood nature of the pastoralist community, and the refusal of the religious leader are among the key factors that contributed to the observed non-response rate.

Table 8: Survey Sample and Non response rate, March 2022

Category	Target	Achievement
Household	582	503 (86%)
children 6-59 month age	508	432(85%)
Cluster	39	39

Anthropometric data was collected from 432 children in the age group 6 to 59 months. Regarding the sex of the children, 50.5% and 49.5% were boys and girls respectively. The overall ratio of boys to girls was 1 with a p-value of 0.962 indicating that both boys and girls are equally represented in the anthropometric survey. The age ratio of children 6-29 months to 30-59 months was 0.87 which is close to the expected value (P-value= 0.808), pointing out that both age groups are equally represented in this survey.

Table 9: Distribution of age and sex of the sample, March 2022

	Boys		Girls		Total		Ratio
AGE (mo)	**no.**	**%**	**no.**	**%**	**no.**	**%**	**Boy:girl**
6-17	35	43.2	46	56.8	81	18.8	0.8
18-29	61	50.8	59	49.2	120	27.8	1.0
30-41	33	39.3	51	60.7	84	19.4	0.6
42-53	64	63.4	37	36.6	101	23.4	1.7
54-59	25	54.3	21	45.7	46	10.6	1.2
Total	218	50.5	214	49.5	432	100.0	1.0

The mean household size was 5.8 and the percentage of under-five children was 17.6% with a mean birth rate of 0.8%. The distribution of the surveyed population is characterized by high birth and death rates which represent a typical developing country's population pyramid (Fig 2).

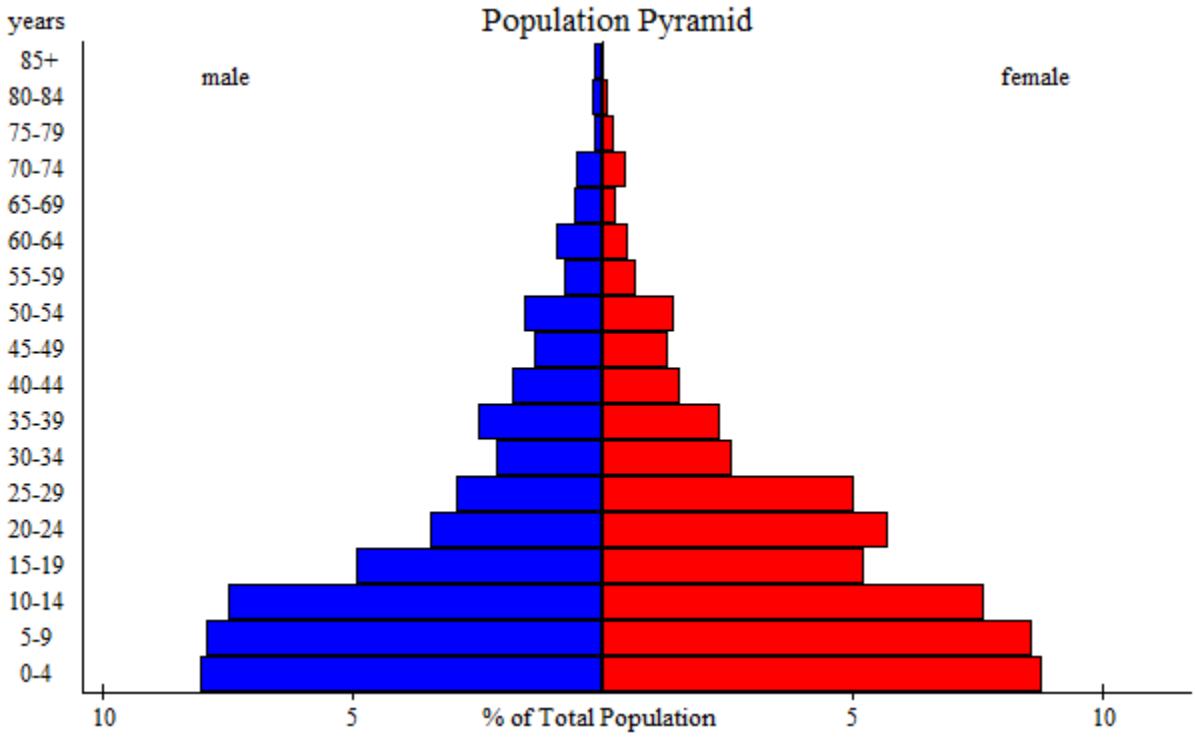

Figure 2: Population age and sex pyramid, March 2022

5.2. Anthropometric Results of Children 6 -59 Months (Based on WHO standards 2006)

Data were checked for outliers (values that lie between +/-3 SD from the observed mean) and outliers were flagged by the SMART software which are not considered plausible values (i.e. Indicate the incorrect value of either of the three measurements (weight, height, or age). The SMART flags were excluded from the analysis (WHZ, HAZ, and WAZ for 8, 11, and 4 children respectively).

The overall data quality of this survey was excellent based on the ENA for SMART software Plausibility check result. The value of sex ratio, standard deviation, and kurtosis across all the surveyed clusters was also excellent. Anthropometric measurements (weight, height, and MUAC) had excellent scores across the surveyed clusters. The distribution of the data was symmetrical across all the surveyed clusters and the Poisson distribution indicated the uniform distribution of the wasted cases across the sampled clusters.

The overall data quality of the survey is 0% based on the plausibility report generated by ENA for SMART software which indicates the excellent quality of the data and could be taken as acceptable data to be used for further analysis and programmatic decisions.

5.2.1. Prevalence of Acute Malnutrition Based on Weight-for-Height z-scores (and/or oedema) and by sex

Weight-for-Height (W/H**)** is the nutrition index that reflects short-term growth failure (acute malnutrition, wasting) and is defined by a child's weight (kg) and its height or length (cm) in relation to a standard or reference population of the same height/length. Acute malnutrition prevalence is estimated from the weight for height (W/H) index values combined with the presence of oedema. The WFH indices are expressed in Z-scores according to WHO 2006 reference. Global Acute Malnutrition (GAM) is defined as <-2 z scores weight-for-height and/or oedema. While Severe Acute Malnutrition (SAM) is defined as <-3 z scores weight-for-height and/or oedema).

Global Acute Malnutrition (GAM) prevalence in this survey based on Weight for height Z scores (WHZ< - 2 and/or oedema) is 12.7 %(9.9 - 16.3 95% C.I.). Severe Acute Malnutrition (SAM) in this survey appeared to be 2.1 %(1.1 - 4.1 95% C.I.). No oedema cases were reported in this survey. The findings indicated the presence of **high malnutrition** situation (GAM rate of <12.7%) in the area according to UNICEF's new threshold classification for the prevalence of malnutrition.

The SAM prevalence among girls was 2.4 %(0.9 - 6.4 95% C.I.) which is slightly higher than boys (1.9%, 0.7 - 4.9 95% C.I.), but the difference is not statistically significant (P-value =0.340) significant.

Table 10: Prevalence of Acute Malnutrition based on Weight-for-Height z-scores (and/or oedema) and by Sex, March 2022

	All n = 424	Boys n = 214	Girls n = 210
Prevalence of global malnutrition (<-2 z-score and/or oedema)	(54) 12.7 % (9.9 - 16.3 95% C.I.)	(28) 13.1 % (9.1 - 18.5 95% C.I.)	(26) 12.4 % (8.8 - 17.1 95% C.I.)
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no oedema)	(45) 10.6 % (8.3 - 13.4 95% C.I.)	(24) 11.2 % (7.8 - 15.9 95% C.I.)	(21) 10.0 % (6.8 - 14.5 95% C.I.)
Prevalence of severe malnutrition (<-3 z-score and/or oedema)	(9) 2.1 % (1.1 - 4.1 95% C.I.)	(4) 1.9 % (0.7 - 4.9 95% C.I.)	(5) 2.4 % (0.9 - 6.4 95% C.I.)

The prevalence of oedema is 0.0 %

Analysis of acute malnutrition by age group indicated that SAM prevalence was higher among children in the age group 54-59 months and it was zero among children in the age group 18 to 29 months. In addition, MAM prevalence among children in the age group 6-17 and 54 -59 months was 16.7% and 22.2% respectively which is high compared to the value reported in the other age groups.

Similarly, MAM prevalence was low among children in the age group 19-53 months. The difference in the MAM prevalence across the different age groups implies the existing gaps in weaning and recommended complementary feeding practices as well as it reflects the low level of IYCF practice in the area.

Table 11: Prevalence of SAM and MAM by Age, based on Weight-for-Height z-scores and/or oedema, March 2022

Age (mo)	Total no.	Severe wasting (<-3 z-score)		Moderate wasting (>= -3 and <-2 z-score)		Normal (> = -2 z score)		Oedema	
		No.	%	No.	%	No.	%	No.	%
6-17	79	2	2.5	13	16.5	64	81.0	0	0.0
18-29	116	0	0.0	8	6.9	108	93.1	0	0.0
30-41	83	2	2.4	6	7.2	75	90.4	0	0.0
42-53	101	2	2.0	8	7.9	91	90.1	0	0.0
54-59	45	3	6.7	10	22.2	32	71.1	0	0.0
Total	424	9	2.1	45	10.6	370	87.3	0	0.0

5.2.2. Acute Malnutrition and Oedema based on Weight-for-Height z-scores

Table 12: Distribution of Acute Malnutrition and Oedema based on Weight-for-Height z-scores, March 2022

	<-3 z-score	>=-3 z-score
Oedema present	Marasmic kwashiorkor. 0 (0.0 %)	Kwashiorkor. 0 (0.0 %)
Oedema absent	Marasmic No. 12 (2.8 %)	Not severely malnourished. 420 (97.2 %)

5.2.3. Prevalence of Acute Malnutrition based on MUAC cut off's (and/or oedema) and by Sex

The Mid-Upper Arm Circumference (MUAC) is an anthropometric measurement used to evaluate wasting in children aged 6 to 59 months. It is widely used in nutrition programs to determine child admission to feeding programs. It is also a good predictor of mortality among under-five children. The analysis was carried out using the standard MUAC cut-off points (i.e. < 115 mm for SAM and between 115 mm and 125 mm for MAM). The prevalence of acute malnutrition by MUAC did not use exclusion, so the analysis was performed for all 432 children.

