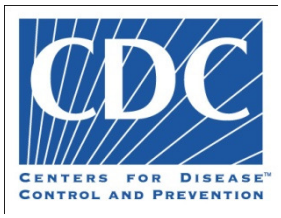
Malawi Government

# A REPORT FOR THE NATIONAL MICRONUTRIENT SURVEY

# 2009



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# Executive Summary

This report summarizes the findings of the Malawi Micronutrient Survey conducted in the Malawi households from 7th July to 6th August 2009. The collaborating partners included the Department of Nutrition, HIV and AIDS in the Office of President and Cabinet (DHNA-OPC), Ministry of Health (MOH), the National Statistics Office (NSO), the United Nations Children's Fund (UNICEF), and the U.S. Centers for Disease Control and Prevention (CDC). Funding was provided by the Irish Aid and UNICEF. The survey collected data on vitamin A, iodine, iron, and anaemia status of the population, assessed overall nutritional status of target groups based on anthropometric indices, and provided other relevant information for the planning, implementation and monitoring of appropriate population based interventions to prevent vitamin and mineral deficiencies in Malawi. Population groups surveyed included: under five children (6-59 months old), school-aged children (6-12 years old), women of childbearing age (15-49 years old), and adult men (20-55 years old).

**Survey objectives**

The objectives of the survey were:

- To determine the prevalence of vitamin A, iodine and iron deficiencies, and anaemia, using biochemical and hematological indicators.
- To assess nutritional status based on anthropometric indicators.
- To determine the proportion of households using iodised salt meeting national recommendations.
- To estimate coverage of micronutrient interventions and programmes including vitamin A and iron-folate supplementation and de-worming among select population groups.
- To document knowledge, behaviours and practices related to the consumption of salt and centrally-processed cooking oil, maize flour, wheat flour and complementary foods so as to guide programs to fortify these food vehicles with appropriate vitamins and minerals.

**Methodology**

The 2009 National Micronutrient Survey was composed of integrated tools used to assess the micronutrient status of the population. Data collection included anthropometric measurements, haematological and biochemical assessments, salt sample analysis and questionnaires that included a general Knowledge, Attitude, and Practice (KAP) survey and the Fortification Rapid Assessment Tool (FRAT).

The survey, conducted in 26 of the 28 districts, was cross-sectional and employed a two-stage cluster sampling design combining geographical stratification by region (North, Centre, and South). In each stratum (region) 40 Enumeration Areas (clusters) were randomly selected using probability proportional to population size (PPS). Fifteen households were selected from each EA using systematic random sampling giving 600 households per strata and a total of 1800 households in the three strata for interviews and sample collection. Survey participants were identi-

fied at the selected household by the interviewers on arrival at a selected cluster. A written or thumb print consent to carry on the interview and sample collection were requested. The head of each selected household was interviewed irrespective of gender.

**Summary of Results**

**Growth status**

Over a third (48.8%) of the under five children were stunted (HAZ<-2SD) with (17.9%) being severely stunted (HAZ <-3SD), 12.1% of the under five children were underweight (WAZ<-2SD) and 3.6% were severely underweight (WAZ<-3SD). Only 1.8% of the under five children were wasted (WHZ <-2SD), 0.3% were severely wasted (WHZ<-3SD), 4.9% were overweight (WHZ>2SD) and 0.5% were obese (WHZ>3SD). There were only 1.7% of school-aged children who were thin (BAZ<-2SD), 0.2% who were severely thin (BAZ<-3SD) and 0.8% who were obese (BAZ>2SD). The prevalence of stunting (HAZ<-2 SD) was 31.0% and the prevalence of severe stunting (HAZ<-3SD) was 8.8%. There were few school-aged children who had HAZ>2 (1.7%) and HAZ>3 (0.7%). The prevalence of underweight (WAZ<-2 SD) was 14.4% and the prevalence of severe underweight (WAZ<-3SD) was 3.8%. There were very few children who had WAZ>2 (0.4%) and WAZ>3 (0.08%). A majority of non-pregnant women of childbearing age (79.8%) had a normal body mass index (18.5-24.9 kg/$m^2$), 5.2% were underweight (<18.5 kg/$m^{2)}$ and 2.5% were obese (>30.0 kg/$m^2$).

**Morbidity**

Many households reported having heard of mosquito bed nets (97.3%), of these 75.3% reported using mosquito bed nets in their homes. In households that reported using bed nets, 61.6% of the fathers, 77.4% of the mothers and 54.2% of the children under the age of 5, sleep under a mosquito bed net. All of the households with mosquito bed nets had treated them with insecticide in the previous 12 months. Malaria parasitemia was highly prevalent in under five children (21.9%) and school-aged children (17.5%) compared with pregnant women (5.1%), non-pregnant women (5.1%) and men (5.4%). The prevalence of intestinal parasites in school-aged children was as follows: 1.5% had hookworm, 1.3% had *Schistosoma mansoni* and none had tapeworm infection. Knowledge of intestinal worms was not very high, only 47.7% of the school-aged children had heard about intestinal worms. The prevalence of *Schistosoma haematobium* infection in school-aged children was 18.9% and in women was 10.3%. Most of the women, 90.0%, had heard about urinary schistosomiasis compared with 60.2% among school-aged children.

**Food Consumption**

The Fortification Rapid Assessment Tool (FRAT), a modified 24-hour recall, was utilized to describe consumption of centrally processed staple foods. The most promising staple foods for fortification seems to be cooking oil and sugar with more than 50% of men, women and under five children consuming these products on an average day. Wheat flour and maize flour was consumed by 17-33% and 4-7% of

respondents, respectively. Only 4% of under five children consumed complimentary foods on an average day.

It was found that 19.1% of the children were introduced to solid foods before 6 months, 63.4% were introduced at 6 months and 17.5% after 6 months. Of the children who had stopped breastfeeding, 2.0% stopped between 0-6 months, 7.3% stopped breast-feeding at 6-12 months and 76.2% stopped breast-feeding between 12-24 months

**Iodine status**

Most of the households (89.6%) had salt on the day of the survey and of these 94.4% had iodine detected using the rapid test and 95.2% using the titration test. Although most households had salt with some iodine content, 82.6% had ≥15 parts per million (ppm) of iodine, which is the required amount at household level. Iodine content exceeded the Malawi standard of 100 ppm among 16.9% of households. There were 11.2% of the school-aged children who had urinary iodine levels less than 50µg/L, 28.6% had urinary iodine levels less than 100µg/L and 21.1% had urinary iodine levels greater than 300µg/L. Only 12.0% of the non-pregnant women had urinary iodine levels <50µg/L, 25.7% had urinary iodine levels <100µg/L and 22.6% of the women had urinary iodine levels >300µg/L.

**Vitamin A status**

Due to the need to further investigate RBP data, Vitamin A deficiency results will be provided in a separate report.

Most of the under five children (91.8%) had received vitamin A supplementation, usually (49.6%) during a routine health facility visit. Most women (93.0%) had also received vitamin A supplementation in the first two months after delivery.

**Anaemia, iron status and iron deficiency anaemia**

The highest prevalence of anaemia was found in under five children, (54.8% haemoglobin (Hb)<11.0 g/dL)-followed by non-pregnant women (32.0% Hb<12.0 g/dL), school-aged children (25.4% Hb<11.5 g/dL), pregnant women (13.0% Hb<11.0 g/dL) and men (12.2% Hb<13.0 g/dL). Iron deficiency was measured using Transferrin receptor (TfR). Iron deficiency was found to be prevalent in 50.9% of under five children, 29.6% of school-aged children, 26.1% in non-pregnant women and 7.1% in men. Iron deficiency anaemia (IDA) assessed by combining Hb with TfR. IDA in under five children was 30.6%, 12.0% in school-aged children, 9.3% in non-pregnant women, and 8.9% in men. Over a third (36.6%) of the pregnant women in the survey reported taking iron supplements and 89.3% reported taking iron at least during one of their pregnancies.

**Changes in nutritional status between the 2001 and 2009 Malawi Micronutrient Surveys**

Children 6-36 months of age were assessed in the 2001 micronutrient survey. Thus, for comparison purposes we have restricted the 2009 data for under five children to the same age group. Other age groups were similar. From 2001 to 2009 there was a decrease in the prevalence of stunting (HAZ<-2; 58.8% vs 43.0%), underweight (WAZ<-2; 24.2% vs 11.0%) and wasting (WHZ<-2; 6.2% vs 2.3%). There was an increase in the prevalence of overweight women (BMI>25 kg/$m^2$; 8.0% vs 12.5%), but the prevalence of obesity was similar (BMI>30 mg/$m^2$; 2.5%);

There was no difference in the proportion of households that had the recommended level of 15-40 ppm iodine in salt (26.2% vs 23.5%).

Due to the need to further investigate RBP data, Vitamin A deficiency results will be provided in a separate report.

There was a significant decrease in the prevalence of anaemia (79.7% vs 64.8%) and iron deficiency anaemia (59.3% vs 33.5%) in children 6-36 months of age and an increase in iron deficiency anaemia among men (2.4% vs 8.9%). There were no significant changes in the other target groups.

The findings and conclusions of this report do not necessarily represent the official position of the U.S. Centers for Disease Control and Prevention.

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# LIST ABBREVIATIONS

| | |
|---|---|
| AGP | Alpha-1-Acid Glycoprotein |
| AIDS | Acquired Immunodeficiency Syndrome |
| BMI | Body Mass Index |
| BAZ | BMI-for-age Z-score |
| CDC | Centers for Disease Control and Prevention |
| CHSU | Community Health Sciences Unit |
| CI | Confidence Interval |
| CRP | C-Reactive Protein |
| DHS | Demographic Health Survey |
| DNHA-OPC | Department of Nutrition HIV and AIDS in the Office of President |
| EAs | Enumeration Areas |
| FRAT | Fortification Rapid Assessment Tool (FRAT) |
| IDA | Iron Deficiency Anaemia |
| IDD | Iodine Deficiency Disorders |
| IVAGG | International Vitamin A Consultative Group |
| GOM | Government of Malawi |
| HAZ | Height-for-Age Z-Score |
| HIV | Human Immunodeficiency Syndrome |
| KAP | Knowledge, Attitude and Practice |
| MI | Micronutrient Initiative |
| MICS | Multiple Cluster Indicator Survey |
| MDGs | Millenium Development Goals |
| MNS | Micronutrient Survey |
| NCHS | National Center for Health Statistics |
| NSO | National Statistical Office |
| OPC | Office of the President and Cabinet |
| PPS | Proportional to Population Size |
| RBP | Retinol Binding Protein |
| SD | Standard Deviation |
| SF | Serum Ferritin |
| TfR | Transferrin Receptor |
| UIC | Urinary Iodine Concentration |
| UNICEF | United Nations Children's Fund |
| USA | United States of America |
| WAZ | Weight-for-Age Z-score |
| WHO | World Health Organization |
| WHZ | Weight-for-Height Z-score |
| ZP | Zinc Protoporphyrin |

# 1. Introduction

## 1.1 Nutrition Situation in Malawi

Malnutrition is a major cause of ill-health and contributes to infant and child morbidity and mortality. According to the 2006 Malawi Multiple Cluster Indicator Survey (MICS)[1], 46% of under-five children were stunted (too short for their age), 21% were underweight (too thin for their age); and 4% were wasted (too thin for their height). The data showed no significant improvement compared to the 1992, 2000 and 2004 Malawi Demographic and Health Surveys.[2,3,4] The situation is exacerbated by the high prevalence of HIV and AIDS.

Micronutrient deficiencies were high. The 2001 National Micronutrient Survey measured micronutrient situation in under five children (6-36 months), school-aged children (6-12 years), non-pregnant women of child bearing age (15-45) and men (20-55). The survey revealed that 60% of under five children, 38% of school-aged children, 57% of women and 37% of men had vitamin A deficiency (serum retinol values below 20 µg/dL); 80% of under five children, 27% of women, 22% of school-aged children and 17% of men were found to be anaemic (haemoglobin <11g/dL); and 58.9% of under five children had Iron Deficiency Anaemia (IDA) as measured by zinc Protoporphyrin (ZP) and haemoglobin.

## 1.2 Nutrition Interventions to Date

The Government of Malawi (GOM), with support from partners, is implementing a number of interventions to combat micronutrient malnutrition guided by the National Plan of Action for the Prevention and Control of Micronutrient Malnutrition (2003-2008) that articulated the GOM's response to the high prevalence of micronutrient deficiencies. The Plan of Action was based on four main Pillars namely, micronutrients supplementation, food fortification, dietary diversification and modification, and public health measures. Activities included supplementation with vitamin A and iron targeting under-five children, school-aged children, pregnant and post-natal women as appropriate; fortification of selected centrally-processed foods (salt, sugar, edible oil, wheat and maize flour); promotion of dietary diversification and modification, promotion of exclusive breastfeeding for infants aged 0-6 months, continued breastfeeding to 2 years and beyond, appropriate and timely complemen-

[1] Malawi Multiple Indicator Cluster Survey, 2006, http://www.childinfo.org/files/MICS3_Malawi_FinalReport_2006_eng.pdf, http://www.nso.malawi.net/nada/ddibrowser/?id=8

[2] Malawi Demographic Health Survey, 1992, http://www.measuredhs.com/pubs/pub_details.cfm?ID=89&srchTp=advanced

[3] Malawi Demographic Health Survey, 2000, http://www.measuredhs.com/pubs/pub_details.cfm?ID=337&srchTp=advanced

[4] Malawi Demographic Health Survey, 2004, http://www.measuredhs.com/pubs/pub_details.cfm?ID=575&srchTp=advanced

tary feeding, and nutrition education, and malaria control, de-worming and an Expanded Programme on Immunisation.

## 1.3 Survey Rationale

Malawi needs updated information on the micronutrient situation in the country and to measure the impact of the above interventions. The last micronutrient survey was conducted in 2001, and a School Health and Nutrition survey carried out in 2006 only captured a limited number of indicators and focused solely on school-aged children. Thus, developing a pragmatic micronutrient action plan based on out-dated and/or inadequate information would not be appropriate. It is for these reasons that the Government of Malawi found it crucial to conduct a national micro-nutrient survey having multiple purposes. The survey was expected to:

- Evaluate the impact of interventions aimed at alleviating the problems of micro-nutrient malnutrition in Malawi;
- Help guide the revision of the micronutrient action plan and guide the new policy direction on micronutrient deficiency in the country;
- Serve as baseline data for monitoring progress of planned vitamin A sugar fortification and other ongoing fortification activities;
- Serve as baseline data for comparison of impact of future interventions through formative evaluation; and thereby
- Help to accelerate child survival and development and thus achieve the Millen-nium Development Goals (MDGs)

## 1.4 Objectives of the Survey

**Overall Objective:**
To determine the prevalence of micronutrient deficiencies (anaemia, vitamin A, iron and iodine) among under five and school-aged children, women of child-bearing age and men; to estimate the coverage of supplementation/fortification interventions for the three micronutrients; and assess the knowledge and practices related to micronutrients.

**Specific objectives**
**Vitamin A Status**

- To determine the prevalence of vitamin A deficiency in children aged 6-59 months, school-aged children aged 6-12 years, in women aged 15-49 years of age and men 20-55 years;
- To estimate the coverage of vitamin A supplementation among children 6-59 months of age and post-partum women (within 8 weeks after delivery);

**Anaemia and Iron Status**

- To determine the prevalence of anaemia and iron deficiency anaemia in children aged 6-59 months and 6-12 years, women 15-49 years and in men 20-55 years of age;
- To determine the relationship between anaemia and iron deficiency and parasitic infection in school-aged children;
- To estimate the coverage of iron-folate supplementation in women 15-49 years;
- To estimate coverage of de-worming coverage in children aged 12-59 months and 6-12 years;

**Iodine status**

- To estimate the proportion of children aged 6-12 years and women aged 15-49 years having adequate urinary iodine concentration levels;
- To determine the coverage of iodised salt utilization at household level;

**Other**

- To estimate the prevalence of malnutrition among children 6-59 months of age using anthropometric measures;
- To estimate the prevalence of under-nutrition and obesity among non-pregnant women of child bearing age, 15-49 years;
- To assess the use and levels of consumption of centrally processed foods namely sugar, cooking oil, maize meal, wheat flour and complementary foods by household members

# 2. METHODS

## 2.1 Methodology

This chapter describes the study components in terms of survey design, target population, sample size calculations, sampling methodology, selection of clusters, ethical considerations, survey teams and training, survey implementation, data entry and analysis and statistical weights.

## 2.2 Components of the Survey

The 2009 National Micronutrient Survey was composed of integrated tools that were used to assess the micronutrient status of the population. The various methods were used for data collection including anthropometric measurements, hematological and biochemical assessments, salt sample analysis and questionnaires. A general Knowledge, Attitude, and Practice (KAP) survey and a Fortification Rapid Assessment Tool (FRAT) were utilized to gather further information.

## 2.3 Survey Design

The survey was cross-sectional and employed a stratified two-stage cluster sampling design combining geographical stratification by region (North, Central, South) followed by cluster sampling within each stratum. The first stage involved selection of enumeration areas (EAs), the designation commonly used in the data collection for every census conducted in Malawi and adopted from the National Statistics Office (NSO) for the 2008 census. The second stage involved selection of households[5] from the selected EAs. In each stratum (region), 40 EAs (clusters) were randomly selected using probability proportional to population size (PPS). All households in each EA were listed through an enumeration exercise conducted prior to the data collection. From the household lists, 15 households from each EA were selected using systematic random sampling. All eligible individuals within each selected household were invited to participate in the survey. A total of 600 households per stratum and a total of 1800 households in the three strata were selected for interviews and samples collection. Data collection proceeded only after obtaining consent from the participating households.

The survey was designed to provide both nationally and regionally representative data for Northern, Central and Southern regions. Randomly selected clusters that were included in the survey covered 26 of the 28 districts in Malawi: twelve districts in Southern region, nine districts in the Central region, and five of the six districts in the Northern region. Appendix I includes a map of Malawi with a list of the districts by region. In the Southern Region, Neno district was not included by chance after

[5] A household is defined as a group of people who share a common cooking pot, excluding visitors.

selecting the sample with PPS, while in the North the Island district of Likoma was deliberately left out due to limitations in accessibility.

## 2.4 Selection of Households

Household enumeration and random selection of 15 households within each cluster was conducted in October 2008 by NSO enumeration teams. Each enumeration team was given general enumeration area maps. With the help of a local guide, a map marking the boundaries of the cluster, the major roads, lanes, streets and physical boundaries such as streams and rivers were drawn. The location of each dwelling unit was then marked on the map. Once the enumeration was completed, the households were sequentially numbered. Then the survey supervisor calculated the sampling interval (total number of households registered divided by 15) and 15 households were selected from the list using systematic random sampling. Each household retained their selection number, 1-15, which was used to identify the eligible target population within each household.

## 2.5 Target populations

The target populations to assess iron and vitamin A status were children aged 6 to 59 months as they are the most vulnerable years for deficiencies, and women of childbearing age, 15-49 years. Iodine deficiency was assessed in children aged 6-12 years and women aged 15-49 years. These population groups were sampled to be representative at both national and regional levels. Micronutrient status was also assessed in adult men aged 20-55 years, except for iodine. Adult men were sampled to be representative at the national level only. The survey only targeted populations indicated above and excluded hospitalized individuals within a target population and children with a physical disability that would affect either height or weight measurement.

## 2.6 Sample size determination

Sample size estimates were based on the need to determine prevalence of micronutrient deficiencies with a precision of 5% at the national-level (10% precision at the regional-level) and 95% confidence intervals. For each target group, sample size calculations were estimated using reported prevalence estimates from previous surveys[6,7,8], if unavailable a 50% prevalence was assumed (i.e. urinary iodine, vitamin A). Where possible, design effects were estimated using data from the 2001 MNS, otherwise design effects were assumed to be 2.0. Calculations assumed a 90% household-response rate, 90% individual-response rate, and average household size of 4.3 persons[9]. Estimates for the population proportion for each target group were

[6] Malawi National Micronutritent Survey, 2001
[7] Malawi Demographic Health Survey, 2004
[8] Malawi Indicator Cluster Survey, 2006
[9] Malawi Demographic Health Survey, 2004

obtained from NSO (Refer to Appendix II for further information on sample size calculation). Table 2-1 below shows the sample size required by target group to establish national prevalence ± 5% for each indicator and the expected number of eligible individuals participating assuming the three stratum, 40 clusters per stratum, and 15 households per cluster: 40 * 15 * 3 = 1,800 households. The required sample size was 2775 subjects from 1800 households without replacement.

**Table 2-1 Estimated sample size required to establish national prevalence ± 5% by target group and indicator**

| Target Group | Indicator | Sample Size Required | Estimated Number of Participants |
|---|---|---|---|
| Children 6-59 months | Anaemia | 1,017 | 1,110 |
| | Iron deficiency | 1,407 | 1,110 |
| | Vitamin A deficiency | 930 | 1,110 |
| | Wasting | 123 | 1,110 |
| | Stunting | 639 | 1,110 |
| Children 6-12 y | Anaemia | 453 | 627 |
| | Iodine deficiency | 642 | 627 |
| | Vitamin A deficiency | 636 | 627 |
| Non-pregnant women 15-49 years** | Anaemia | 333 | 744 |
| | Iron deficiency | 342 | 744 |
| | Vitamin A deficiency | 705 | 744 |
| | BMI <18.5 | 162 | 744 |
| | BMI >25 | 192 | 744 |
| | Iodine deficiency | 642 | 744 |
| Men 20-55 years | Anaemia | 369 | 294 |
| | Vitamin A deficiency | 597 | 294 |

**Assumes sampling includes all under five children, all women and school-aged children from every other household, and 3 men per cluster*
***Assuming 13% of women 15-49 years of age would be pregnant*

## 2.7 Selection of participants

Participants were identified at the selected household level by the interviewers on arrival at a selected cluster. The head of each selected household was interviewed irrespective of gender. The interviewer slowly explained to the head of the household the purpose of the survey, how his or her household was selected and what collaboration was expected from him or her. Then he/she was requested to give a written or thumb print consent to carry on the interview and sample collection where necessary.

Table 2-2 describes the target population eligible according to the 15 households selected within each cluster. All children aged 6-59 months in selected households were eligible to participate in the survey. In every other household selected (all odd numbered households preselected), all women aged 15-49 years (pregnant and non-pregnant) and children aged 6-12 years were eligible to participate. The child's

mother or caretaker answered the questionnaires on behalf of the children. In 3 preselected households, one man aged 20-55 years was selected to participate in the survey. If more than one man was eligible in the household, then the first man listed on the household listing was selected. The fortification rapid assessment tool (FRAT) was administered to nine preselected households in each cluster. In 3 households a woman of reproductive age 15-49 years (ideally the main cook) completed the FRAT; in 3 households the FRAT was completed on behalf of a child 12-59 months; and in 3 households a man 20-55 years completed the FRAT.

**Table 2-2 Target population eligibility by household number**

| | Household # | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Questionnaire** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** |
| Household – all households complete | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Infant/child (6-59 mo) - all children of this age group in the households indicated should be assessed. | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| School-aged child (6-12 y) - all children of this age group in the households indicated should be assessed. | X | | X | | X | | X | | X | | X | | X | | X |
| Woman (15-49 y) - all women (pregnant and non-pregnant) of this age group in the households indicated should be assessed. | X | | X | | X | | X | | X | | X | | X | | X |
| Man (20-55 y)/FRAT - ONE MAN in the households indicated should be assessed. Select the first eligible man listed on the household listing form. | | | | | | | | | X | | X | | X | | |
| Woman FRAT - the PRIMARY COOK for the households indicated should complete FRAT. | | | X | | X | | X | | | | | | | | |
| Infant/child FRAT - ONE CHILD AGED 12-59 MONTHS in the households indicated will complete FRAT. Select first eligible child on household listing form. | | X | | X | | X | | | | | | | | | |

If eligible occupants of a house were not present, three recall visits were made over subsequent days. Selected households were not replaced if no eligible respondents were available.

## 2.8 Community Mobilization

Community mobilization teams were fielded nationally to inform the nation about the survey. The district administrative structure which includes District Commissioners, Chief Executives, the Officer In-Charge of Police, District Health Officers, District Information Officers, District Agriculture Development Officers, District Social Welfare Officers, District Community Development Officers, Director of Planning and Development, District Education Officers, District Nutrition Officers and local leaders were informed of the survey one month prior to the field data and biological specimen collection. Other forms of media such as print and electronic

media were used to publicize the survey. Traditional leaders and village headmen were also informed of the survey during the household listing exercise. To ensure that people would be available on the day of the survey, a day or two before the data collection, advance teams also served as publicity teams to remind village headmen and local police stations of the date the survey team would be present in the cluster to collect data.

## 2.9 Ethical Considerations

In order to ensure the National Micronutrient Survey followed principles to prevent unethical risk to study participants, an application was submitted and approved by the National Health Sciences Research Committee. The five principles guiding ethics in research namely; scientific merit, equitable selection of subjects, seeking informed consent, confidentiality and coercion, were followed. Each of the principles was followed as indicated below;

**Scientific merit**
The methods used in the research were based on the guidelines by CDC and MI, which were appropriate to the aims of the investigation. The design of the 2001 National Micronutrient Survey was taken into account to design the survey. The size of the survey was appropriate and method used to calculate sample size as indicated in previous sections.

**Equitable selection of participants**
The study participants were selected randomly from the target population of children aged 6-59 months, school-aged children (6-12 years), women of reproductive age (15-49 years) and adult men (20-55 years) to increase generalizability of findings.

**Informed consent**
The study participants were informed to ensure they fully understood the nature of the survey, the reasons the survey was being conducted, the possible benefits to individuals and their communities as well as any possible harm they might suffer. In this particular survey there was no harm anticipated except for discomfort during capillary blood collection. Trained personnel collected blood samples after a written or thumb print consent was obtained from the head of the household, each adult participant, and the primary caregiver or a legal guardian for the child participants after the interviewer had explained the purpose of the survey. Community leaders had been informed about the study to obtain communal consent.

**Confidentiality**
The data collected during the survey has been maintained and will be stored at NSO for three years from the time of data collection and will be only released to others with the explicit consent of all those concerned.

**Coercion**
Coercion and deception was unacceptable. Hence every procedure was adequately explained to all concerned.

**Identification of a health condition**
Survey participants identified as having severe anemia (hemoglobin <7 g/dL women and children, <9 g/dl for pregnant women), malaria or parasites were provided with a referral to the local hospital for evaluation.