GAM and SAM prevalence based on MUAC cut-off point is 2.5 % (1.5 - 4.2 95% C.I.) and 0.7(0.2 - 2.1 95% C.I.) respectively as shown in Table 9. The GAM prevalence among girls was found to be 3.3% which is slightly higher than the 1.8% GAM prevalence of boys. Likewise, SAM prevalence among girls was 1.4% which is higher than the prevalence reported among boys (i.e. 0.0%) but, the difference is statistically not significant (P= 0.081).

Table 13: Prevalence of acute malnutrition based on MUAC cut off's (and/or oedema) and by sex, March 2022

	All n = 432	Boys n = 218	Girls n = 214

Prevalence of global malnutrition (< 125 mm and/or oedema)	(11) 2.5 % (1.5 - 4.2 95% C.I.)	(4) 1.8 % (0.7 - 4.8 95% C.I.)	(7) 3.3 % (1.7 - 6.3 95% C.I.)
Prevalence of moderate malnutrition (< 125 mm and >= 115 mm, no oedema)	(8) 1.9 % (1.0 - 3.4 95% C.I.)	(4) 1.8 % (0.7 - 4.8 95% C.I.)	(4) 1.9 % (0.7 - 4.7 95% C.I.)
Prevalence of severe malnutrition (< 115 mm and/or oedema)	(3) 0.7 % (0.2 - 2.1 95% C.I.)	(0) 0.0 % (0.0 - 0.0 95% C.I.)	(3) 1.4 % (0.4 - 4.3 95% C.I.)

The GAM prevalence of children among children aged 30-59 is zero-based on MUAC while it is 11.1% and 1.7% for children aged 6-17 group and 18-29 Group respectively according to Table 10

Table 14: Prevalence of acute malnutrition by age, based on MUAC cut off's and/or oedema, March 2022

		Severe wasting (< 115 mm)		Moderate wasting (>= 115 mm and < 125 mm)		Normal (> = 125 mm)		Oedema	
Age (mo)	Total no.	No.	%	No.	%	No.	%	No.	%
6-17	81	3	3.7	6	7.4	72	88.9	0	0.0
18-29	120	0	0.0	2	1.7	118	98.3	0	0.0
30-41	84	0	0.0	0	0.0	84	100.0	0	0.0
42-53	101	0	0.0	0	0.0	101	100.0	0	0.0
54-59	46	0	0.0	0	0.0	46	100.0	0	0.0
Total	432	3	0.7	8	1.9	421	97.5	0	0.0

5.2.4. Prevalence of combined GAM and SAM based on WHZ and MUAC cut off's (and/or oedema) and by sex

The prevalence of malnutrition based on combined GAM and SAM by WHZ and MUAC was 12.7 %(10.0 - 16.1 95% C.I.)), and 2.5 %(1.4 - 4.5 95% C.I.) respectively. The GAM and SAM prevalence among girls were 12.6 %(9.2 - 17.1 95% C.I.) and 3.3 % (1.5 - 7.1 95% C.I.) respectively, and 12.8 %(8.9 - 18.2 95% C.I.) and 1.8 %(0.7 - 4.8 95% C.I.)among boys respectively. The prevalence of combined GAM and SAM rates was slightly higher in girls than in boys but the difference is not statistically significant.

Table 15: Prevalence of combined GAM and SAM based on WHZ and MUAC cut off's (and/or oedema) and by sex*, March 2022

	All n = 432	Boys n = 218	Girls n = 214
Prevalence of combined GAM (WHZ <-2 and/or MUAC < 125 mm and/or oedema)	(55) 12.7 % (10.0 - 16.1 95% C.I.)	(28) 12.8 % (8.9 - 18.2 95% C.I.)	(27) 12.6 % (9.2 - 17.1 95% C.I.)
Prevalence of combined SAM (WHZ < -3 and/or MUAC < 115 mm	(11) 2.5 % (1.4 - 4.5 95%	(4) 1.8 % (0.7 - 4.8 95%	(7) 3.3 % (1.5 - 7.1 95% C.I.)

and/or oedema	C.I.)	C.I.)

*With SMART or WHO flags a missing MUAC/WHZ or not plausible WHZ value is considered as normal when the other value is available.

Table 16: Number of cases for combined GAM and SAM prevalence, March 2022

	GAM		SAM	
	no.	%	no.	%
MUAC	1	0.2	2	0.5
WHZ	44	10.2	8	1.9
Both	10	2.3	1	0.2
Edema	0	0.0	0	0.0
Total	55	12.7	11	2.5

Total population: 432

5.2.5. Prevalence of Underweight based on Weight-for-Age z-scores by sex

Underweight is defined as inadequate low weight relative to age (weight-for-age z-scores- WHO 2021) and Underweight status reflects current and past nutritional experience in the community. It is a good measure of both wasting and stunting and is quite useful in child growth monitoring. Underweight prevalence analysis included 427 children in the age group 6- 59 months.

The prevalence of underweight among 6-59 month children was 28.3 % (24.3 - 32.6 95% C.I.) and 7.7 % (5.0- 11.8 95% C.I.) of them were severely underweight. The results on the underweight status of the children are classified as **very high** according to the UNICEF 2018 thresholds classification (i.e.>15%).

The underweight and severe underweight prevalence among boys are found to be 34.0 % (28.1 – 40.4 95% C.I.) and 9.8 % (5.8 - 16.1 95% C.I.)respectively. Underweight and severe underweight among girls were 22.5 % (16.7 - 29.7 95% C.I.) and 5.6 % (3.0 - 10.4 95% C.I.) respectively. Both the underweight and severe underweight prevalence was significantly higher in boys than in girls.

Table 17: Prevalence of underweight based on weight-for-age z-scores by sex, March 2022

	All n = 428	Boys n = 215	Girls n = 213
Prevalence of underweight (<-2 z-score)	(121) 28.3 % (24.3 - 32.6 95% C.I.)	(73) 34.0 % (28.1 - 40.4 95% C.I.)	(48) 22.5 % (16.7 - 29.7 95% C.I.)
Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	(88) 20.6 % (17.1 - 24.5 95% C.I.)	(52) 24.2 % (19.6 - 29.4 95% C.I.)	(36) 16.9 % (11.6 - 23.9 95% C.I.)
Prevalence of severe underweight (<-3 z-score)	(33) 7.7 % (5.0 - 11.8 95% C.I.)	(21) 9.8 % (5.8 - 16.1 95% C.I.)	(12) 5.6 % (3.0 - 10.4 95% C.I.)

The underweight prevalence was almost uniformly distributed across the different age groups but children in the age group 18-29 and 42-53 months were more affected by severe underweight with a prevalence of 10.1% and 8.9% respectively.

Table 18: Prevalence of underweight by age, based on weight-for-age z-scores, March 2022

		Severe underweight (<-3 z-score)		Moderate underweight (>= -3 and <-2 z-score)		Normal (> = -2 z score)		Oedema	
Age (mo)	Total no.	No.	%	No.	%	No.	%	No.	%
6-17	78	5	6.4	14	17.9	59	75.6	0	0.0
18-29	119	12	10.1	26	21.8	81	68.1	0	0.0
30-41	84	3	3.6	16	19.0	65	77.4	0	0.0
42-53	101	9	8.9	17	16.8	75	74.3	0	0.0
54-59	46	4	8.7	15	32.6	27	58.7	0	0.0
Total	428	33	7.7	88	20.6	307	71.7	0	0.0

5.2.6. Prevalence of Stunting based on Height-for-Age z-scores and by Sex

Stunting is measured based on a height-for-age z-score of <-2 standard deviations below the World Health Organization (WHO) Child Growth Standards median. The analysis of stunting prevalence included 418 children (13 outlier values were excluded based on the SMART flags).

The stunting prevalence in this survey was 38.0 %(32.0 - 44.4 95% C.I.) which is classified as **very high** (≥30) according to the new UNICEF new threshold cut-offs. Stunting prevalence among males children was 42.5 % (34.9 - 50.3 95% C.I.) and the prevalence of stunting among girls was found to be 33.5 %(25.9 - 42.0 95% C.I.). The severe stunting prevalence among boys and girls was 16.0 %(10.7 - 23.4 95% C.I.) and 10.5 %(6.6 - 16.4 95% C.I.) respectively where the prevalence of severe stunting among boys seems much higher than girls, but the difference is not statistically significant (P value= 0.155).

Table 19: Prevalence of stunting based on height-for-age z-scores and by sex, March 2022

	All n = 421	Boys n = 212	Girls n = 209
Prevalence of stunting (<-2 z-score)	(160) 38.0 % (32.0 - 44.4 95% C.I.)	(90) 42.5 % (34.9 - 50.3 95% C.I.)	(70) 33.5 % (25.9 - 42.0 95% C.I.)
Prevalence of moderate stunting (<-2 z-score and >=-3 z-score)	(104) 24.7 % (20.3 - 29.8 95% C.I.)	(56) 26.4 % (20.7 - 33.1 95% C.I.)	(48) 23.0 % (17.4 - 29.7 95% C.I.)
Prevalence of severe stunting (<-3 z-score)	(56) 13.3 % (9.7 - 18.0 95% C.I.)	(34) 16.0 % (10.7 - 23.4 95% C.I.)	(22) 10.5 % (6.6 - 16.4 95% C.I.)

The age-disaggregated analysis indicated that stunting level was higher in children in the age group 18-29 months as compared to the other age groups.

Table 20: Prevalence of stunting by age based on height-for-age z-scores, March 2022

		Severe stunting (<-3 z-score)		Moderate stunting (>= -3 and <-2 z-score)		Normal (> = -2 z score)	
Age (mo)	Total no.	No.	%	No.	%	No.	%
6-17	75	6	8.0	16	21.3	53	70.7
18-29	118	27	22.9	30	25.4	61	51.7
30-41	82	9	11.0	27	32.9	46	56.1
42-53	101	10	9.9	23	22.8	68	67.3
54-59	45	4	8.9	8	17.8	33	73.3
Total	421	56	13.3	104	24.7	261	62.0

5.2.7. Mean z-scores, Design Effects, and Excluded Subjects

The mean Z scores for wasting (WHZ), underweight (WAZ), and stunting (HAZ) were 0.87±1.06, -1.47±0.98, and -1.65±1.14 respectively, which indicate the poor nutritional status of the surveyed population compared to the WHO reference population. The standard deviations for WHZ, WAZ, and HAZ were within the acceptable range of 0.8-1.2. The values of the design effect for WHZ and HAZ were 1.05 and 1.77 respectively which implies the presence of moderate inter-cluster variability and no inter-cluster variability was observed for WAZ (I.e. 1.00).

***Table 21*: Mean Z scores and Design Effects, March 2022**

Indicator	n	Mean z-scores ± SD	Design Effect (z-score < -2)	z-scores not available*	z-scores out of range
Weight-for-Height	424	-0.86±1.04	1.00	0	8
Weight-for-Age	428	-1.47±0.99	1.00	0	4
Height-for-Age	421	-1.65±1.15	1.67	0	11

* contains for WHZ and WAZ the children with edema.

5

[5] *UNICEF Prevalence threshold for Acute malnutrition, Stunning and underweight 2018 (issue 24)*

Indicator	N[6]	n[7]	%	95% C.I
Children ever breastfeed (EvBF)				
Early Initiation of Breastfeeding 0-23 Months within one hour of birth (EIBF)				
Exclusive Breastfeeding 0-5 months (EBF)				
Continued breastfeeding at 1 year (children 12–15 months)				
Continued breastfeeding at 2 years (children 20–23 months)				
Introduction of solid, semi-solid or soft foods for age				

5.3. INFANT AND YOUNG CHILD FEEDING (IYCF) PRACTICES RESULTS

Under Infant and Young Child Feeding (IYCF), practices related to exclusive breastfeeding, complementary feeding, and minimum dietary diversity were analyzed for children less than two years from the surveyed household. The analysis is based on the sampled population for anthropometric measurement. Due to low sample and methodology limits, results cannot be generalized for the overall population or district but are presented as indicative information. A total of 188 children 0-23 months old were included for the IYCF indicator.

[6] Denominator
[7] Numerator

6-8 months (ISSSF)				
Minimum Dietary Diversity for 6-23 months (MDD[8])				
Minimum Meal Frequency for aged 6-23 months ((MMF[9])				
Minimum acceptable diet 6–23 months				

The graph – below shows the percentage of children belonging to different age groups between 0-23 months. Altogether 29% (55) of the children were below 6 months of age, 17% (31) were between 6-8months of age, 11% (20) of children were between 9-11 months and 50.5% (82) were between 12-23months of age.

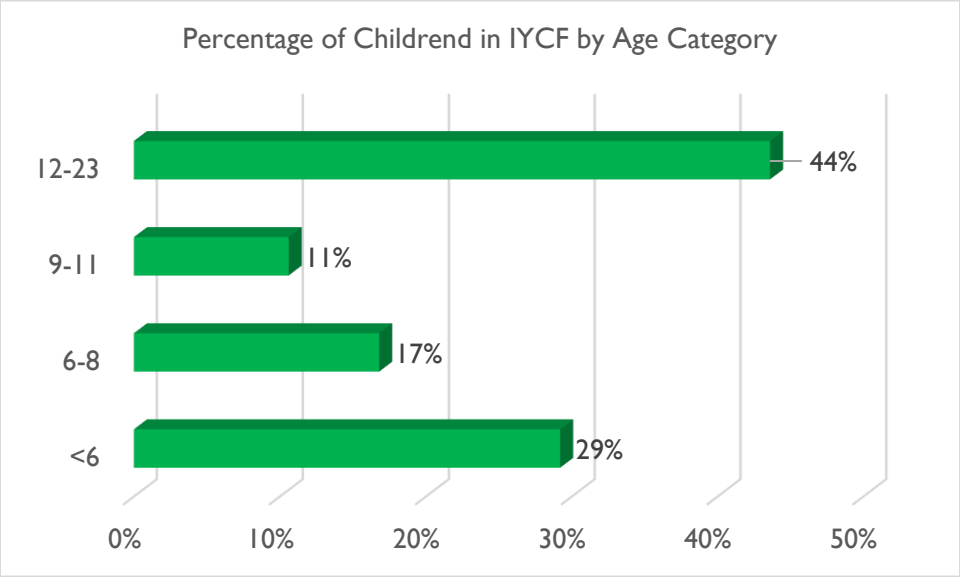

Figure 3: Percentage of children in IYCF by Age Category

5.3.1. Ever breastfed (EvBF):

Breastfeeding is recommended for all infants worldwide except, in very few cases, for those with specific medical conditions. The survey result indicates that 84.6% of children 6-23 months were reportedly having ever been breastfed in Zalingie Locality.

5.3.2. Early initiation of breastfeeding (EIBF):

In the Zalingei locality, 76.0% (70.7-82.4%) of newborns were initiated breast feeding in less than

[8] Proportion of children 6–23 months of age who receive foods from 4 or more from the seven food groups (WHO, 2010).

[9] Proportion of breastfed and non-breastfed children 6–23 months of age who receive solid, semi-solid, or soft foods (but also including milk feeds for non-breastfed children) the minimum number of times or more. For breastfed children, the minimum number of times varies with age (2 times if 6–8 months and 3 times if 9–23 months). For non-breastfed children the minimum number of times does not vary by age (4 times for all children 6–23 months) (WHO, 2010).

1-hour afterbirth while, 19.7%(14.4-25.5,95% CI) and 3.2% (1.1-5.9%) of the newborns were initiated breast feeding between 1-23 hrs and more than 24 hr respectively. As a result, the survey finding indicates that majority of the newborn are initiated breastfeeding immediately after birth.

Table 22: Initiation of breastfeeding

Initiation of breastfeeding	Frequency	Percent	95% CI	
			Lower	Upper
Between 1- 23 hours	37	19.7	14.4	25.5
Don't know	1	.5	0.0	2.1
less than 1 hour	144	76.6	70.7	82.4
More than 24 hours	6	3.2	1.1	5.9
Total	188	100.0	100.0	100.0

5.3.3. Exclusive Breast-Feeding

Out of 188 children aged less than 23 months 55 children under 6 months old (0 -5 months) had been included in the survey, of them 95%(53) were breastfed during survey execution but, 4% (2) were not currently breastfed. Out of those currently breastfed children, 75% (40) of them were solely breastfed and did not have any other foods or anything else (during the last 24 hours).

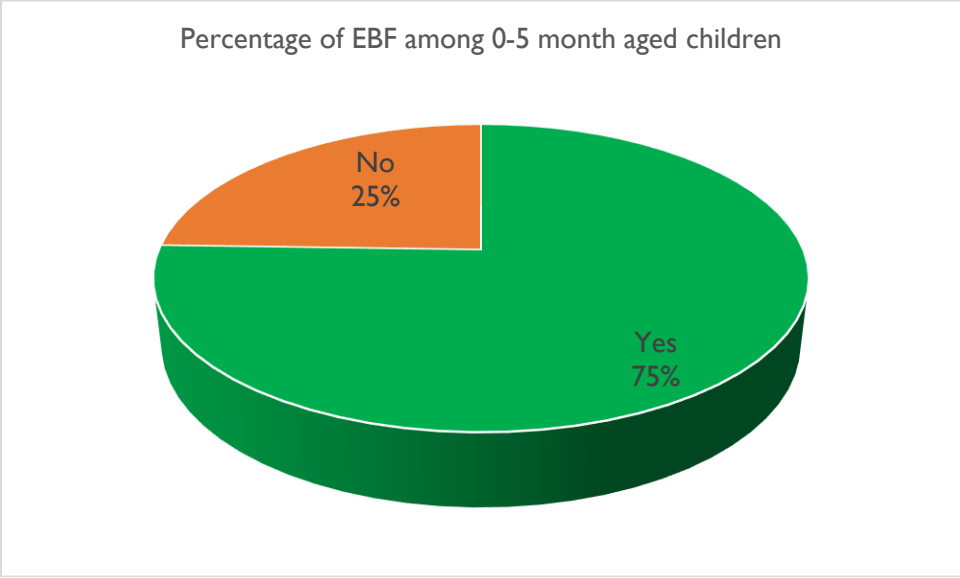

Figure 4: *Percentage of EBF among 0-5 month aged children*

5.3.4. Continued breastfeeding/Continued breastfeeding at 1 year

The proportion of children 12–15 months of age who received breast milk during the previous day. Nineteen (19) children aged between 12 – 15 months were included in this survey, and all of them

were breastfed for the past 24 hours, which means that the rate of continued breastfeeding at 1 year is 100 %(19) (table 25)

5.3.5. Continued breastfeeding/Continued breastfeeding at 2 years

The proportion of children 20–23 months of age who received breast milk during the previous day. Twenty-nine (29), children from 20 – 23 months old age were surveyed, and just 12 of them were still breastfed, which means that the continued breastfeeding at a 2-year rate is 41.4%.