**REFERRAL FORM** **Date:** ____/____/_____

Dear Doctor/Health Care Provider,

_____(**name**) has voluntarily participated in the 2009 Malawi Micronutrient Survey. The objective of this survey is to obtain information to determine the current prevalence of micronutrients deficiencies among the vulnerable population groups. As part of this survey, blood was taken for malaria and hemoglobin testing, urine for *Schistosomia haematobium* testing and stool for S*chistosomia mansoni* testing. The tests were performed and participant tested had

_____

The tests were not intended to be a substitute for a visit to you at _____ (**name of hospital**) for a complete examination. No attempt has been made by our study team to diagnose or treat medical conditions of the participant. We are informing you of the results of tests so that the participant can be further evaluated and treated.

Sincerely yours,

Counselor's/Health technician's name_____

## 2.10 Survey teams and training

Three types of field teams were involved in conducting the survey: (i) a community mobilization team to inform local authorities of the survey one month prior to the field data collection; (ii) an advance team to inform communities of the arrival of the data collection team at least a day before data collection; and (iii) a survey team to collect data and biological specimens collection. In addition, the survey team was responsible for handling and transportation, processing and testing. Each survey team consisted of one supervisor, two interviewers, three laboratory technicians, two anthropometric technicians and two drivers. One national survey supervisor, one national laboratory supervisor, three regional survey supervisors and three regional laboratory supervisors oversaw the field data collection, biological specimens' collection, handling and transportation, processing and testing. Appendix III outlines the roles and responsibilities of survey personnel.

All survey personnel underwent 12 day training on the survey objectives, tools and procedures before commencement of the survey. Specialists from Bunda College, CHSU, Ministry of Health, NSO, Department of Nutrition HIV and AIDS in the Office of the President and Cabinet (DNHA-OPC), Centers for Disease Control and Prevention (CDC) and United Nations Children's Fund (UNICEF) conducted the training (Appendix IV training schedule). After the orientation of the survey objectives the survey group split into two: (i) comprised of team members to be responsible for questionnaire administration, taking of anthropometric measures and salt sample collection (ii) the laboratory technician responsible for blood, urine and stool sample collection.

Survey staff with previous anthropometric experience were selected as anthropometric technicians and were trained by Bunda College of Agriculture Nutritionists and CDC technical experts on the correct measurements of height, length and weight. Anthropometric technicians also went through a standardization exercise for anthropometric measurements on under five children, men and women.

Interviewers were trained to understand the intent of and importance of each question, follow-up on the selected household, selection of the interviewee in the household, conducting rapid salt testing for iodine, the interview techniques and on completing the 7 questionnaires used in the survey. Team leaders were identified from the group of potential interviewers during the training.

All laboratory personnel who participated during the survey came from government district hospitals and only those who had experience in conducting similar surveys were selected from the national list. These teams were trained by CHSU laboratory personnel and CDC technical experts on: (i) the correct technique for finger stick and capillary blood collection into microtainers; (ii) use of Hemocue instruments for analysis of haemoglobin; (iii) processing, storage and transport of blood samples for later analysis of vitamin A and iron deficiency; (iv) storage and transport of urine samples for later analysis of iodine deficiency; (v) malaria testing; and (vi) preparation and analysis of stool and urine samples for parasitic infections.

Pre–testing and role plays were part of the training programme for all survey staff (i.e. interviewers, anthropometric technicians, and laboratory personnel) to ensure hands on experience and consistency before the actual data collection. Two pilot studies were conducted in six clusters in Lilongwe district. The clusters were different from those selected for the actual survey. The senior technical team and consultants from CDC and UNICEF supervised the exercise. The aims of the pilot included pre-testing the questionnaires, estimating the time required to complete a household interview and to perfect the logistics arrangements. According to performance of the first pilot, a second pilot was conducted in order to perfect logistics and the performance of teams. The second pilot was conducted successfully and the teams were prepared to start survey data collection.

The teams consisted of 1 Team Leader, 2 Anthropometry technicians, 2 Interviewers, 3 Laboratory Technicians and 3 Drivers. There were six regional supervisors and two national supervisors who visited all the survey teams in the field and helped in sorting-out any arisen issue. National supervisors were from The National Micronutrient Taskforce.

Survey questionnaires were first developed in English. Written translations were made into Tumbuka and Chichewa and checked by back translation. All English questionnaires with informed consent can be found in Appendix V.

## 2.11 Survey implementation

The survey was conducted in July and August, 2009. Ten survey teams collected data and biological specimens for a period of six weeks. Each team spent two to three days per cluster. Survey participants were selected at the household level by the interviewers on arrival guided by the survey criteria. The head of each household was interviewed irrespective of gender. When all eligible occupants of a house were not present, three recall visits were made over subsequent days. Selected households were not replaced if no eligible respondents were available.

The team leader explained the purpose of the survey to the household head. Data collection only started after obtaining informed consent initially from household head. Thereafter, informed consents were obtained from each adult participant, and in the case of children, from their primary caretakers after the interviewer had explained the purpose of the survey. Appropriate questionnaires were administered to the target group (i.e. children aged 6 to 59 months old, school-aged children 6 to 12 years, women aged 15 to 49 years, and men 20 to 55 years of age). Information on children less than five years of age was obtained by interviewing the primary caretaker. Paper copies of the questionnaires were administered in each respondent's language of choice. No local translator was employed because teams were allocated interviewers who spoke the local languages of the areas surveyed.

In addition to interview questions, anthropometric measurements, blood, urine and stool were collected from the appropriate target groups. Table 2-3 details the indicators assessed for each target group. Pre-printed labels were used to identify completed survey questionnaires and the associated biological and salt samples collected for later testing. Details of the labeling procedure are provided in Appendix IV.

**Table 2-3 Target groups and indicators assessed in the National Nutrition Survey, Malawi 2009**

| Target group | Specimen Collected or Measurement Taken | Indicators Assessed |
|---|---|---|
| Children (6 – 59 months) | Blood | - Haemoglobin<br>- Retinol binding protein<br>- Ferritin<br>-Transferrin receptor<br>- CRP/AGP<br>- Malaria parasitemia |
| | Height and Weight | - Nutritional status |
| | FRAT (subsample*) | - Centrally processed foods |
| Children (6 – 12 years) | Blood | - Haemoglobin<br>- Retinol binding protein<br>- Ferritin<br>-Transferrin receptor<br>- CRP/AGP<br>- Malaria parasitemia |
| | Urine | - Urinary iodine<br>- Urinary Schistosomiasis |
| | Stool | - Hookworm/Roundworm<br>- Schistosoma mansoni |
| | Height and Weight | - Nutritional status |
| Women (15 – 49 years) | Blood | - Haemoglobin<br>- Retinol binding protein<br>- Ferritin<br>-Transferrin receptor<br>- CRP/AGP<br>- Malaria parasitemia |
| | Urine | - Urinary iodine<br>- Urinary Schistosomiasis |
| | Height and Weight | - Nutritional status |
| | FRAT (subsample*) | - Centrally processed foods |
| Men (20 – 55 years) | Blood | - Haemoglobin<br>- Retinol binding protein<br>- Ferritin<br>-Transferrin receptor<br>- CRP/AGP<br>- Malaria parasitemia |
| | FRAT (subsample*) | - Centrally processed foods |
| Household | Salt | - Iodine content |

*FRAT (Fortification Rapid Assessment Tool) was completed by 3 women of reproductive age 15-49 years (ideally the main cook), 3 children 12-59 months; and 3 men 20-55 years within each cluster

### 2.11.1 Household and individual questionnaires

The household questionnaire was administered to the head of the household and obtained the following information: household listing, general household characteristics, household assets, bed net use and use of iodised salt. Household questionnaire assisted in the identification of eligible survey participants. Eligible participants were then asked to complete a questionnaire appropriate for their target group. Refer to Appendix 5 for survey questionnaires.

### 2.11.2 Anthropometry

Once the interviews were completed the interviewer escorted the respondents to the Central Community Laboratory site set in the cluster where height/length and weight measurements were taken for all children and non-pregnant women using standard methods as described in Appendix VII.

### 2.11.3 Age

The date of birth of each eligible under five child was recorded. Verification of birth date was made using health passports or any written document. Where the date of birth was unknown, a local calendar of events developed by NSO was used to estimate the child's date of birth. The age of women (in years) was based on self-report, health passport and calendar of events.

### 2.11.4 Length/height

For children less than 24 months old, recumbent length was measured to the nearest 0.1 cm using a field appropriate length board. The same device was used to measure standing height to the nearest 0.l cm for children aged 24 months and older and for non-pregnant women (15 to 49 years). All length/height measurements were taken with the participant not wearing shoes.

### 2.11.5 Body weight

Electronic Uni-scales were used to measure body weight of non-pregnant women of childbearing (15-49 years) and children aged 6-59 months and 6-12 years to the nearest 0.1 kg. Children who could not stand on their own were weighed while being held by their mothers (or an adult) using the mother-child tare function on the scale. All weight measurements were taken with minimal clothing and with the participant not wearing shoes.

### 2.11.6 Oedema

The presence of bi-lateral pitting oedema was determined for under five children by physical assessment by the interviewer.

### 2.11.7 Salt sample collection and processing

Salt samples were collected from households and qualitative "spot" tests for the presence of iodine using rapid test kits for potassium iodate (MBI KITS, Madras, India) were done. Approximately two tablespoons of salt were collected in plastic bags from every odd numbered household. The bags were sealed and stored in manila envelopes to protect iodine loss from light and moisture. Information on the brand of the iodised salt, method of storage of salt and location where the salt had been purchased was also documented. A 250 g packet of salt was given to every household as replacement of the salt sample provided for testing during the survey. The bag of collected salt was labeled ready to be transported to the Community Health Sciences Unit (CHSU) laboratory for quantitative salt iodine tests (Appendix VIII). It should be noted that during the salt titrations, the potassium thiosulphate solution was 10 times more concentrated than required. The titration values were therefore adjusted by multiplying by 10 but this may not accurately adjust for the true concentrations. The high concentration of the titration solution reduces accuracy at low volumes of 0 to 2 mL used in the titrations. A subsample of leftover salt from 60 households was sent to Chancellor College for reanalysis.

### 2.11.8 Blood collection, processing and storage

Trained laboratory personnel were centrally located at the field laboratory site where the anthropometric measurements were taken. The laboratory personnel collected blood samples through a finger prick from all eligible subjects using a HemoCue lancet (Appendix IX). The first drop of blood collected was used to create a thick smear slide for malaria assessment (Appendix X). The finger was then wiped clean and the third drop was drawn into a HemoCue cuvette for evaluation of hemoglobin by the photometric method using the HemoCue Hemoglobin system (HemoCue AB, Angelholm, Sweden) (Appendix XI).

Additional capillary blood was then collected in a 500 microliter (µL) microtainer with EDTA for processing and stabilization for later analysis at an international laboratory in Germany and CDC Atlanta, United States of America (USA). The blood samples of sufficient volume were spun for plasma, which was separated into cryovials, frozen and transported to CHSU laboratory and later to the international laboratories. While at the field laboratory, blood and urine samples were maintained at refrigeration temperatures (approximately 4°C) using insulated shipping containers and frozen cold packs until they were taken for freezing. These samples were accompanied by the sample tracking thermometers provided by CDC to

monitor the temperatures from the field laboratory to the district laboratory and finally to central laboratory CHSU

### 2.11.9 Urine and stool collection, processing and storage

Stool samples were collected from school-aged children and urine samples were collected from both school-aged children and women of childbearing age. The stool samples were assessed for the presence of parasitic infections (hookworm, round-worm and *Schistosoma mansoni*) using the concentration method (Appendix XII), since parasitic infections maybe important as indicators of both morbidity and as potential factors associated with anaemia and iron deficiency anaemia (IDA). Urine samples were collected and visually inspected for the presence of blood. A 2-5ml aliquot of urine was transferred into an iodine-free storage vial in duplicate and later sent to Zimbabwe Government Analyst laboratory for processing. The remaining sample was analysed for urinary Schistosomiasis (*Schistosoma haematobium*, (Appendix XIII).

### 2.11.10 Anthropometry analysis and interpretation

**Reference:** Paediatric anthropometric data presented in this report were interpreted using the 2006 WHO Child Growth Standards[10].

**Z-scores:** The anthropometric indices used for evaluating the nutritional status of children include height-for-age, weight-for-age, and weight-for-height. These indices are interpreted using classifications based on Z-scores (standard deviation units from the reference median). The WHO recommends that a Z-score cut-off point of <-2 be used to classify low height-for-age, low weight-for-age, and low weight-for-height for estimating the prevalence of malnutrition. The reference Z-score distribution for each index has a mean of 0.0 and a standard deviation (SD) of 1.0. A Z-score cut-off of >+2 should be used to classify high weight-for-height for estimating the prevalence of overweight (also a form of malnutrition). A Z-score of -2 corresponds to the 2.3rd percentile on the reference distribution, while a Z-score of +2 corresponds to the 97.7th percentile on the reference distribution.