Table 23: Continued breastfeeding

Continued breastfeeding	Age Group				
	6-8	9-11	12-15	16-19	20-23
No	3%(1)	0.0%(0)	4.0%(1)	27.0%(7)	58.6%(17)
Yes	97%(30)	100.0%(19)	96.0%(24)	73.0%(19)	41.4%(12)
	100.0%(31)	100.0%(19)	100.0%(25)	100.0%(26)	100.0%(29)

5.3.6. Introduction of complementary foods/Introduction of solid, semi-solid, or soft foods

The proportion of infants aged 6–8 months of age who receive solid, semi-solid, or soft foods compared with the total of Infants 6–8 months of age who expected to receive solid, semi-solid, or soft foods during the previous day.

Out of 31 children aged 6 – 8 months who were included in the survey, 16 of them had been given a solid, semi-solid or soft food during the last 24 hours, this means that the introduction of complementary foods rate is 52%.

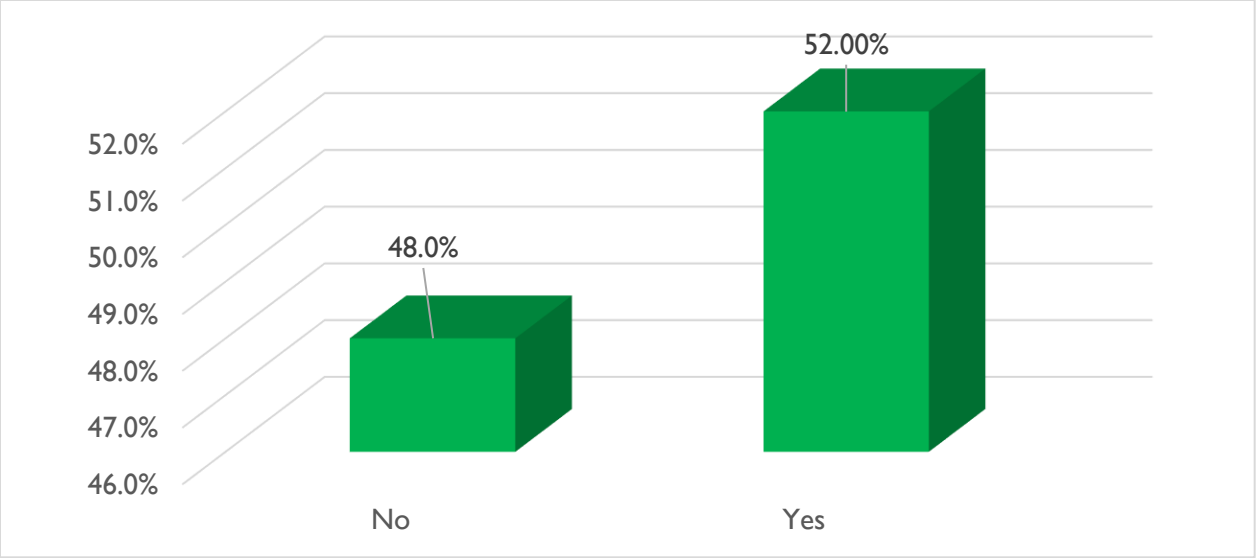

Figure 5*: Ontime introduction of complementary feeding*

5.3.7. Minimum Meal Frequency

Among those who were 6-8 months and were breastfed, 41.9% (13) were found to have met the minimum required meal frequency (>= 2 times per day) while the largest proportion 58.1% (18) were fed less than the required feeding frequency for their age.
Off those children aged 9-11 months who responded to the meal frequency question, 42.0% (8) were found to have been fed minimum required meal frequency (i.e. >= 3 times per day) while the large proportion of 58.0% (11) was being fed less than the required frequency. Similarly, in the age groups, 12-23 months 52.5% (42) were getting the adequate minimum required feeding frequency for their age.

Overall, 50.5% of the children 9-23 months old were receiving at least 3 meals per day while the remaining 49.5% of the children 6-23 months breastfed received less than 3 meals below the recommended meal frequency for their age. This suggests that infant and young child feeding practices need to be further promoted and strengthened.

Table 24: Meal frequency given to the child still breastfed and non-breastfed

Meal frequency of child breastfed	Age Category		Total
	9-11	12-23	
<3 times: (inadequate feeding frequency for 9 - 23 months)	58.0%(11)	47.5%(38)	49
>= 3 times: (Adequate feeding frequency for 9 - 23 months)	42.0%(8)	52.5%(42)	50

Total	100.0%(19)	100.0%(80)	99

5.3.8. Minimum Dietary Diversity Score

The table below shows the cross-tabulation between different age groups of children aged between 6-23 months and their dietary diversity scores. A child consuming less than 4 food groups per day (in the past 24 hours including day and night) is said to have not met the minimum dietary diversity while children consuming 4 or more food groups are assumed to have met the minimum or adequate dietary diversity score.

From the table given below (Table 26) it can be interpreted that, among those children aged 6-8 months, 9-11 months, and 12-23 months 67.7%, 70.0%, and 51.2% respectively were found to have inadequate dietary diversity scores. Overall, 6-23 month age group children 57.9% (77) of children have consumed less than 4 food groups per day (in the past 24 hours) in which they are not the minimum adequate dietary diversity score in which, the higher proportion of children experienced less diversified diet that has been contributed for the existing poor nutritional prevalence in the study locality.

Table 25: Cross-tabulation of age group and minimum dietary diversity score

Minimum Dietary Diversity	Age Category			Total
	6-8	9-11	12-23	6-23
Inadequate dietary diversity (<4 food groups consumed)	67.7%(21)	70.0%(14)	51.2%(42)	57.9%(77)
Adequate dietary diversity (>=4 food groups consumed)	32.3%(10)	30.0%(6)	48.8%(40)	42.1%(56)
Total	100.0%(31)	100.0%(20)	100.0%(82)	100.0%(133)

5.4. Maternal Nutrition

Maternal nutrition was assessed by measuring the MUAC of all pregnant and lactating women in all sampled households. Based on the survey findings, 14.5% of the pregnant and lactating women were identified as at risk for malnutrition problems. Only one case of severe malnutrition was reported among PLW across all the surveyed clusters.

Table 26: Prevalence of malnutrition among PLW, March 2022

	Frequency	Percent	95% CI	
MUAC			Lower	Upper
<23CM	15	14.2	8.5	21.7
≥23CM	91	85.8	78.3	91.5

Total	106	100.0	100.0	100.0

5.5. Mortality results

Five hundred three households were interviewed for the mortality survey to estimate the retrospective CMR and U5MR. A recall period of 93 days was used in the mortality survey and the start of the recall period was December 21st of 2021 (end of the year).

The crude death rate (CDR) was 0.38 deaths per 10,000 per day (0.18-0.79 95% C.I), with an under 5 death rate (U5DR) of 0.22 (0.03-1.70, 95% C.I) as shown in Table__24. The mortality rates are well below the global emergency thresholds of 1 and 2, respectively.

Table 27: Mortality rates, March 2022

HOUSEHOLD INFORMATION			
Total population		Children 0-59 months	
Total number of HH residents	2945	Number 0-5 years	485
The total number of people who joined HH in the recall period	67	Number 0-5yrs joined HH during the recall period	14
The total number of people who left HH in the recall period	212	Number 0-5 years left HH during the recall period	28
Total number of births during the recall period			21
Total number deaths during recall period	10	Number 0-5 years deaths during recall period	1
Crude mortality rate (deaths/10,*000*/day)	0.38 (0.18-0.79)	Under-5 mortality rate (deaths/10,000/day)	0.22 (0.03-1.70)
Design effect	1.3	Design effect	1.00

5.6. Children's Morbidity

According to the UNICEF conceptual framework on causes of malnutrition, the disease is an immediate cause of malnutrition. It also affects food intake, which is also categorized as an immediate cause. It is important therefore to assess morbidity to its effect on the nutritional status of the surveyed children.

To assess child morbidity mothers/caregivers of children aged 6 to 59 months were asked to recall whether their children have had any illness in the past 2 weeks prior to the survey. Those who gave a confirmatory answer to this question were asked a follow-up question on the type of illness that affected their children. Additionally, caregivers were also asked whether or not they sought any assistance to treat theirs. Of the 432 children, 59.3% (256) of children have had some kind of illness in the past two weeks before the survey. Only 20% of the caregivers of sick children sought assistance to treat their children.

Table 28: Prevalence of reported illness in children in the two weeks prior to interview (n=256), March 2022

	6-59 months
Prevalence of reported illness (n=256)	59.3% (54.4 -63.1 95% C.I.)

Fever (48.4%) and cough (48%) was the most reported symptom of child illnesses followed by diarrhea (14.8) and 23.4% reported different types of symptoms (e.g. like skin infection, eye infection, etc).