**Standard Deviation (SD):** The SD of the Z-score provides information on the spread of the distribution and the quality of the anthropometric measurements performed for a survey. The SD is calculated unweighted, thus does not take into account the complex sample design. In the reference population, the SD of the Z-score distribution for height-for-age and weight-for-height is 1.0. A Z-score SD that is lower than 0.9 indicates that the distribution is more homogeneous with less variation compared to the reference distribution. A Z-score SD >1.0 and <1.2 indi-

[10] 2006 curves WHO Multicentre Growth Reference Study Group. WHO child growth standards based on length/height, weight and age. *Acta Paediatr Suppl.* 2006;450:76-85.

cates that the distribution has a wider spread than the reference. A Z-score SD >1.3 is suggestive of inaccurate anthropometric measurements and/or inaccurate age information.[11]

### 2.11.10.1 Children aged 6-59 months

The anthropometric indicators of length/height-for-age, weight-for-age, weight-for-length/height were determined for children surveyed using the Nutristat: Nutritional Anthropometry Program and the WHO Reference 2007 STATA Macro package version 9. Values in the following ranges were excluded from the analysis as recommended[12].

- Weight-for-Height Z-score (WHZ) <-5.0 or >5.0
- Weight-for-Age Z-score (WAZ) <-6.0 or >5.0
- Height-for-age Z-score (HAZ) <-6.0 or >6.0

At the population level, the prevalence of low Z-scores for each anthropometric index was interpreted as described in Table 2-4.

**Table 2-4 Anthropometric Index and Interpretation of Malnutrition Severity based on Population Prevalence[13]**

| Anthropometric Index | Low | Medium | High | Very High |
|---|---|---|---|---|
| WHZ <-2 | <5.0% | 5.0-9.9% | 10.0-14.9% | ≥15.0% |
| HAZ <-2 | <20.0% | 20.0-29.9% | 30.0-39.9% | ≥40.0% |
| WAZ <-2 | <10.0% | 10.0-19.9% | 20.0-29.9% | ≥30.0% |

**Anthropometric indices**

**Height-for-age:** A low height-for-age indicates stunting, which reflects a long term deficit of height increment as a result of inadequate nutrient intake and/or a history of illness and disease such as diarrhoea and respiratory illness. On a population level, a high prevalence of stunting is usually associated with poor socioeconomic conditions and a greater risk for frequent and/or early exposure to adverse environmental conditions such as illness and inadequate nutrition.[14] A decrease in the prevalence of stunting usually parallels improvements in economic conditions. In developing countries the prevalence of low height-for-age ranges from 10% to 60%. The WHO classifies countries with a <20% prevalence in low height-for-age (Z-score <-2) are classified as countries with low prevalence of stunting.

**Weight-for-age**: This index is primarily a composite of height-for-age and weight-for-height. On a cross-sectional basis, weight-for-age is less useful than height-for-age or weight-for-height in defining nutritional status. In most populations where

11 WHO Global Database on Child Growth and Malnutrition. World Health Organization, 1997

12 2006 curves WHO Multicentre Growth Reference Study Group. WHO child growth standards based on length/height, weight and age. *Acta Paediatr Suppl.* 2006;450:76-85

13 World Health Organization. Physical status: The use and interpretation of anthropometry: Report of a WHO expert committee. WHO Technical Report Series 854, 1995

there are few children with low weight-for-height, the weight-for-age status provides essentially similar information as height-for-age.[14]

**Weight-for-height:** Low weight-for-height, or wasting, is an indicator of acute under-nutrition and is often the result of severe food shortages and/or prolonged severe illness. Unlike the wide variation in stunting rates observed in developing countries, the prevalence of wasting is usually less than 5% in most countries provided there is no severe food shortage. Weight-for-height is also an indicator for over nutrition or excessive body weight relative to linear growth. Overweight and obesity were defined as the proportion of under five children with a weight-for-height +2 SD and +3 SD, respectively[15].

#### 2.11.10.2 School-Aged Children (6-12 years)

Body mass index (BMI) for school-aged children was calculated as weight (kg) divided by height (m) squared (Wt kg/[Ht m]$^2$). The BMI-for-age Z scores (BAZ) were derived using the WHO Anthroplus software using the 2007 WHO Growth Reference chart which is a reconstruction of the 1977 National Center for Health Statistics (NCHS)/WHO reference. It uses the original NCHS data set supplemented with data from the WHO child growth standards sample for under-fives. To develop this reference the same statistical methodology was used as in the construction of the WHO standards. For children aged 5 to 19 years, the +1 SD in the WHO reference (equivalent to the 85th percentile) coincides at 19 years with the adults cut-off of BMI =25 [kg/m$^2$], which is the cut-off for overweight. Similarly, the +2 SD (equivalent to the 97th centile) coincides at 19 years with the adults cut-off of BMI=30 [kg/m$^2$], which is the recommended cut-off for obesity. For thinness and severe thinness, the cut-offs are -2 and -3 SD, respectively. Values outside the following range (-5, +5) were excluded from analyses as recommended[16]. For this analysis we reported the number of school children who were obese (+2SD), thin (-2SD) and severely thin (-3SD).

#### 2.11.10.3 Non pregnant women (15-49 years)

Body mass index (BMI) for non-pregnant women was calculated as weight (kg) divided by height (m) squared (kg/m$^2$). The individuals were classified as underweight, normal weight; overweight or obese using the BMI categories shown in Table 2-5.

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[14] World Health Organization. Physical status: The use and interpretation of anthropometry: Report of a WHO expert committee. WHO Technical Report Series 854, 1995

[15] Mercedes de Onis, Monika Blo¨ssner, and Elaine Borghi. Global prevalence and trends of overweight and obesity among preschool children. Am J Clin Nutr 2010;92:1257–64.

[16] WHO AnthroPlus for personal computers Manual: Software for assessing growth of the world's children and adolescents. Geneva: WHO, 2009 (http://www.who.int/growthref/tools/en/ ).

**Table 2-5 Body Mass Index (BMI) classification for non-pregnant women[17]**

| BMI (kg/m²) | Weight Classification of Individuals |
|---|---|
| <18.5 | Underweight |
| 18.5-24.9 | Normal |
| 25.0-29.9 | Overweight |
| ≥30.0 | Obese |

The public health significance of the population prevalence of low BMI (<18.5) is interpreted as presented in Table 2-6. A high prevalence of low BMI may be an indication of food insecurity and/or widespread disease. Excessive thinness may also highlight the vulnerability of populations living in difficult circumstances such as seasonal variation, drought or epidemics.

**Table 2-6 Categories of prevalence of low BMI (<18.5) according to public health significance[18]**

| **Normal** | **Low Prevalence** (warning sign, monitoring required) | **Medium Prevalence** (poor situation) | **High Prevalence** (serious situation) | **Very High Prevalence** (critical situation) |
|---|---|---|---|---|
| 3-5% | 5-9% | 10-19% | 20-39% | ≥40% |

### 2.11.11 Salt titration analysis and interpretation

The 1995 Salt Iodisation Act and 1998 regulation requires that iodine levels in salt should be 80-100 parts per million (ppm) iodine at port of entry, the iodisation levels at the plant and prepacking factory should be 80-100 ppm and at wholesale or retail level the levels should be a minimum of 50 ppm. Iodine losses from point of production to consumption can then be well in excess of 50%. Thus at the household level, the WHO recommends that adequately iodised salt should have iodine levels of at least 15 ppm[18]. In order to eliminate salt deficiency, it is recommended that at least 90% of households should use salt with an iodine content of 15-40 ppm. The interpretation of the household iodine status is presented in Table 2-7

**Table 2-7 Criteria for assessing iodine content in household salt[20]**

| Salt iodine content | Iodine status at household level |
|---|---|
| < 15 ppm | Inadequately iodised |
| ≥15-40 ppm | Adequately iodised |
| >40 ppm | Excessively iodised |

[17] World Health Organization. Physical status: The use and interpretation of anthropometry: Report of a WHO expert committee. WHO Technical Report Series 854, 1995

[18] Assessment of iodine deficiency disorders and monitoring their elimination: A Guide for Programme Managers. WHO/UNICEF/ICCIDD, 3rd Edition, 2007

### 2.11.12 Urinary iodine analysis and data interpretation

Urinary iodine analyses were performed in Zimbabwe, at the Government Analyst Laboratory. School-aged children are commonly assessed for iodine status because they are generally easier to survey in schools and serve as a proxy indication of iodine status for the general population. Women of childbearing age are the most vulnerable population because iodine deficiency directly affects the mental and physical development of the foetus when a woman is pregnant. For this survey, the iodine status was assessed for both school-aged children (6-12 years) and women of child-bearing age (15-49 years). The interpretation of a population's iodine status based on median urinary iodine levels for different target groups is presented in Table 2-8. Urinary iodine criteria (among school-age children and non-pregnant women) for monitoring progress towards the elimination of Iodine Deficiency Disorders (IDD) require that <50% have a urinary iodine value below 100 µg/L and <20% have a urinary iodine value below 50 µg/L.[19]

**Table 2-8 Criteria for assessing iodine nutrition based on median urinary iodine concentrations in different target groups[22]**

| Median urinary iodine (µg/l) | Iodine intake | Iodine Status |
|---|---|---|
| **School-age children (≥6 years), men, and non-pregnant, non-lactating women** | | |
| < 20 | Insufficient | Severe iodine deficiency |
| 20-49 | Insufficient | Moderate iodine deficiency |
| 50-99 | Insufficient | Mild iodine deficiency |
| 100-199 | Adequate | Adequate iodine nutrition |
| 200-299 | Above require-ments | May pose a slight risk of more than adequate iodine intake in these populations |
| ≥300 | Excessive* | Risk of adverse health consequences (iodine-induced hyperthyroidism, autoimmune thyroid disease) |
| **Pregnant Women** | | |
| < 150 | Insufficient | |
| 150-249 | Adequate | |
| 250-499 | Above require-ments | |
| ≥ 500 | Excessive* | |
| **Lactating women and children less than 2 years of age** | | |
| < 100 | Insufficient | |
| ≥ 100 | Adequate | |

*The terms "excessive" means in excess of the amount required to prevent and control iodine deficiency.

[19] Assessment of iodine deficiency disorders and monitoring their elimination: A Guide for Programme Managers. WHO/UNICEF/ICCIDD, 3rd Edition, 2007

### 2.11.13 Modified Fortification Rapid Assessment Tool (FRAT)

The Fortification Rapid Assessment Tool (FRAT) is a 24-hour recall tool created by PATH Canada that is specifically designed to gather information to aid in the fortification of the most appropriate foods in developing countries. A modified version of the FRAT was utilized in the Malawi survey. The National Fortification Alliance had already identified the centrally processed foods for fortification (sugar and cooking oil with vitamin A, maize meal and complementary foods (such as Likuni Phala) with iron, folate and other nutrients). The FRAT was used to assess the availability and usual consumption patterns of these centrally-processed foods, specifically sugar, oil, maize meal, and complementary foods. To obtain the most accurate quantitative information possible, estimates of usual serving sizes were determined through a cooking exercise to standardize amounts (Appendix V).

FRAT information was gathered on a national sample of women (primary cook), men and under five children (described in Table 2-2). The respondents were first asked if their intake the previous day was typical since the FRAT attempts to estimate usual consumption. If yes, then they were asked the consumption questions about that day. If their intake the previous day was not usual then they were asked to think of a typical day. Then each respondent was asked to list the foods of either the day before or the usual day. The interviewers were trained to probe for all foods eaten the previous day by starting with the morning meal and carrying the respondent along the entire day. Following the listing of foods and beverages, respondents were asked a series of questions about centrally processed sugar, oil, maize meal and complementary foods. Caretakers of under five children were also asked the series of questions on consumption of centrally processed complementary foods.

### 2.11.14 Vitamin A status

Vitamin A status was assessed using retinol binding protein (RBP) as a surrogate indicator for serum retinol because RBP is more durable and has an approximate equi-molar relationship with serum retinol.[20] Serum retinol criteria for defining vitamin A deficiency is <0.70 µmol/L and mild vitamin A deficiency is defined ≥0.70 to <1.05 µmol/L. A subsample of serum collected was also assessed for serum retinol to determine whether these cut-points to define vitamin A deficiency and mild deficiency were appropriate for RBP. Infection or inflammation is one factor known to affect vitamin A status.[21] Prevalence estimates excluding those with

[20] Gorstein J, Sullivan KM, Parvanta I, Begin F. Indicators and Methods for Cross-Sectional Surveys of Vitamin and Mineral Status of Populations. The Micronutrient Initiatve (Ottawa) and the Centers for Disease Control and Prevention (Atlanta), May 2007

[21] Stephensen CB, Gildengorin G. Serum retinol, the acute phase response, and the apparent misclassification of vitamin A status n the third National Health and Nutrition Examination Survey, *Am J Clin Nutr* 2000;72:1170-8.

elevated C-reactive protein (CRP) (≥5mg/L) or alpha-1-acid glycoprotein (AGP) (≥1.0g/L) are provided in the Appendices.[22]

The public health burden of Vitamin A deficiency can be determined based on the prevalence of low serum retinol in under five children, as proposed by the WHO (Table 2-9). In addition, criteria proposed by the International Vitamin A Consultative Group (IVACG) state that a prevalence of vitamin A deficiency >15% among children 2-5 years of age constitutes a public health problem.

**Table 2-9 Public health burden of Vitamin A deficiency based on serum retinol <0.7 μmol/L in children ≥1 year[23]**

| Public health burden of vitamin A deficiency | Prevalence of low serum retinol (%) |
|---|---|
| Mild | ≥2 to ≤10 |
| Moderate | ≥10 to <20 |
| Severe | ≥20 |

Information on vitamin A supplementation obtained by questionnaire and from health cards where available is also reported.