Table 29: Symptom breakdown in the children in the two weeks prior to the interview (n=256), March 2022

Illness	Frequency	Percent	95% Confidence Interval	
			Lower	Upper
Fever	124	48.4	42.2	54.3
Cough	123	48.0	41.8	53.5
Diarrhea	38	14.8	10.5	19.1
Other	47	18.4	13.7	23.4

Additionally, caregivers were also asked whether or not they sought any assistance to treat their children. Out of 256 children who have had some kind of illness in the past two weeks before the survey only 20.0% (51) of the caregivers of the sick child sought assistance to treat their children.

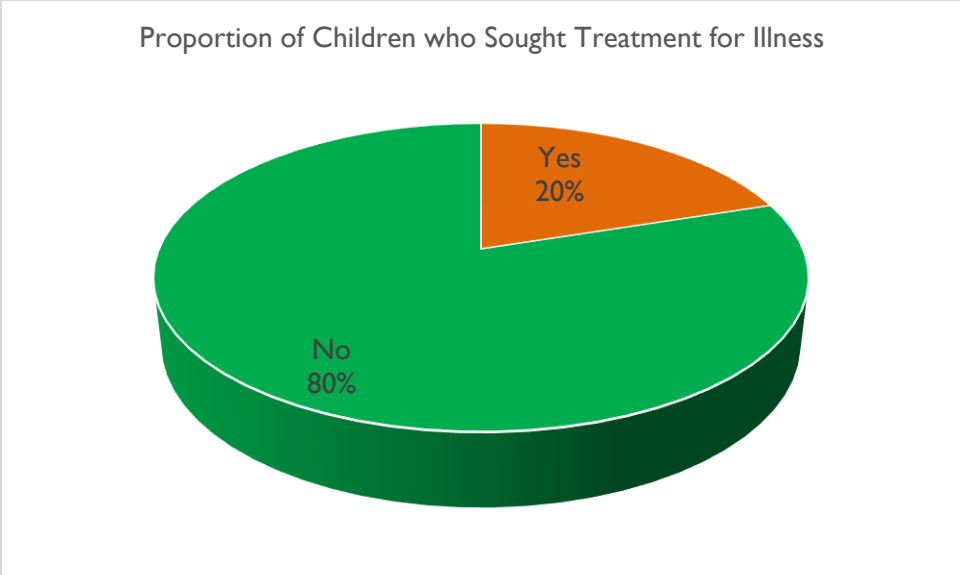

***Figure 6*: Proportion of children who sought treatment**

Of those who sought treatment, 14.5% of them were sought treatment from a government clinic/hospitals, with 3.5% seeking treatment from a pharmacy, and 2% from a private clinic of the caretaker seek treatment in traditional healer as well as provide home-based care (Figure 6)

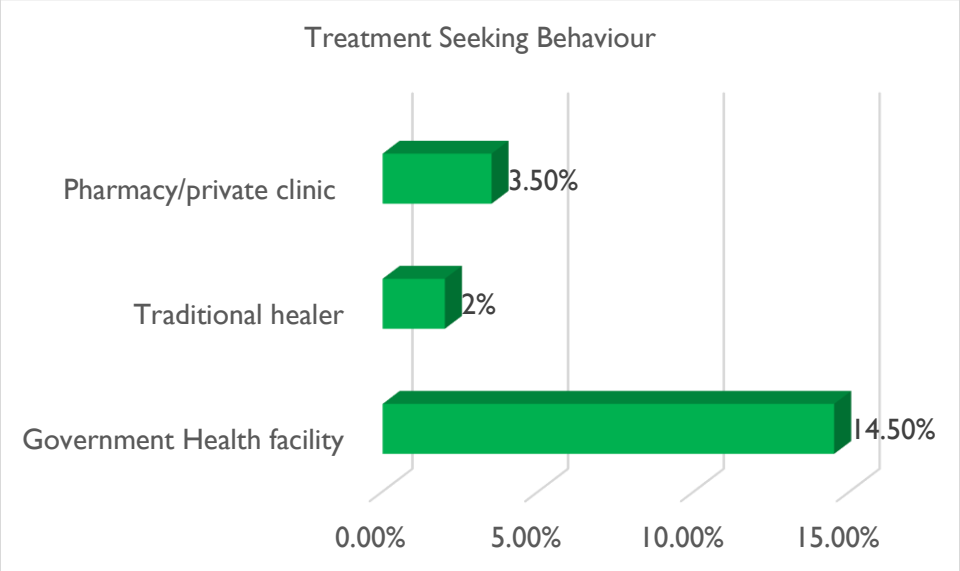

***Figure 7*: Health Seeking Behaviour of children**

5.7. Vaccination Results

The primary objective of the national EPI program is to achieve the recommended Sphere coverage (>95%) and WHO (>80%) national coverage for all vaccines/antigens. The measles vaccination of the children as confirmed by vaccination card was 40.5% and the coverage is 77.5% based on vaccination card and mother recalled. The vaccination coverage is below the Sphere and WHO standards which

indicates the poor performance of measles vaccine coverage in the survey area.

Table 29: Vaccination coverage: BCG for 6-59 months and measles for 9-59 months, March 2022

Measles	Measles (with card)=210	Measles (with card or confirmation from mother)=329
YES	40.5% (44.8-54.7 95% C.I.)	77.5% (73.3-81.6 95% C.I.)

6. DISCUSSION

The response rate in this survey was above 85%, hence the reserve clusters were not sampled for actual data collection. The nutritional status and the demographic profile of households were in line with the assumption and initial planned target of the survey. The over-sex ratio and sex/age distribution p-value are above 0.05 indicating both sex groups were equally represented in the survey and sex/age observation was well represented as compared to the normal sex/age distribution of the WHO reference population (2006). WHZ score flagged value is 1.9% with a 1.05 standard deviation which is between 0.8 and 1.2, and weight, height, and MUAC measurement data quality scores were 4, 7, and 5 respectively. The overall data quality score is 0 **this is Excellent**.

Wasting, or acute malnutrition, is a reduction or loss of body weight to height. Addressing wasting is critically important because of the heightened risk of disease and death for children who lose too much of their body weight. Recognizing that accelerated global action is needed to address the pervasive and corrosive problem of the double burden of malnutrition, in 2012 the World Health Assembly Resolution 65.6 endorsed a Comprehensive implementation plan on the maternal, infant, and young child nutrition, which specified a set of six global nutrition targets that to be achieved by 2025. The sixth target is to reduce and maintain childhood wasting to less than 5%. Globally, the wasting level is 6.7% while nationally it is 7%.

The Global Acute Malnutrition (GAM) in this survey is 12.7% (9.9-16.3 95% CI) which is considered high (10-15%) and reflects **the critical malnutrition situation** of the area based on the UNICEF 2018 malnutrition level threshold cut off. The prevalence of acute malnutrition (WHZ<-2 and/or oedema) was highest among the younger age group of children aged 54-59 months. This indicates problems with child feeding practices and the presence of a low level of IYCF practices in the area.

According to the UNICEF conceptual framework of malnutrition, drivers of malnutrition include inadequate diet, poor nutrition practices, inadequate services, and disease. As the survey finding indicated that the proportion of children, who reported ill 2 weeks before the study was 59.3% which has negatively influenced the nutritional situation of the locality. Among the children, reported ill, major illnesses included Fever/Undiagnosed malaria at 48.4%, ARIs at 48.0%, Diarrhea at 10.5%, other infections at 13.5% that are likely due to unsafe use of water, and being malaria-endemic area.

Poor health-seeking behavior of the caretaker, high prevalence of childhood illness, low immunization coverage, and low level of IYCF practice in the area coupled with deteriorated socio-economic situation, COVID-19 pandemic disease, and political instability potentially contributed to the observed high malnutrition prevalence in the Zalingie locality.

Stunting has long-term effects on individuals and societies, including diminished cognitive and physical development, reduced productive capacity and poor health, and an increased risk of degenerative diseases such as diabetes. Due to the severe and irreversible outcome of stunting, it's one of the key indicators of the sustainable development goal (SDG) as part of "ending all forms of malnutrition" by 2030, specifically reducing the prevalence of stunting by 40% (from 2012 levels).

The finding depicted that the prevalence of stunting founds to be 38.0% (32.0-44.4 95% CI) which is above the critical limit level of the UNICEF 2018 (>30%) malnutrition level threshold. The current survey finding shows that stunting was more prevalent in children in the age group18-29 month followed by children in the age group 30-41 months as compared to the other age groups. Poor maternal nutrition status and inappropriate feeding practices were among the potential root factors for the observed high stunting rate in the surveyed population. This higher stunting prevalence in the early age group raises a point to explore other multiple contributing factors such as low birth weight, poor exclusive breastfeeding, and complementary feeding practices.

The prevalence of underweight in children 6 to 59 months of age was 28.3% (24.3-32.6 95% CI) which is above the critical limit of ≥15% based on the UNICEF malnutrition level of threshold cut off. Child morbidity has been considered a significant contributing factor to the nutritional status of children.

The primary objective of the national EPI program is to achieve the recommended Sphere coverage (>95%) and WHO (>80%) national coverage for all vaccines/antigens. The measles vaccination of the children confirmed by card was 40.5% and both by card and mother recall was 77.5% which is below the Sphere as well as WHO recommended standards. Therefore, the measles vaccine coverage seems to be performing poorly and far from the national target.

The mortality findings from a 93-day recall period indicated a low level with crude death rate CDR of 0.38 (0.18-0.79)/10,000/day and under-five death rate U5DR of 0.22 (0.03-1.70)/10,000/day which is below the WHO thresholds of 1 person/10,000/days and 2 person/10,000/day for CDR and U5DR respectively.