### 2.11.15 Anaemia, Iron Status and Iron Deficiency Anaemia

Assessing iron status requires the measurement of several biochemical indicators. Anaemia, which is often used as a proxy for iron deficiency, was assessed through hemoglobin values. Iron deficiency was assessed using a combination of serum ferritin (SF) and transferrin receptor (TfR) and indicators of inflammation; CRP≥5 mg/L or AGP≥1 g/L.

#### 2.11.15.1 Analysis of Data on Anaemia

Anaemia was assessed using a HemoCue photometric instrument version Hemocue 201+ (HemoCue AB, Angelholm, Sweden). Cuvettes were filled with blood from a finger prick for measurement hemoglobin levels. The results were recorded directly onto the questionnaire. Major advantages of the HemoCue photometer is that it can be battery-operated, is easily portable, displays hemoglobin levels in one minute

[22] Thurnham DI, McCabe GP, Northrop-Clewes CA, Nestel P. Effects of subclinical infection on plasma retinol concentrations and assessment of prevalence of vitamin A deficiency: meta-analysis. Lancet. 2003 Dec 20;362(9401):2052-8

[23] Vitamin A Indicators for assessing vitamin A deficience and their application in monitoring and evaluating intervention programmes. WHO. 1996. http://www.who.int/nutrition/publications/micronutrients/vitamin_a_deficieny/WHO_NUT_96.10/en/index.html

and avoids complicated handling of blood samples in potentially harsh field conditions. Quality Control of the HemoCue instrument was ensured by using the liquid control cuvette for each specific instrument before the instrument was used in each cluster. Liquid controls (High, Medium and Low) were also used at the beginning and end of each day as further assurance of the quality of HemoCue readings. Log sheets were kept of all quality control measurements (Appendix XI). Hemoglobin levels were adjusted for pregnancy, altitude, and smoking status by adjusting the individual haemoglobin values as indicated in Table 2-10.

**Table 2-10 Adjustments to haemoglobin cutoffs and individual haemoglobin values for pregnancy, altitude, and smoking status[24]**

| **Trimester of pregnancy** | **Adjustment to individual haemoglobin value (g/dl)** |
|---|---|
| First | +1.0 |
| Second | +1.5 |
| Third | +1.0 |
| Trimester unknown | +1.0 |
| **Altitude (m)** | |
| <1000 | No adjustment |
| ≥1000, <1250 | -0.2 |
| ≥1250, <1750 | -0.5 |
| ≥1750, <2250 | -0.8 |
| ≥2250, <2750 | -1.3 |
| ≥2750, <3250 | -1.9 |
| ≥3250, <3750 | -2.7 |
| ≥3750, <4250 | -3.5 |
| ≥4250, <4750 | -4.5 |
| ≥4750, <5250 | -5.5 |
| ≥5250 | -6.7 |
| **Smoking status** | |
| Non-smoker | No adjustment |
| Smoker, amount unknown | -0.3 |

Cut-offs for anaemia varied by target group; anaemia was defined as <11.0 g/dL for under five children (6-59 months), as <11.5 g/dL for school-aged children (6-12 years), as <12.0 g/dL for non-pregnant women (15-49 years), as <11.0 g/dL for pregnant women (15-49 years) and as <13.0 g/dL for adult men (20-55 years). The public health burden of anaemia in a population is indicated in Table 2-11.

[24] Sullivan KM, Mei Z, Grummer-Strawn L, Parvanta I. Haemoglobin adjustments to define anaemia. *Tropical Medicine and International Health*, 13(10); 1267-71 Oct 2008.

**Table 2-11 WHO classification of public health significance of anaemia in populations based on the prevalence of hemoglobin[25]**

| Category of public health significance | Prevalence of anaemia (%) |
|---|---|
| Severe | ≥40 |
| Moderate | 20.0-39.9 |
| Mild | 5.0-19.9 |
| Normal | ≤4.9 |

### 2.11.15.2 Analysis of Data on Iron Status

Iron deficiency was assessed using two indicators: serum ferritin and transferrin receptor (TfR). Ferritin levels correlate with total body iron stores.[26] Low serum ferritin reflects depleted iron stores and hence is a precondition for iron deficiency in the absence of infection. However, serum ferritin is also an acute-phase reactant and is elevated in response to infectious or inflammatory processes. Consequently, serum ferritin levels in the normal range reflect iron sufficiency in the absence of infections or inflammatory illness and interpretation of serum ferritin is problematic in populations where the incidence of infection is high.

The other biochemical indicator used in the survey for assessing iron status was transferrin receptor (TfR). TfRs are found on cell membranes and allow iron-bound transferrin to enter the cell. When the iron supply is inadequate, there is an up-regulation of TfR to enable the cell to compete more effectively for iron. The number of membrane receptors is in proportion to the receptors found in plasma. An increase in serum TfR levels is seen in patients with iron deficient erythropoiesis or iron deficiency anaemia. Unlike ferritin, TfR remains normal in patients with acute or chronic infection, inflammation or liver disease and appears to be effective in distinguishing iron deficiency anaemia from anaemia as a result of chronic disease. Additionally, TfR is not an acute phase reactant and does not vary with age, gender, or pregnancy.[26] We examined both TfR and serum ferritin to indicate iron deficiency in our analyses. Individuals were classified as having iron deficiency if they had low ferritin (<12µg/L for under five children and <15µg/L for all other groups) or elevated TfR (>8.3mg/L) regardless of CRP or AGP status. Prevalence estimates excluding those with elevated C-reactive protein (CRP) (≥5mg/L) or alpha-1-acid glycoprotein (AGP) (≥1.0g/L) are provided in the Appendices.

[25] Assessing the iron status of populations: report of a Joint World Health Organization/Centers for Disease Control and Prevention Technical Consultation on the Assessment of Iron Status at the Population Level, Geneva, Switzerland, 6–8 April 2004. – 2nd ed.

### 2.11.15.3 Analysis of Data on Iron Deficiency Anaemia (IDA)

Iron deficiency anaemia (IDA) in the survey was measured by combining TfR or serum ferritin levels and hemoglobin levels (i.e. an elevated TfR or reduced ferritin in combination with low hemoglobin indicated IDA). The combination of serum ferritin and TfR in populations provides the most complete picture of iron status (Table12-2). Because serum ferritin increases in the presence of inflammation and TfR, in general, is not affected by inflammation, the combination of the tests is optimal in determining which indicator should be used to describe iron deficiency in a population. Iron deficiency prevalence based on serum ferritin should be used except where inflammation is prevalent (Table 2-12, row 2) in which case the prevalence based on transferrin receptor is more appropriate.[26]

**Table 2-12 The Interpretation of low serum ferritin and high transferrin receptor concentrations in population surveys**

| Percentage of serum ferritin values below threshold[a] | Percentage of transferrin receptor values above threshold[b] | Interpretation |
|---|---|---|
| <20%[c] | <10% | Iron deficiency is not prevalent |
| <20%[c] | ≥10% | Iron deficiency is prevalent; inflammation is prevalent |
| ≥20%[d] | ≥10% | Iron deficiency is prevalent |
| ≥20% | <10% | Iron depletion is prevalent |

[a] Less than 5 years <12 mg/L; all other groups <15mg/L
[b] >8.3 mg/L
[c] <30% for pregnant women
[d] >30% for pregnant women

### 2.11.16 Malaria

*Plasmodium falciparum* is the most common cause of malaria infection in Malawi. Of the four species that cause malaria, *P falciparum* contributes the highest rates of morbidity and mortality[27]. All subjects in the survey, whether febrile or not, had thick smears made from capillary blood samples. These were analyzed at the end of each day of fieldwork. Presence of *P. falciparum* trophozoites, the asexual erthrocytic development stage of the parasite, and the level of parasitemia, using the 1-plus to 4-plus system, were recorded. Presence of *P. falciparum* gametocytes, the sexual erythrocytic stage and the level of parasitemia were also both recorded. It is the asexual erythrocytic cycle, with the presence of trophozoites, which cause clinical

[26] Assessing the iron status of populations: report of a Joint World Health Organization/Centers for Disease Control and Prevention Technical Consultation on the Assessment of Iron Status at the Population Level, Geneva, Switzerland, 6–8 April 2004. – 2nd ed.
[27] Snow RW, Guerra CA, Noor AM, Myint HY, Hay SI. The global distribution of clinical episodes of *Plasmodium falciparum* malaria. Nature 2005 Mar 10;434(7030):214-217.

symptoms of infection such as fever, headaches, nausea, and muscle aches.[28] Malaria parasitemia rates are counts of the asexual parasites, or trophozoites, in the blood. The gametocytes, the sexual erythrocytic cycle, are taken up by mosquitoes to complete the life cycle for *Plasmodium* species. They are therefore responsible for the transmission of malaria.

Malaria parasitemia, the count of trophozoites or active parasites found circulating the blood, was determined from the thick smear samples. The prevalence of malaria in each age group was calculated and the level of parasitemia in under five children. The relationship between malaria parasitemia and anaemia was also explored as well as the relationship between reported fever and malaria parasitemia.

### 2.11.17 Urinary Schistosomiasis

Urinary schistosomiasis is a common infection in Malawi due to the infestation of water snails particularly in the southern part of Lake Malawi.[29] These snails are the intermediate host of *Schistosoma haematobium* which causes urinary schistosomiasis. Urinary schistosomiasis causes bleeding inside the bladder and contributes to the anaemia status of the child. Such a loss of blood is sometimes visible in the urine. Urine samples from school-aged children and women of childbearing age were assessed with a colorimetric dipstick method for the presence of blood in the urine (Appendix XIII). An aliquot of urine was examined under the microscope for the presence of *Schistosoma haematobium* eggs (Appendix XIII). School-aged children and women of childbearing age were also asked whether they had urinary schistosomiasis and whether they had blood in their urine on the day of the survey to see if they recognized and correctly assigned possible meaning to the symptoms of blood in their urine and pain when urinating. Data were reported by dipstick result for presence of blood in the urine and by egg count. The egg count results were also used in combination with the hemoglobin results to assess the impact of *Schistosoma haematobium* infection on anaemia. The knowledge data on urinary schistosomiasis was also tabulated.

### 2.11.18 Intestinal parasites

Some intestinal parasites cause blood loss and therefore contribute to anaemia. These infections also contribute to general morbidity. The presence of parasitic infections such as hookworm, roundworm and *Schistosoma mansoni* were assessed in school-aged children through analysis of stool samples. School-aged children were also asked a set of questions to assess their knowledge of intestinal parasites. The prevalence of each intestinal parasite (hookworm, roundworm and *Schistosoma*

[28] Malaria, Laboratory Identification of Parasites of Public Health Concern. http://www.dpd.cdc.gov/dpdx/HTML/Malaria.htm

[29] Bowie C, Purcell B, Shaba B, Makaula P, Perez M. A national survey of the prevalence of schistosomiasis and soil transmitted helminths in Malawi. *BMC Infect Dis*. 2004 Nov 16;4:49.

*mansoni*) was reported by age group, standard/grade, sex, residence, region as well as a weighted national figure. The hookworm results were also analyzed with the hemoglobin data to assess the impact of hookworm infection on anaemia. The knowledge of intestinal parasites by school-aged children was also reported.

## 2.12 Data entry and analysis plan

During the survey, questionnaires were collected, reviewed for completion at the end of each day, edited and transported weekly to the NSO where the data were entered into computer files using CSPRO version 6.04 by NSO staff. The data entry staff remained at NSO during the survey and received the completed surveys as the data was collected. Any errors in completing questionnaires were corrected in the field when possible. To reduce computer data entry error, the entry screen was programmed to accept only codes within a predetermined range. All laboratory samples were labeled with an identification that indicated the cluster number and household number and an individual number (Appendix 6). The individual number also indicated whether the sample was collected from an under five child, school-aged child, woman or man. These indices were used to link laboratory data to demographic data. All data were also double entered and verified. Once the data were entered and the data sets cleaned, analysis was conducted using weighted data (Appendix 16) taking into account the study design to obtain national prevalence estimates. The design effect for the analysis (Appendix 17) and methods of variance estimation for survey data were used to account for the stratified sampling design; standard errors were calculated using the Taylor-series approximation. Data was assumed to be missing completely at random (MCAR). The proportion of data that was missing was less than 5% and therefore missing data was excluded from the analyses using pairwise deletion. Adjusted chi-square statistics and their corresponding p-values were used to identify bivariate associations; statistical significance was defined as $p<0.05$. All analyses were completed using STATA version 10 (Stata Corp LP, College Station, Texas, USA). The reported prevalence and 95% confidence intervals are weighted while counts are unweighted. When prevalence was zero, confidence intervals were not calculated.

# 3. PARTICIPATION RATES AND CHARACTERISTICS OF RESPONDENTS

## 3.1 Participation Rates

Data were collected from a target of 1,800 households (120 clusters x 15 households per cluster). Among the 1,800 households invited to participate, 93.5% (1,675) agreed to participate, 4.2% (75) were not at home, 0.6% (10) refused, and 1.7% (31) were not available for other reasons (e.g., dwelling was abandoned or used to house livestock). Table 3-1 summarizes targeted sample size and the actual data collected among households that agreed to participate.