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[10] Issued May 2021 Global Nutrition Report

7. CONCLUSION

The prevalence of global acute malnutrition (GAM) among the surveyed population using weight for height z-score was estimated at 12.7 % (9.9 - 16.3 95% C.I.) and the prevalence of severe acute malnutrition (SAM) was 2.1% (1.1- 4.1 95% CI)**.** Therefore, with this level of GAM and SAM, the nutrition situation of the district is considered **"High "**, based on the UNICEF malnutrition level of classification. While CDR of 0.38 (0.18-0.79)/10,000/day and under-five death rate U5DR of 0.22 (0.03-1.70)/10,000/day which is below the WHO threshold of 1 person/10,000/days and 2 person/10,000/day for CDR and U5DR respectively which is within the expected rate.

8. RECOMMENDATION

I. Continue implementing the ongoing CMAM program to treat and prevent acute malnutrition among vulnerable children. Taking into account the high rate of MAM cases noted by the survey, consider expanding the TSFP program and distribution sites to reach far to communities and helps to improve community-based case detection, referral, and access to service.

II. Considering that a number of malnourished children were referred to health facilities and nutrition centers for treatment, there is a need to scale up a community-level screening in order to detect all malnourished cases that need to be enrolled in treatment programs. This can be achieved through regular training and providing incentives to community nutrition volunteers.

III. Increase the capacity of community health workers to identify and refer malnutrition cases to the treatment centers.

IV. According to survey findings, proportionally boys were more affected by both acute and chronic malnutrition compared to girls. There is a need to conduct a Nutrition Causal Analysis (NCA) study to understand why boys tend to be more malnourished in the County and also identify the predominant causes of malnutrition to be prioritized for intervention.

V. Survey results have shown that chronic malnutrition is a burden for the locality. Therefore, more efforts are needed for stunting prevention through various multi-sectoral interventions. Good to start in community engagement and strengthen community networking through, community figures/ influential persons (religious leaders), community health volunteers, Women group/Mother to mother support group, father to a father support group, and school youth club, should consider intensifying health and nutrition education activities on ways of diversifying the household diet, good IYCF practices, improving household hygiene and

sanitation practices, improving health-seeking behaviors as well as sensitizing the community on the domestic treatment of drinking water.

VI. Investment in public health and education programs to promote a healthy diet for mothers and children and the healthy start of complementary feeding. This can be done through the 1000 days IYCF campaign

VII.

VIII. The survey finding shows that 59.3% of children (6-59) months reported being ill. Prevalence of fever/malaria and ARI/cough and diarrhea were the main reported illnesses across the cluster. In additional only 20% of the children who reported ill, and their caregivers sought treatment. Need to improve and encourage prompt health-seeking behavior in the event of an illness.

IX. The survey finding indicated that around 77% of the children are getting Meals the vacation of which 44.5% are conformed by EPI card that is below the sphere recommended standard. Hence, we need to improve immunization coverage and documentation of immunized children.

9. REFERENCES

1. Sudan IPC Acute Food Security Analysis April 2021 – February 2022.
2. Simple Spatial Survey Method (S3M-II), 2018
3. *SMART Survey Methodology guiding note 2017.*
4. fao_guidelines_for_measuring_dietary_diversity_2010_october
5. *UNICEF Prevalence threshold for Acute malnutrition, Stunning and underweight 2018 (issue 24)*
6. Issued May 2021 Global Nutrition Report

10. APPENDICIES

10.1. Appendix 1:- Plausibility check for: ZLG-2022-AAH-Suanda-CD.as

Overall data quality

Criteria	Flags*	Unit	Excel.	Good	Accept	Problematic	**Score**
Flagged data (% of out of range subjects)	Incl	%	0-2.5 0	>2.5-5.0 5	>5.0-7.5 10	>7.5 20	**0** (1.9 %)
Overall Sex ratio (Significant chi square)	Incl	p	>0.1 0	>0.05 2	>0.001 4	<=0.001 10	**0** (p=0.847)
Age ratio(6-29 vs 30-59) (Significant chi square)	Incl	p	>0.1 0	>0.05 2	>0.001 4	<=0.001 10	**0** (p=0.808)
Dig pref score - weight	Incl	#	0-7 0	8-12 2	13-20 4	> 20 10	**0** (4)
Dig pref score - height	Incl	#	0-7 0	8-12 2	13-20 4	> 20 10	**0** (7)
Dig pref score - MUAC	Incl	#	0-7 0	8-12 2	13-20 4	> 20 10	**0** (5)
Standard Dev WHZ	Excl	SD	<1.1	<1.15	<1.20	>=1.20	

```
.                                    and   and      and       or
.                        Excl   SD  >0.9  >0.85    >0.80     <=0.80
                                     0     5        10        20        0 (1.04)

Skewness  WHZ            Excl   #   <±0.2 <±0.4    <±0.6     >=±0.6
                                     0     1        3         5         0 (0.06)

Kurtosis  WHZ            Excl   #   <±0.2 <±0.4    <±0.6     >=±0.6
                                     0     1        3         5         0 (-0.19)

Poisson dist WHZ-2       Excl   p   >0.05 >0.01    >0.001    <=0.001
                                     0     1        3         5         0 (p=0.273)

OVERALL SCORE WHZ =                  0-9   10-14    15-24     >25       0 %
```

The overall score of this survey is 0 %, this is excellent.

10.2. Appendix 2:- Assignment of Cluster

Geographical unit	Population siz	Cluster
Kanjomia	9659	1
Garb Almustasfa	4757	2
Khamsa dagaig Camp	13720	3,4
Ishlag Shorta	1102	5
Almohafzin	4844	RC
Alistad	12559	6
Altaif	899	7
Hasahisa	27236	8,9,10
Square 5 Hamidiya camp	4612	11
Square 6 Hamidiya Camp	11370	RC
quare 3 Camp Hamidiya	4844	12
quare 1 Hamidiya Camp	9340	13
quare 2 Camp Hamidiya	12211	14,RC
Algezair	13807	15,16
Doha district	3133	17
Alsalam Camp	8847	18
Al-Hassahisa Square 1	6439	19
Hassahisa square 7	3568	20
Al-Hassahisa square 3	2843	21
Al-Hassahisa square 6	5482	RC
Abata Sri Meri district	1624	22
Furqan Ahmed Algali	1624	23
Abu Dumo	1015	24
Hella Aldoum	1131	25
Safrra	957	26
Damret Ali Ajeli	1595	27
Damret Alfaroq	1450	28
D. Regl Alnaam	1363	29
Furgan alskeikh Alnadee	2378	30
Traj Shamal	1305	31
Alreyad	1131	32
Abdulla Mukhtar	1740	33
Arkoum Shemal	1479	34
Damret Koki	899	35
Kubri Azoum	1276	36
Kulkulya	1711	37
Arra	1276	38
Balda	1537	39