**Table 3-1 Target sample size and participation by target group**

| | Household | Under five children, 6-59 mo | School-aged children, 6-12 y | Women, 15-49 y | Men, 20-55 y |
|---|---|---|---|---|---|
| Target sample size* | 1,800 | 1,100 | 627 | 744 | 390 |
| Number eligible to participate in partici-pating households | 1,791 | 1,124 | 807 | 804 | 197 |
| Actual participation** | | | | | |
| -Questionnaire | 1791 | 1094 | 758 | 754 | 173 |
| -Anthropometry | -- | length 980 weight 981 | height 698 weight 696 | height 577 NP weight 576 NP | -- |
| -Blood collected | -- | 1003 | 673 | 571 NP 68 P | 146 |
| -Urine collected | -- | -- | 641 | 529 NP 65 P | -- |
| -Stool collected | -- | -- | 528 | -- | -- |
| -FRAT† | -- | 166 | -- | 234 | 173 |
| -Salt collected§ | 745 | -- | -- | -- | -- |

*Refer to Appendix 2 for calculations
**Excludes respondents with an age missing or out of range for target group
-- not applicable for this group
NP=non-pregnant women, P=pregnant
†Target sample size of FRAT was 360 for each target group
§Target sample size was 900 households for salt titrations.

## 3.2 Demographics and socioeconomic characteristics of the respondents

Demographic, social and economic characteristics of a population can have profound influence on nutritional status. Therefore understanding these characteristics is a prerequisite for understanding of nutrition indicators of a particular population.

Data were collected on the demographic, social and economic characteristics of the household survey population. This chapter presents the results of the household survey in the following organization:

- Sample Frame stratification by region
- Demographic characteristics of the respondents
- Household economic characteristics

## 3.3 Residence (Urban/Rural)

The distribution of residences in the National Micronutrient Survey was very similar to the 2008 Population and Housing Census (Table 3-2). The survey included 1,479 rural households (84.5%) and 312 urban households (15.6%).

**Table 3-2 Location of Households by Region**

| Region (n=1791) | Micronutrient survey 2009 | | | | Malawi National Census 2008 | |
|---|---|---|---|---|---|---|
| | Urban | | Rural | | Urban | Rural |
| | N | % (95% CI) | N | % (95% CI) | % | % |
| Northern | 120 | 19.9 (10.1-35.5) | 479 | 80.1 (64.5-89.9) | 14.1 | 85.9 |
| Central | 102 | 16.1 (7.7-30.8) | 490 | 83.9(69.2-92.3) | 15.1 | 84.9 |
| Southern | 90 | 14.0 (6.2-28.4) | 510 | 86.1 (71.6-93.8) | 15.9 | 84.1 |
| National | 312 | 15.6 (9.7-24.0) | 1479 | 84.5 (76.1-90.3) | 15.3 | 84.7 |

*Data are weighted to account for survey design, CI- Confidence Interval*

## 3.4 Age Distribution

For under five children the ranges used for analyses were 6-11 months (6 month range), 12-23 months (1 year range), and 24-35 months (1 year range), 36-47 months (1 year range), and 48-59 months (1 year range). For school-aged children the age ranges used for analysis were 6-8 years (3 year range), and 9-12 years (4 year range). In women, the age ranges used were 15-19 years (5 year range), 20-29 years (10 year range), 30-39 years (10 year range), and 40-49 years (10 year range). In men the age ranges used were 20-29 years (10 year range), 30-39 years (10 year range), 40-49 years (10 year range), and 50-55 years (6 year range).

We did not know the age of some of the respondents and some ages were out of the specified age ranges in the target group. There were missing age values for 30 under five children (14 were out of range and 16 were missing), 49 school-aged children (5 were out of range and 44 were missing), 50 women (all missing) and 24 men (all missing). For under five children, the date of birth was recorded on the survey forms. Despite the fact that the forms had instructions regarding date of birth cut-offs on the forms and that all the interviewers received training that included a session on inclusion criteria by age prior to the survey, there were some problems with the ages of some under five children. In some instances, the calculated age was less than 6 months (sometimes in the negative range) (11 children) or greater than

59 months (3 children). Respondents with missing or an out of range age for the target group were excluded from the analysis.
The mean age for under five children was 2.6 ± 1.3 years, for school-aged children was 8.8 ± 2.0 years, for women was 28.5 ± 8.9 years and for men was 33.5 ± 9.0 years. Table 3-3 shows the age distribution of the study population.

**Table 3-3 Age distribution by region**

| Target group | Northern | | Central | | Southern | | National | |
|---|---|---|---|---|---|---|---|---|
| | N | % (CI) | N | % (CI) | N | % (CI) | N | % (CI) |
| **Under five children (n=1094)** | | | | | | | | |
| 6-11 months | 53 | 14.2 (10.9-18.3) | 43 | 12.1 (9.6-15.2) | 46 | 12.6 (9.6-16.4) | 142 | 12.6 (10.7-14.8) |
| 12-23 months | 87 | 23.3 (19.9-27.1) | 82 | 22.8 (19.1-27.0) | 78 | 21.4 (17.4-25.9) | 247 | 22. (19.8-24.9) |
| 24-35 months | 88 | 23.6 (19.8-27.9) | 88 | 28 (20.6-29.5) | 86 | 23.6 (19.8-27.8) | 262 | 24.1 (21.5-26.8) |
| 36-47 months | 76 | 20.4 (16.7 -24.6) | 86 | 24.2 (20.7-28.2) | 87 | 23.8 (20.1-28.0) | 249 | 23.6 (21.2-26.1) |
| 48-59 months | 69 | 18.5 (15.0-22.6) | 57 | 16.1 (12.8-20.0) | 68 | 18.6 (14.6-23.5) | 194 | 17.5 (15.1-20.3) |
| **School-aged children (n=758)** | | | | | | | | |
| 6-8 years | 120 | 49.4 (45.4-53.4) | 124 | 48.3 (42.8-53.7) | 116 | 45.0 (39.5-50.5) | 360 | 46.9 (43.5-50.3) |
| 9-12 years | 123 | 50.6 (46.6-54.6) | 133 | 51.8 (46.3-57.2) | 142 | 55.0 (49.5-60.5) | 398 | 53.1 (49.7-56.6) |
| **Women (n=754)** | | | | | | | | |
| 15-19 years | 46 | 17.4 (13.9-21.7) | 55 | 22.1 (17.7-27.3) | 29 | 12.0(8.6-16.5)* | 130 | 16.8 (14.3-19.7) |
| 20-29 years | 117 | 44.3 (38.5-50.3) | 99 | 39.8 (33.3-46.6) | 111 | 46.1 (40.1-52.2) | 327 | 43.3 (39.4-47.3) |
| 30-39 years | 63 | 23.9 (19.1-29.4) | 65 | 26.1 (21.0-32.0) | 57 | 23.7 (19.0-29.0) | 185 | 24.7 (21.5-28.1) |
| 40-49 years | 38 | 14.4 (11.1-18.4) | 30 | 12.1 (8.1-17.5) | 44 | 18.3 (13.8-23.8) | 112 | 15.2 (12.5-18.5) |
| **Men (n=173)** | | | | | | | | |
| 20-29 years | 24 | 36.4 (24.2-50.6) | 27 | 40.9 (28.9-54.1) | 15 | 36.6 (23.4-52.1) | 66 | 38.5 (30.2-47.5) |
| 30-39 years | 24 | 36.4 (24.3-50.4) | 22 | 33.3 (25.2-42.6) | 15 | 36.6 (22.5-53.4) | 61 | 35.1 (27.5-43.5) |
| 40-49 years | 17 | 25.8 (16.9-37.1) | 11 | 16.7 (9.6-27.3) | 8 | 19.5 (9.5-36.0) | 36 | 19.0 (13.0-27.0) |
| 50-55 years | 1 | 1.5 (0.2-10.3) | 6 | 9.1 (4.3-18.3) | 3 | 7.3 (2.3-21.2) | 10 | 7.4 (3.9-13.7) |

*Data are weighted to account for survey design, CI-Confidence Interval.*

## 3.5 Sex Distribution

Table 3-4 shows the sex distribution of the under five and school-aged children. Almost equal percentages of boys and girls were included in the survey and were comparable to the sex distribution found in the 2008 Malawi national census.

**Table 3-4 Sex distribution of under five children (6-59 months) and school-aged children (6-12 years)**

| Age category | Micronutrient Survey | | | | Malawi National Census 2008 | |
|---|---|---|---|---|---|---|
| | Male | | Female | | Male | Female |
| | N | % (CI) | N | % (CI) | % | % |
| Under five children | 517 | 48.5 (45.4-51.6) | 564 | 51.5 (48.4-54.6) | 49.4 | 50.6 |
| School-aged children | 378 | 51.4 (46.8-55.9) | 370 | 48.6 (44.1-53.2) | 49.4 | 50.6 |

*Data are weighted to account for survey design, CI-Confidence Interval, missing values: under five children (n=13), school-aged children (n=10)*

## 3.6 Marital Status

The distribution of the marital status of the men and women who were recruited in the survey is shown in Table 3-5. Most of the women who were interviewed as heads of households were married. However, there were more men who were married (81.6%) than women (66.8%). Of the married men, 91.6% were in a monogamous relationship while 8.4% were in a polygamous relationship.

**Table 3-5 Marital status of women (15-49 years) and men (20-55 years)**

| Marital Status Category | Women | | Men | |
|---|---|---|---|---|
| | N | % (CI) | N | % (CI) |
| Married | 513 | 66.8 (62.3-71.0) | 142 | 81.6 (74.2-87.3) |
| Widowed | 35 | 4.8 (3.4-6.8) | 2 | 1.7(0.4-7.0) |
| Divorced | 46 | 7.5 (5.7-9.7) | 3 | 2.8 (0.9-8.4) |
| Separated | 25 | 3.3 (2.1-5.0) | 1 | 0.7 (0.0-4.9) |
| Never married | 117 | 16.5 (13.3-20.3) | 19 | 12.0 (7.4-19.0 |
| Not married but living with partner | 11 | 1.3 (0.6-2.7) | 6 | 1.1(0.5-2.7) |

*Data are weighted to account for survey design, CI-Confidence Interval, missing values: men (n=6), women (n=7)*

## 3.7 Education Status

The level of education attained has an influence on health knowledge which in turn influences decision making on nutrition and health care issues. The respondents were, therefore, asked whether or not they were able to read and write and the highest level of formal education they had attained. Most of the women, 64.7%, reported that they were able to read and write. Similarly, most of the men, 84.2%, were able to read and write. Table 3-6 shows that significantly more women in the Northern region were able to read and write compared with the Central and Southern regions respectively. However there were no significant differences in the literacy levels in men by region.

**Table 3-6 Literacy level for women and men by region**

| | Northern | | Central | | Southern | | National | |
|---|---|---|---|---|---|---|---|---|
| **Self-reported literacy** | **N** | **% (CI)** | **N** | **% (CI)** | **N** | **% (CI)** | **N** | **% (CI)** |
| **Women** | | | | | | | | |
| Able to read and write | 203 | 76.9 (71.2-81.8) | 159 | 65.4 (56.0-73.8) | 145 | 60.4 (53.6-66.9)* | 507 | 64.7 (59.6-69.3) |
| **Men** | | | | | | | | |
| Able to read and write | 57 | 87.7 (77.7-93.4) | 51 | 79.7 (69.2-87.3) | 36 | 87.8 (73.1-95.0) | 144 | 84.2 (76.9-89.5) |

*Data weighted to account for survey design, *p<0.05 comparison across regions for each gender, CI-Confidence Interval, missing values: men (n=3), women (n=7)*

In terms of formal education, all the men reported to have received some education. However, there were some women (14.8%) who had received no formal education.

There was a significant difference in the levels of formal education in the women by region (Table 3-7). There were significantly more women who reported to have received formal education in the Northern region compared with the Central and Southern regions. However, there were no significant differences in the level of formal education by region in the men.

**Table 3-7 Formal education of the women and men by region**

| | Northern | | Central | | Southern | | National | |
|---|---|---|---|---|---|---|---|---|
| | N | % (CI) | N | % (CI) | N | % (CI) | N | % (CI) |
| **Women** | | | | | | | | |
| **Level of formal education*** | | | | | | | | |
| No formal education | 12 | 4.7 (2.4-9.1) | 27 | 10.9(6.7-17.3) | 49 | 21.0 (16.0-27.1)* | 88 | 14.8 (11.7-18.5) |
| Education up to std 5 | 63 | 24.9 (18.2-33.0) | 100 | 40.5 (33.5-47.9) | 82 | 35.2 (29.3-41.6) | 245 | 36.1 (32.0-40.4) |
| Education up to Std 6-8 | 117 | 46.3 (39.5-53.2) | 70 | 28.3 (22.5—35.0) | 61 | 26.2 (20.7-32.5) | 248 | 29.6 (25.9-33.6) |
| Education up to Sec & above | 61 | 24.1 (17.7-31.9) | 50 | 20.2(12.4-31.3) | 41 | 17.6 (12.9-23.5) | 152 | 19.5 (15.3-24.6) |
| **Men** | | | | | | | | |
| **Level of formal education** | | | | | | | | |
| No formal education | 0 | -- | 0 | -- | 0 | -- | 0 | -- |
| Education up to std 5 | 16 | 25.0 (14.9-38.8) | 19 | 32.2 (20.3-47.0) | 11 | 29.0 (16.6-45.5) | 46 | 30.0 (21.8-39.4) |
| Education up to Std 6-8 | 29 | 45.3 (31.7-59.7) | 19 | 32.2 (21.0-45.9) | 15 | 39.5 (26.0-54.8) | 63 | 37.1 (28.9-46.1) |
| Education up to Sec & Above | 19 | 29.7 (10.4-42.6) | 21 | 35.6 (24.3-48.7) | 12 | 31.6 (18.9-47.7) | 52 | 33.1(25.2-42.0) |

*Data weighted to account for survey design,* p<0.05 test signifies variable differs across groups, CI-Confidence Interval, missing values: women (n=21), men (n=12)*

## 3.8 Smoking Status

More men reported that they smoke compared with women. There were 29.2% men versus 2.7% women who reported smoking at the time of the survey.