10.3. Appendix 3 :- Evaluation of Enumerator

Standardisation test results					Precision				Accuracy		OUTCOME			
Weight		subjects	mean	SD	max	Technical	TEM/mea	Coef of re	Bias from	Bias from median			From	From
		#	kg	kg	kg	TEM (kg)	TEM (%)	R (%)	Bias (kg)	Bias (kg)			Supervisor	Median
	Supervisor	10	13.2	2.3	0.4	0.18	1.3	99.4	0	0.13	TEM poor	R value go	Bias good	Bias poor
	Enumerator 1	10	13.2	2.3	0.4	0.16	1.2	99.5	0.08	0.15	TEM poor	R value go	Bias acceptable	Bias poor
	Enumerator 2	10	13.2	2.3	0.5	0.21	1.6	99.2	0.07	0.16	TEM rejec	R value go	Bias acceptable	Bias poor
	Enumerator 3	10	13.1	2.3	1.3	0.35	2.6	97.7	0.15	0.2	TEM rejec	R value ac	Bias poor	Bias poor
	Enumerator 4	10	13.1	2.3	0.8	0.25	1.9	98.9	0.09	0.15	TEM rejec	R value ac	Bias acceptable	Bias poor
	Enumerator 5	10	13.1	2.3	0.7	0.2	1.5	99.2	0.08	0.12	TEM poor	R value go	Bias acceptable	Bias poor
	Enumerator 6	10	13.3	2.3	2.5	0.59	4.4	93.4	0.15	0.26	TEM rejec	R value po	Bias poor	Bias reject
	enum inter 1st	6x10	13.1	2.2	-	0.36	2.8	97.4	-	-	TEM rejec	R value acceptable		
	enum inter 2nd	6x10	13.2	2.3	-	0.21	1.6	99.2	-	-	TEM accep	R value good		
	inter enum + sup	7x10	13.2	2.3	-	0.26	2	98.6	-	-	TEM rejec	R value acceptable		
	TOTAL intra+inter	6x10	-	-	-	0.44	3.3	96.2	-	-	TEM rejec	R value acceptable		
	TOTAL+ sup	7x10	-	-	-	0.41	3.1	96.7	-	-	TEM rejec	R value acceptable		
Height		subjects	mean	SD	max	Technical	TEM/mea	Coef of re	Bias from	Bias from median			From	From
		#	cm	cm	cm	TEM (cm)	TEM (%)	R (%)	Bias (cm)	Bias (cm)			Supervisor	Median
	Supervisor	10	95.8	10	1	0.37	0.4	99.9	0	0.27	TEM good	R value go	Bias good	Bias good
	Enumerator 1	10	95.6	9.9	1.4	0.54	0.6	99.7	0.3	0.35	TEM accep	R value go	Bias good	Bias good
	Enumerator 2	10	95.5	9.9	1.3	0.44	0.5	99.8	0.38	0.34	TEM accep	R value go	Bias good	Bias good
	Enumerator 3	10	95.7	10	1.6	0.47	0.5	99.8	0.31	0.23	TEM accep	R value go	Bias good	Bias good
	Enumerator 4	10	96.1	10	4	0.92	1	99.2	0.47	0.69	TEM poor	R value go	Bias acceptable	Bias accep
	Enumerator 5	10	96	9.9	1.1	0.46	0.5	99.8	0.39	0.59	TEM accep	R value go	Bias good	Bias accep
	Enumerator 6	10	95.8	10	1.6	0.49	0.5	99.8	0.24	0.35	TEM accep	R value go	Bias good	Bias good
	enum inter 1st	6x10	96	9.9	-	0.68	0.7	99.5	-	-	TEM accep	R value good		
	enum inter 2nd	6x10	95.6	9.6	-	0.45	0.5	99.8	-	-	TEM good	R value good		
	inter enum + sup	7x10	95.8	9.7	-	0.52	0.5	99.7	-	-	TEM accep	R value good		
	TOTAL intra+inter	6x10	-	-	-	0.82	0.9	99.3	-	-	TEM accep	R value good		
	TOTAL+ sup	7x10	-	-	-	0.76	0.8	99.4	-	-	TEM accep	R value good		
MUAC		subjects	mean	SD	max	Technical	TEM/mea	Coef of re	Bias from	Bias from median			From	From
		#	mm	mm	mm	TEM (mm)	TEM (%)	R (%)	Bias (mm)	Bias (mm)			Supervisor	Median
	Supervisor	10	145.1	12	6.4	1.72	1.2	97.9	0	1.11	TEM good	R value ac	Bias good	Bias accep
	Enumerator 1	10	146.7	11.8	7	1.95	1.3	97.3	2.03	2.26	TEM good	R value ac	Bias poor	Bias poor
	Enumerator 2	10	145.4	11.6	4	1.38	0.9	98.6	0.97	1.08	TEM good	R value ac	Bias good	Bias accep
	Enumerator 3	10	146.4	11.8	3	1.32	0.9	98.7	1.39	1.91	TEM good	R value ac	Bias acceptable	Bias accep
	Enumerator 4	10	145.4	11.5	7	2.13	1.5	96.6	1.14	1.39	TEM accep	R value ac	Bias acceptable	Bias accep
	Enumerator 5	10	144.8	13.4	17	4.59	3.2	88.3	1.18	1.99	TEM rejec	R value re	Bias acceptable	Bias accep
	Enumerator 6	10	141.8	13.2	19	4.6	3.2	87.8	3.43	3	TEM rejec	R value re	Bias reject	Bias poor
	enum inter 1st	6x10	144.4	12.5	-	3.58	2.5	91.8	-	-	TEM rejec	R value poor		
	enum inter 2nd	6x10	145.8	11.7	-	2.27	1.6	96.2	-	-	TEM accep	R value acceptable		
	inter enum + sup	7x10	145.1	12	-	2.67	1.8	95	-	-	TEM accep	R value acceptable		
	TOTAL intra+inter	6x10	-	-	-	4.25	2.9	87.6	-	-	TEM rejec	R value reject		
	TOTAL+ sup	7x10	-	-	-	3.96	2.7	89.2	-	-	TEM rejec	R value reject		
Suggested cut-off points for acceptability of measurements														
Parameter		MUAC mn	Weight Kg	Height cm										
individual	good	<2.0	<0.04	<0.4										
TEM	acceptable	<2.7	<0.10	<0.6										
(intra)	poor	<3.3	<0.21	<1.0										
	reject	>3.3	>0.21	>1.0										
Team TEM	good	<2.0	<0.10	<0.5										
(intra+inte	acceptable	<2.7	<0.21	<1.0										
and Total	poor	<3.3	<0.24	<1.5										
	reject	>3.3	>0.24	>1.5										
R value	good	>99	>99	>99										
	acceptable	>95	>95	>95										
	poor	>90	>90	>90										
	reject	<90	<90	<90										
Bias	good	<1	<0.04	<0.4										
	acceptable	<2	<0.10	<0.8										
	poor	<3	<0.21	<1.4										
	reject	>3	>0.21	>1.4										

10.4. Appendix 4:- Result Tables for NCHS growth reference 1977

Table 3.2: Prevalence of acute malnutrition based on weight-for-height z-scores (and/or oedema) and by sex

	All n = 429	**Boys** n = 217	**Girls** n = 212
Prevalence of global malnutrition **(<-2 z-score and/or oedema)**	(60) 14.0 % (10.8 - 17.9 95% C.I.)	(28) 12.9 % (8.5 - 19.1 95% C.I.)	(32) 15.1 % (11.2 - 20.0 95% C.I.)
Prevalence of moderate malnutrition **(<-2 z-score and >=-3 z-score, no oedema)**	(54) 12.6 % (9.5 - 16.5 95% C.I.)	(24) 11.1 % (7.1 - 16.8 95% C.I.)	(30) 14.2 % (10.3 - 19.1 95% C.I.)
Prevalence of severe malnutrition **(<-3 z-score and/or oedema)**	(6) 1.4 % (0.6 - 3.0 95% C.I.)	(4) 1.8 % (0.7 - 4.7 95% C.I.)	(2) 0.9 % (0.2 - 3.8 95% C.I.)

The prevalence of oedema is 0.0 %

Table 3.3: Prevalence of acute malnutrition by age, based on weight-for-height z-scores and/or oedema

		Severe wasting (<-3 z-score)		Moderate wasting (>= -3 and <-2 z-score)		Normal (> = -2 z score)		Oedema	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	81	3	3.7	16	19.8	62	76.5	0	0.0
18-29	117	1	0.9	10	8.5	106	90.6	0	0.0
30-41	84	0	0.0	7	8.3	77	91.7	0	0.0
42-53	101	0	0.0	10	9.9	91	90.1	0	0.0
54-59	46	2	4.3	11	23.9	33	71.7	0	0.0
Total	429	6	1.4	54	12.6	369	86.0	0	0.0

Table 3.4: Distribution of acute malnutrition and oedema based on weight-for-height z-scores

	<-3 z-score	**>=-3 z-score**
Oedema present	Marasmic kwashiorkor. 0 (0.0 %)	Kwashiorkor. 0 (0.0 %)

Oedema absent	Marasmic No. 6 (1.4 %)	Not severely malnourished. 426 (98.6 %)

Table 3.5: Prevalence of acute malnutrition based on MUAC cut off's (and/or oedema) and by sex

	All n = 432	**Boys** n = 218	**Girls** n = 214
Prevalence of global malnutrition **(< 125 mm and/or oedema)**	(11) 2.5 % (1.5 - 4.2 95% C.I.)	(4) 1.8 % (0.7 - 4.8 95% C.I.)	(7) 3.3 % (1.7 - 6.3 95% C.I.)
Prevalence of moderate malnutrition **(< 125 mm and >= 115 mm, no oedema)**	(8) 1.9 % (1.0 - 3.4 95% C.I.)	(4) 1.8 % (0.7 - 4.8 95% C.I.)	(4) 1.9 % (0.7 - 4.7 95% C.I.)
Prevalence of severe malnutrition **(< 115 mm and/or oedema)**	(3) 0.7 % (0.2 - 2.1 95% C.I.)	(0) 0.0 % (0.0 - 0.0 95% C.I.)	(3) 1.4 % (0.4 - 4.3 95% C.I.)

Table 3.6: Prevalence of acute malnutrition by age, based on MUAC cut off's and/or oedema

	Severe wasting **(< 115 mm)**	**Moderate wasting** **(>= 115 mm**	**Normal** **(> = 125 mm)**	**Oedema**

				and < 125 mm)					
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	81	3	3.7	6	7.4	72	88.9	0	0.0
18-29	120	0	0.0	2	1.7	118	98.3	0	0.0
30-41	84	0	0.0	0	0.0	84	100.0	0	0.0
42-53	101	0	0.0	0	0.0	101	100.0	0	0.0
54-59	46	0	0.0	0	0.0	46	100.0	0	0.0
Total	432	3	0.7	8	1.9	421	97.5	0	0.0

Table 3.7: Prevalence of combined GAM and SAM based on WHZ and MUAC cut off's (and/or oedema) and by sex*

	All n = 432	**Boys** n **=** 218	**Girls** n **=** 214
Prevalence of combined GAM (WHZ <-2 and/or MUAC < 125 mm and/or oedema)	(61) 14.1 % (11.0 - 17.9 95% C.I.)	(29) 13.3 % (9.0 - 19.3 95% C.I.)	(32) 15.0 % (11.1 - 19.8 95% C.I.)
Prevalence of combined SAM (WHZ < -3 and/or MUAC < 115	(8) 1.9 % (1.0 - 3.5 95%	(4) 1.8 % (0.7 - 4.7 95%	(4) 1.9 % (0.7 - 4.8 95%

mm and/or oedema	C.I.)	C.I.)	C.I.)

*With SMART or WHO flags a missing MUAC/WHZ or not plausible WHZ value is considered as normal when the other value is available

3.8: Detailed numbers for combined GAM and SAM

	GAM		SAM	
	no.	**%**	**no.**	**%**
MUAC	1	0.2	2	0.5
WHZ	50	11.6	5	1.2
Both	10	2.3	1	0.2
Edema	0	0.0	0	0.0
Total	61	14.1	8	1.9

Total population: 432

Table 3.5: Prevalence of acute malnutrition based on the percentage of the median and/or oedema

	n = 429
Prevalence of global acute malnutrition **(<80% and/or oedema)**	(36) 8.4 % (6.2 - 11.3 95% C.I.)
Prevalence of moderate acute malnutrition **(<80% and >= 70%, no oedema)**	(34) 7.9 % (5.7 - 10.9 95% C.I.)

Prevalence of severe acute malnutrition **(<70% and/or oedema)**	(2) 0.5 % (0.1 - 1.9 95% C.I.)

Table 3.9: Prevalence of malnutrition by age, based on weight-for-height percentage of the median and oedema

		Severe wasting **(<70% median)**		**Moderate wasting** **(>=70% and <80% median)**		**Normal** **(> =80% median)**		**Oedema**	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	81	1	1.2	11	13.6	69	85.2	0	0.0
18-29	117	1	0.9	5	4.3	111	94.9	0	0.0
30-41	84	0	0.0	4	4.8	80	95.2	0	0.0
42-53	101	0	0.0	6	5.9	95	94.1	0	0.0
54-59	46	0	0.0	8	17.4	38	82.6	0	0.0
Total	429	2	0.5	34	7.9	393	91.6	0	0.0

Table 3.9: Prevalence of underweight based on weight-for-age z-scores by sex

	All n = 430	**Boys** n = 216	**Girls** n = 214
Prevalence of underweight **(<-2 z-score)**	(165) 38.4 % (33.6 - 43.4 95% C.I.)	(88) 40.7 % (34.2 - 47.6 95% C.I.)	(77) 36.0 % (28.7 - 44.0 95% C.I.)
Prevalence of moderate underweight **(<-2 z-score and >=-3 z-score)**	(132) 30.7 % (26.8 - 34.9 95% C.I.)	(70) 32.4 % (27.5 - 37.7 95% C.I.)	(62) 29.0 % (22.6 - 36.3 95% C.I.)
Prevalence of severe underweight **(<-3 z-score)**	(33) 7.7 % (5.3 - 11.0 95% C.I.)	(18) 8.3 % (5.3 - 13.0 95% C.I.)	(15) 7.0 % (3.9 - 12.3 95% C.I.)

Table 3.10: Prevalence of underweight by age, based on weight-for-age z-scores

	Severe underweight	**Moderate underweight** **(>= -3 and <-2**	**Normal** **(> = -2 z score)**	**Oedema**

		(<-3 z-score)		z-score)					
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	80	8	10.0	20	25.0	52	65.0	0	0.0
18-29	119	14	11.8	40	33.6	65	54.6	0	0.0
30-41	84	1	1.2	29	34.5	54	64.3	0	0.0
42-53	101	6	5.9	26	25.7	69	68.3	0	0.0
54-59	46	4	8.7	17	37.0	25	54.3	0	0.0
Total	430	33	7.7	132	30.7	265	61.6	0	0.0

Table 3.11: Prevalence of stunting based on height-for-age z-scores and by sex

	All n = 425	**Boys** n = 215	**Girls** n = 210
Prevalence of stunting **(<-2 z-score)**	(135) 31.8 % (26.1 - 38.0 95% C.I.)	(74) 34.4 % (27.5 - 42.0 95% C.I.)	(61) 29.0 % (22.2 - 36.9 95% C.I.)
Prevalence of moderate stunting **(<-2 z-score and >=-3 z-score)**	(100) 23.5 % (18.8 - 29.1 95% C.I.)	(55) 25.6 % (19.7 - 32.5 95% C.I.)	(45) 21.4 % (15.8 - 28.4 95% C.I.)
Prevalence of severe stunting **(<-3 z-score)**	(35) 8.2 % (5.8 - 11.7 95% C.I.)	(19) 8.8 % (5.5 - 13.9 95% C.I.)	(16) 7.6 % (4.3 - 13.1 95% C.I.)

Table 3.12: Prevalence of stunting by age based on height-for-age z-scores

		Severe stunting (<-3 z-score)		**Moderate stunting (>= -3 and <-2 z-score)**		**Normal (> = -2 z score)**	
Age	**Total**	**No.**	**%**	**No.**	**%**	**No.**	**%**

(mo)	no.						
6-17	80	5	6.3	17	21.3	58	72.5
18-29	119	17	14.3	33	27.7	69	58.0
30-41	82	3	3.7	23	28.0	56	68.3
42-53	100	7	7.0	19	19.0	74	74.0
54-59	44	3	6.8	8	18.2	33	75.0
Total	425	35	8.2	100	23.5	290	68.2

Table 3.13: Prevalence of overweight based on weight for height cut off's and by sex (no oedema)

	All n = 429	**Boys** n = 217	**Girls** n = 212
Prevalence of overweight (WHZ > 2)	(0) 0.0 % (0.0 - 0.0 95% C.I.)	(0) 0.0 % (0.0 - 0.0 95% C.I.)	(0) 0.0 % (0.0 - 0.0 95% C.I.)
Prevalence of severe overweight (WHZ > 3)	(0) 0.0 % (0.0 - 0.0 95% C.I.)	(0) 0.0 % (0.0 - 0.0 95% C.I.)	(0) 0.0 % (0.0 - 0.0 95% C.I.)

Table 3.14: Prevalence of overweight by age, based on weight for height (no oedema)

		Overweight (WHZ > 2)		Severe Overweight (WHZ > 3)	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**
6-17	81	0	0.0	0	0.0
18-29	117	0	0.0	0	0.0
30-41	84	0	0.0	0	0.0
42-53	101	0	0.0	0	0.0
54-59	46	0	0.0	0	0.0
Total	429	0	0.0	0	0.0

Table 3.15: Mean z-scores, Design Effects and excluded subjects

Indicator	n	Mean z-scores ± SD	Design Effect (z-score < -2)	z-scores not available*	z-scores out of range
Weight-for-Height	429	-1.06±0.91	1.06	0	3

Weight-for-Age	430	-1.68±0.94	1.08	0	2
Height-for-Age	425	-1.42±1.12	1.69	0	7

* contains for WHZ and WAZ the children with edema.

10.5. Appendix 5 Anthropometric Questionnaries

ANTHROPOMETRIC & HEALTH QUESTIONNAIRE

(To be conducted in EVERY HH with children 6-59 months from the random starting point onwards)

Date (D/M/Y): ……/……/…….. Cluster No: …… Team No: ……… State: ……..

Locality: …… Village: ……..

1.	1.2	1.3	4.	5.	6.	1.7	8.	9.	1.10	1.11	1.12	1.13	14.
Child no.	HH no. (number in order of visit)	Sex --- m = male f = female	Age in months (use calendar of events)	Weight in Kg To nearest 0.1kg	Height in CM.	Oedema --- n = No y = Yes	MUAC in mm **To nearest 0.1cm**	BCG scar 0= No 1= Yes	Measles Vaccine (9-59 months) --- 0 = No 1 = Yes with EPI card 2 = Yes recall	Illness in past 2 weeks? --- 0 = No 1 = Yes If no, skip questions (1.12,1.13) and go to 1.14	Type of Illness only if 1.10 is Yes --- 1 = Fever* 2 = Cough** 3 = Diarrhoea** 4 = Skin Infections 5 = Eye infections 96 = Other	Treatment sought only if 1.11 is Yes --- 0 = None sought 1 = Hospital 2 = PHCC/PHCU 3 = Mobile /outreach clinic 4 = CBD 5 = Private clinic	Maternal MUAC PLWs (Pregnant and Lactating Mothers) MUAC in mm (ex
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													

10.6. Appendix 6 Mortality Questionnaries

DEMOGRAPHY & MORTALITY QUESTIONNAIRE

DATE OF INTERVIEW: [ ][ ]/[ ][ ]/ [ ][ ]

COUNTRY:	**STATE:**	**VILLAGE:**
NAME OF INTERVIEWER:		
CLUSTER NO. [ ][ ]	**TEAM NO.** [ ][ ]	**HOUSEHOLD[11] NO.** [ ][ ]

01	02	03	04	05	06	07	08	09	10
No.	Name	Sex (M/F)	Age (years)	Joined on or after:	Left on or after:	Born on or after:	Died on or after:	Cause of death (optional)	Location of death (optional)
				_____21th of Dec, 2021_____ (Start date of the recall period - ex. Jan. 1, 1900)					
				WRITE 'Y' for YES. Leave BLANK if NO.					
a) List all the household members that are **currently living** in this household.									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
b) List all the household members that have **left this household** (out migrants) **since the start** of the recall period.									
1					Y				
2					Y				
3					Y				
4					Y				
5					Y				
c) List all the household members who **died** since the start of the recall period.									
1							Y		
2							Y		
3							Y		
4							Y		
5							Y		

Was anyone in the household pregnant at the start of the recall period? No [ ] Yes [ ] If yes, how many? _____

10.7. Appendix 7:- Cluster Control from

Region: _____ Woreda: _____ Village: _____ Cluster #: _____ Team number: _____

Date of sampling/data collection: _____ / _____ / _____(DD/MM/YY)

*If household or eligible child are absent, team should re-visit the household once before leaving the village to conduct the interview and/or measure the child.

HH **no**	Head of HH name	First Visit Outcome 1 = completed 2 = part completed 3 = refused 4 = absent*	Number of eligible children	Number of eligible children measured	Household needs to be revisited Yes or No	Household revisited Yes or No	Second Visit Outcome (If necessary) 1 = completed 2 = part completed 3 = refused 4 = absent	Comments
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								