## 3.9 Reproductive History of Women of Childbearing Age

There were 9.3% of women who reported that they were pregnant at the time of the survey, 90.4% of the women were not pregnant and 0.3% were not sure whether or not they were pregnant. Of those who reported being pregnant at the time of the survey, 37.1% were in the first trimester, 38.3% were in the second trimester and 24.6% were in the third trimester of pregnancy.

All women were also asked the number of times they had been pregnant (gravidity) and 16.4% had never been pregnant, whereas 83.6% had had at least one pregnancy (Table 3-8).

**Table 3-8 Number of pregnancies among women of childbearing age (15-49 years)**

| Number of pregnancies | Number of women | |
|---|---|---|
| | N | % (CI) |
| Never pregnant | 117 | 16.4(13.8-19.5) |
| 1-4 pregnancies | 397 | 53.1 (49.0-57.3) |
| 5-9 pregnancies | 205 | 27.9 (24.3-31.8) |
| 10-14 pregnancies | 16 | 2.5 (1.6-4.1) |

*Data are weighted to account for survey design, CI-Confidence Interval, missing values (n=69)*

Of the 619 women who reported to have ever been pregnant, 1.9% had no living children (Table 3-9). The 15 women who had ten to twelve children had lost one or two children.

**Table 3-9 Number of living children among women of child bearing age (15-49 years)**

| Number of living children | Number of women (n=619) | |
|---|---|---|
| | N | % (CI) |
| No children | 9 | 1.9 (0.9-3.9) |
| 1-4 children | 453 | 74.6 (70.3-78.4) |
| 5-10 children | 139 | 23.5 (19.8-27.7) |

*Data are weighted to account for survey design, CI-Confidence Interval, missing values (n=36)*

## 3.10 Tribal Groups

There are several tribal groups in Malawi with their own distinct languages and cultural practices which have an impact on health and nutrition practices. Table 3-10 shows the tribal distribution of the 1,791 households included in the survey.

**Table 3-10 Frequency distribution of tribal groups**

| | North | | Central | | South | | National | |
|---|---|---|---|---|---|---|---|---|
| Tribal groups | N | % (CI) | N | % (CI) | N | % (CI) | N | % (CI ) |
| Chewa | 27 | 4.8 (3.1-7.5) | 393 | 70.9 (59.0-80.5) | 61 | 10.9 (7.2-16.3)* | 481 | 35.0(30.1-40.3) |
| Lomwe | 3 | 0.5 (0.1-2.3) | 9 | 1.6 (0.8-3.2) | 209 | 37.4 (27.8-48.1) | 221 | 18.3 (13.9-23.7) |
| Tumbuka | 293 | 52.1 (41.7-62.4) | 31 | 5.6 (2.7-11.5) | 5 | 0.9 (0.3-2.8) | 329 | 8.8 (6.9-11.3) |
| Ngoni | 34 | 6.2 (3.9-9.4) | 64 | 11.6 (5.8-21.7) | 50 | 8.9 (4.7-16.4) | 148 | 9.7 (6.3-14.7) |
| Yao | 8 | 1.4 (0.8-2.7) | 31 | 5.6 (2.2-13.3) | 126 | 22.5 (14.5-33.3) | 165 | 13.1 (8.9-18.8) |
| Sena | 0 | -- | 5 | 0.9 (0.3-3.3) | 34 | 6.1 (2.5-14.1) | 39 | 3.2 (1.5-7.0) |
| Tonga | 62 | 11.0 (5.3-21.5) | 6 | 1.1 (0.4-2.6) | 1 | 0.2 (0.0-1.3) | 69 | 1.8 (1.1-3.2) |
| Nkhonde | 40 | 7.1 (3.0-16.0) | 2 | 0.4 (0.0-1.4) | 0 | -- | 42 | 1.0 (0.5-2.1) |
| Lambya | 34 | 6.1 (2.7-13.2) | 0 | -- | 0 | -- | 34 | 0.7 (0.3-1.6) |
| Senga | 7 | 1.3 (0.5-3.3) | 3 | 0.5 (0.0-3.8) | 0 | -- | 10 | 0.4 (0.1-1.3) |
| Other | 54 | 9.6 (4.4-19.7) | 10 | 1.8 (0.8-4.0) | 73 | 14.8 (8.8-23.8) | 137 | 8.0 (5.7-11.1) |

*Data are weighted to account for survey design, CI-Confidence Interval, missing values: * p<0.05 test signifies variable differs across groups, Central region (n=38), Northern region (n=37) and Southern region (n=41)*

## 3.11 Household Economic Status

Household economic status is known to be associated with nutrition status and morbidity patterns. Thus an understanding of household economic characteristics helps to explain some variations in health and nutrition status. In the present survey, data was collected on the following parameters to assess the household economic status: type of housing, sanitation, water supply, household assets and type of fuel used for cooking.

### 3.11.1 Housing Conditions

The majority of the households (67.4%) had grass-thatched roofs with an average of 2.7 rooms per household (Table 3-11).

**Table 3-11 Housing characteristics**

| Characteristics | N | % (CI) |
|---|---|---|
| **Roofing materials** | | |
| Grass thatch | 1138 | 66.8 (60.6-72.5) |
| Corrugated iron sheets | 511 | 31.7 (26.2-37.7) |
| Tiles | 9 | 0.6 (0.3-1.3) |
| Wood planks | 1 | 0.0 (0.0-0.02) |
| Other | 14 | 0.9 (0.5-1.5) |
| **Number of Rooms in Main House** | | |
| 1 Room | 227 | 15.6 (12.8-18.9) |
| 2 Rooms | 551 | 35.7 (32.7-38.8) |
| 3 Rooms | 431 | 26.6 (23.8-29.7) |
| > 4 Rooms | 391 | 22.1 (19.1-25.5) |

*Data are weighted to account for survey design, CI-Confidence Interval, missing values for roofing materials (n=118), number of rooms (n=191)*

### 3.11.2 Ownership of Household Assets

Asset ownership is also a proxy indicator of economic status. In addition to providing an indicator of economic status, ownership of these goods provides measures of other aspects of life. Ownership of a radio or television is a measure of access to mass media; ownership of a refrigerator indicates a capacity for more hygienic food storage; and ownership of a bicycle, motorcycle, or car reflects means of transport, which can be important for seeking emergency medical care or taking advantage of employment opportunities. Ownership of a telephone opens up communication with other users[30]. A list of 8 household assets was read out to the head of the households in order to assess availability of the assets in the household. Households that possessed more assets were assumed to have a higher socioeconomic status. Up to 30.0% (n=477) of the households owned none of the assets, Table 3-12.

[30] Malawi Demographic Health Survey, 2004.

**Table 3-12 Ownership of household assets by region**

| Household Assets | Northern | | Central | | Southern | | National | |
|---|---|---|---|---|---|---|---|---|
| | N | % (CI) | N | % (CI) | N | % (CI) | N | % (CI) |
| **Selected list of assets** | | | | | | | | |
| Radio | 346 | 61.7 (56.0-67.1) | 313 | 56.5 (50.3-62.5) | 313 | 56.1 (51.6-60.5) | 972 | 56.9 (53.5-60.2) |
| Television | 59 | 10.6 (6.6-16.5) | 64 | 11.7 (6.2-21.0) | 46 | 8.3 (5.4-12.5) | 169 | 9.9 (7.0-13.9) |
| Bicycle | 212 | 37.9 (32.8-43.3) | 195 | 35.2 (31.1-39.6) | 237 | 42.6 (37.1-48.2) | 644 | 39.0 (35.8-42.2)* |
| Motorcycle | 4 | 7.2 (0.2-2.3) | 3 | 0.6 (0.1-2.3) | 4 | 0.7 (0.3-1.9) | 11 | 0.7 (0.3-1.3) |
| Oxcart | 25 | 4.5 (2.8-7.2) | 21 | 3.8 (2.5-5.8) | 4 | 0.7 (0.2-2.3) | 50 | 2.4 (1.7-3.4) |
| Car or Truck | 15 | 2.7 (1.0-7.1) | 24 | 4.3 (1.7-10.8) | 7 | 1.3 (0.6-2.8) | 46 | 2.7 (1.4-5.2) |
| Mobile phone | 261 | 46.6 (39.2-54.2) | 178 | 32.1 (24.2-41.3) | 193 | 34.7 (27.9-42.1) | 632 | 35.0 (30.2-40.1) |
| Canoe/boat | 27 | 5.0 (1.9-12.4) | 5 | 1.0 (0.4-2.1) | 13 | 2.4 (`.2-4.7) | 45 | 2.1 (1.3-3.3)* |
| **Assets per household** | | | | | | | | |
| 0 (no assets owned) | 133 | 23.7 (19.6-28.3) | 181 | 32.7(27.5-38.3) | 163 | 29.3 (25.3-33.6) | 477 | 30.0 (27.1-33.1) |
| 1 Asset owned | 136 | 24.2 (20.3-28.6) | 137 | 24.7 (21.4-28.4) | 132 | 23.7 (20.0-27.9) | 405 | 24.2 (21.9-26.7) |
| 2 Assets owned | 139 | 24.7 (20.4-30.0) | 114 | 20.6 (17.9-23.6) | 141 | 25.3 (21.4-29.7) | 394 | 23.3 (21.0-25.7) |
| 3 Assets owned | 96 | 17.1 (13.9-20.9) | 68 | 12.3 (8.9-16.8) | 90 | 16.1 (12.3-21.0) | 254 | 14.7 (12.2-17.5) |
| 4 or more Assets owned | 58 | 10.3 (7.0-15.0) | 54 | 9.8 (5.6-16.4) | 31 | 5.6 (3.7-8.4) | 143 | 7.9 (5.7-10.7) |

*Data are weighted to account for survey design, CI-Confidence Interval, missing values: radio (n=118), television (n=129), bicycle (n=121), motorcycle (n=127), ox-cart (n=125), car or truck (n=119), mobile phone (n=120), boat with motor (n=142).*

### 3.11.3 Household Cooking Fuel

The heads of the households were asked about the type of fuel they use for meal preparation and other domestic use. The majority of the households [88.9% (n=1,506)] use firewood for cooking. Table 3-13 shows the type of cooking fuel used by households in Malawi.

**Table 3-13 Type of household cooking fuel**

| Household Cooking Fuel | N | % (CI) |
|---|---|---|
| Firewood | 1,506 | 88.9 (82.7-93.1 |
| Cow dung | 2 | 0.1 (0.0-0.5) |
| Paraffin | 1 | 0.0 (0.0-0.6) |
| Charcoal | 117 | 7.8 (4.5-13.1) |
| Electricity | 40 | 2.5 (1.1-5.4) |

*Data are weighted to account for survey design, CI-Confidence Interval, missing values (n=125)*

### 3.11.4 Source of Drinking Water

Proper sanitation and access to clean and safe water help prevent transmission of infections. The heads of households were asked their current main source of drinking water. Most of the households, 82.8% had access to clean and safe water supplies i.e. their source of water was either boreholes, protected shallow wells, piped water or public tap water kiosks. A total of 17.2% of the households had a reported source of water that was not safe i.e. lake, rivers, small pond or unprotected shallow wells. Table 3-14 shows the regional distribution of household water sources.

**Table 3-14 Distribution of main source of household drinking water by region**

| Water source | Northern | | Central | | Southern | | National | |
|---|---|---|---|---|---|---|---|---|
| | N | % (CI) | N | % (CI) | N | % (CI) | N | % (CI) |
| Piped water in dwelling | 53 | 9.5 (4.8-18.0) | 65 | 11.7 (5.5-23.3) | 22 | 3.9 (1.8-8.5)* | 140 | 7.8 (4.7-12.7) |
| Public Tap Water Kiosk | 69 | 12.3 (6.9-21.2) | 55 | 9.9 (4.5-20.6) | 107 | 19.1 (10.8-31.7) | 231 | 14.5 (9.6-21.4) |
| Borehole | 249 | 44.5 (33.9-55.7) | 287 | 51.8 (40.2-63.2) | 347 | 62.1 (49.7-73.1) | 883 | 55.8 (48.2-63.1) |
| Protected Shallow Well | 30 | 5.4 (3.7-7.7) | 28 | 5.1 (2.6-9.8) | 23 | 4.1 (2.4-7.1) | 81 | 4.7 (3.2-6.8) |
| Unprotected Shallow Well | 148 | 26.5 (18.2-36.9 | 119 | 21.5 (14.0-31.4) | 60 | 10.7 (6.0-18.6) | 327 | 17.0 (12.8-22.3) |
| Other | 10 | 1.8(0.6-5.1) | 0 | -- | 0 | -- | 10 | 0.2 (0.0-0.6) |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, missing values (n=119)*

### 3.11.5 Availability of Sanitation Facilities

The heads of the households were also asked about the type of sanitary facilities they use for disposal of faecal matter. Table 3-15 shows that 93.2% of the households had sanitary facilities i.e. flush toilet, pit latrine or VIP where as 6.3% had none. Out of 1,571 households with sanitary facilities, 84.7% had pit latrines and 5.7% had flush toilets. Households in the Southern region had higher access to sanitary facilities as only 0.2% of households had no sanitary facilities, compared with 0.5 % in the Northern region and 0.7% in the Central region respectively.

**Table 3-15 Type of sanitary facilities by region**

| Sanitary facilities | Northern | | Central | | Southern | | National | |
|---|---|---|---|---|---|---|---|---|
| | N | % (CI) | N | % (CI) | N | % (CI) | N | % (CI) |
| Flush toilet | 18 | 3.2 (1.0-9.6) | 57 | 10.3 (4.4-22.1) | 13 | 2.3 (0.4-11.9)* | 88 | 5.7 (2.9-11.2) |
| Pit latrine | 474 | 84.5 (79.0-88.7) | 438 | 79.1 (69.6-86.2) | 501 | 89.8 (83.4-93.9) | 1,413 | 84.7 (80.0-88.5) |
| VIP | 48 | 8.6 (5.5-13.2) | 9 | 1.6 (0.8-3.2) | 13 | 2.3 (1.2-4.5) | 70 | 2.8 (2.0-3.9) |
| Bush/river/lake | 18 | 3.2 (1.9-5.4) | 46 | 8.3 (5.0-13.5) | 30 | 5.4 (3.0-9.4) | 94 | 6.3 (4.4-9.0) |
| Other | 3 | 0.5 (0.2-1.6) | 4 | 0.7 (0.3-1.9) | 1 | 0.2 (0.0-1.3) | 8 | 0.5 (0.2-1.0) |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, missing values (n=118)*

### 3.11.6 Index of Socioeconomic status

A composite index of socioeconomic status (SES) similar to the index used in National Micronutrient Survey conducted in 2001 was created using data on household type of cooking fuel, water source, type of toilet, household roofing material, household floor type, number of rooms, and ownership of various household items including radio, television, bicycle, motorcycle, car, oxcart, mobile phone and canoe (Appendix XV). Sufficient information (at least 12 of the 14 items) on all the variables included in the SES index was available for 1,673 households, which represents 93.5% of the sample. Socioeconomic status was classified as follows: 0-2 (low SES), 3-4 (moderate SES) and 5-12 (high SES); 43.1% of households were in the low SES, 30.9% were in the moderate and 26.0% were in the high SES categories. There was a significant difference in the SES status across the three regions, Table 3-16.

**Table 3-16 Household socioeconomic status (SES) by region**

| SES | Northern | | Central | | Southern | | National | |
|---|---|---|---|---|---|---|---|---|
| | N | % (CI) | N | % (CI) | N | % (CI) | N | % (CI) |
| Low | 221 | 39.3 (32.6-46.4) | 283 | 51.2 (43.4-58.9) | 206 | 36.9 (30.9-43.4)* | 710 | 43.1 (38.7-47.6) |
| Moderate | 175 | 31.1 (26.8-35.9) | 137 | 24.8 (21.1-28.8) | 202 | 36.2 (31.9-40.7) | 514 | 30.9 (28.3-33.6) |
| High | 166 | 29.5 (23.1-36.9) | 133 | 24.1 (15.9-34.6) | 150 | 26.9 (21.3-33.4) | 449 | 26.0 (21.5-31.2) |

*Data are weighted to account for survey design, CI-Confidence Interval, missing values (n=118)*

# 4. Anthropometric Status

This chapter provides results from the anthropometry measurements from under five children (6-59 months), school-aged children and non-pregnant women of childbearing age (15-49 years). The organization of this chapter is as follows:

- Under five children
    - Stunting (Height for age z-score)
    - Underweight (Weight for age z-score)
    - Wasting (Weight for height z-score)
- School-aged children
    - Mean height and weight
    - Stunting (Height for age z-score)
    - Underweight (Weight for age z-score)
    - Body mass index (BMI z-score)
- Non-pregnant women of childbearing age
    - Mean height and weight
    - Body mass index (BMI)

## 4.1 Anthropometric status of under five children

### 4.1.1 Stunting (Height-for-Age)

A total of 980 out of 1,094 under five children had valid length or height measurements and age data to calculate height-for-age z-scores (HAZ). The prevalence of stunting (HAZ<-2 SD) was 48.8% and the prevalence of severe stunting (HAZ<-3SD) was 17.9%. The under five children had an overall HAZ mean of -1.8 which was lower than the international reference mean of 0.0. As a measure of data quality (refer to Methods section 2.11.10), the unweighted HAZ standard deviation was 2.2. A Z-score SD >1.3 is suggestive of inaccurate anthropometric measurements and/or inaccurate age information.

Significant differences in the prevalence of stunting were found by age, sex, SES and region. The highest prevalence of stunting was seen in children aged 36-47 months (59.3%) and the lowest prevalence of stunting was seen in children aged 6-11 months (22.8%). A significantly higher prevalence of severe stunting was found in males (21.5%) compared with females (14.5%). Furthermore, there was a significant difference in the prevalence of stunting by SES; the highest prevalence was seen in children in the low SES group. A significantly lower prevalence of stunting was found in children living in the Northern region compared with the Central and Southern regions respectively, Table 4-1.

**Table 4-1 Height-for-age Z-score (HAZ) summary statistics for under five children**

| **Characteristics** | N | Using 2006 WHO reference growth charts Prevalence, % (CI) | |
|---|---|---|---|
| | | <-3SD | <-2SD |
| **Age groups (months** | | | |
| 6-11 | 128 | 7.5 (3.3-15.8)* | 22.8 (16.2-31.1)* |
| 12-23 | 214 | 16.0 (10.8-23.0) | 46.1 (38.7-53.7) |
| 24-35 | 229 | 16.3 (11.8-22.2) | 50.8 (42.8-58.9) |
| 36-47 | 230 | 25.6 (18.2-34.6) | 59.3 (52.1-66.1) |
| 48-59 | 179 | 19.2 (13.2-27.1) | 53.7 (44.9-62.2) |
| **Sex** | | | |
| Male | 464 | 21.5 (17.0-26.9)* | 52.4 (45.8-58.8) |
| Female | 516 | 14.5 (11.0-19.0) | 45.6 (40.6-50.6) |
| **SES** | | | |
| Low | 392 | 23.3 (18.2-29.4)* | 58.4 (52.3-64.0)* |
| Moderate | 348 | 15.5 (11.3-20.1) | 45.1 (39.4-50.9) |
| High | 240 | 12.5 (7.1-20.9) | 37.7 (29.7-46.5) |
| **Residence** | | | |
| Urban | 121 | 17.0 (8.4-31.4) | 38.0 (23.5-55.0) |
| Rural | 859 | 18.0 (14.5-22.1) | 50.2 (45.6-54.8) |
| **Region** | | | |
| Northern | 327 | 10.1 (6.8-14.7) | 35.8 (29.7-42.4)* |
| Central | 321 | 19.7 (14.0-26.8) | 52.7 (45.1-60.1) |
| Southern | 332 | 18.4 (13.8-24.1) | 48.8 (42.0-55.6) |
| **National** | **980** | **17.9 (14.5-21.8)** | **48.8 (44.3-53.4)** |

*Data are weighted to account for survey design; CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, of the under five children with data on height-for age, there was no missing data on sex, SES, residence and region*

### 4.1.2 Underweight (Weight-for age)

A total of 981 out of 1,094 under five children had valid weight measurements and age data to calculate weight-for-age z-scores (WAZ). The proportion of children who were underweight (WAZ<-2 SD) was 12.1% and 3.6% of the children were classified as being severely underweight (WAZ<-3 SD), Table 4-2. The under five children had an overall WAZ mean of -0.8, which was lower than the international reference mean of 0.0. As a measure of data quality (refer to Methods section 2.11.10), the unweighted WAZ standard deviation was 1.2. There were significant differences in the prevalence of children who were underweight by SES with the highest prevalence in children in the low SES group. Additionally, a significantly higher prevalence of underweight children was found in rural compared with urban areas.

**Table 4-2 Weight-for-age Z-score (WAZ) summary statistics for under five children**

| **Characteristics** | N | Using 2006 WHO reference growth charts | Prevalence, % (CI) |
|---|---|---|---|
| | | <-3SD | <-2SD |
| **Age groups (months** | | | |
| 6-11 | 127 | 4.2 (1.3-13.3) | 8.5 (4.2-16.5) |
| 12-23 | 223 | 6.4 (3.4-11.5) | 12.0 (7.9-17.7) |
| 24-35 | 227 | 3.0 (1.3-6.6) | 10.8 (7.2-15.9) |
| 36-47 | 227 | 2.9 (1.1-7.6) | 15.9 (10.5-23.3) |
| 48-59 | 177 | 1.5 (0.3-5.6) | 11.3 (7.3-17.2) |
| **Sex** | | | |
| Male | 474 | 3.4 (2.0-5.8) | 12.9 (9.7-17.1) |
| Female | 507 | 3.8 (2.4-6.0) | 11.3 (8.5-14.9) |
| **SES** | | | |
| Low | 396 | 4.6 (2.7-7.8) | 15.4 (11.8-20.0)* |
| Moderate | 344 | 2.9 (1.4-6.0) | 11.7 (8.4-16.2) |
| High | 241 | 3.0 (1.1-7.4) | 6.8 (3.9-11.4) |
| **Residence** | | | |
| Urban | 125 | 0.7 (0.01-4.8)* | 3.9 (1.6-9.1)* |
| Rural | 856 | 4.0 (2.8-5.8) | 13.2 (10.7-16.1) |
| **Region** | | | |
| Northern | 314 | 1.6 (0.6-4.3) | 7.3 (4.5-11.7) |
| Central | 329 | 4.3 (2.5-7.3) | 13.7 (10.0-18.4) |
| Southern | 338 | 3.6 (2.0-6.2) | 11.8 (8.6-16.0) |
| **National** | **981** | **3.6 (2.5-5.3)** | **12.1 (9.8-14.8)** |

*Data are weighted to account for survey design; CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, of the under five children with data on weight-for age, there was no missing data on sex, SES, residence and region )*

### 4.1.3 Wasting (Weight-for-height)

A total of 968 out of 1,094 under five children had valid weight and length or height measurements and age data to calculate weight-for-age z-scores (WHZ). The prevalence of wasting (WHZ<-2 SD) was 1.8% and the prevalence of severe wasting (WHZ<-3 SD) was 0.3%, Table 4-3. The under five children had an overall WHZ mean of 0.4, which was slightly higher than the international reference mean of 0.0. As a measure of data quality (refer to Methods section 2.11.10), the unweighted WHZ standard deviation was 1.1. There were no significant differences in the prevalence of wasting by age, sex, residence, SES and region. Due to the very small numbers of children who were severely wasted, an analysis of the association between the prevalence of severe wasting and socio-demographic characteristics was not conducted.

The proportion of overweight (WHZ>2SD) children was 4.9% and obesity (WHZ>3SD) was 0.5%. There was no significant difference in the proportion of children who were overweight by age, gender, residence and region but there was a significant difference by SES; the proportion of under five children in the moderate SES who were overweight were significantly less than in the low and high SES groups. Due to the very small numbers of children who were obese, an analysis of the association between the prevalence of obesity and socio-demographic characteristics was not conducted.

**Table 4-3 Weight-for-height Z-score (WHZ) summary statistics of under five children**

| **Characteristics** | N | Using WHO 2006 reference growth charts Prevalence, % (CI) | |
|---|---|---|---|
| | | <-2SD | >2 SD |
| **Age groups (months)** | | | |
| 6-11 | 125 | 5.3 (1.9-14.0) | 0.9(4.6-17.1) |
| 12-23 | 215 | 1.8 (0.4-7.4) | 4.0 (2.0-8.1) |
| 24-35 | 227 | 1.2 (0.3-4.6) | 4.7 (2.5-8.6) |
| 36-47 | 224 | 1.2 (0.3-4.5) | 5.1 (2.9-8.9) |
| 48-59 | 177 | 1.0 (0.2-4.8) | 3.2 (1.3-7.6) |
| **Sex** | | | |
| Male | 465 | 2.0 (1.0-4.0) | 6.2 (4.2-9.2) |
| Female | 503 | 1.6 (0.8-3.4) | 3.7 (2.2-6.3) |
| **SES** | | | |
| Low | 390 | 1.7 (0.7-4.4) | 5.2 (3.3-8.3)* |
| Moderate | 344 | 1.5 (0.6-4.0) | 2.4 (1.3-4.7) |
| High | 234 | 2.3 (0.9-5.9) | 8.1 (4.8-13.2) |
| **Residence** | | | |
| Urban | 123 | 1.1 (0.2-7.5) | 4.8 (2.0-11.1) |
| Rural | 845 | 1.9 (1.0-3.4) | 4.9 (3.6-6.8) |
| **Region** | | | |
| Northern | 309 | 0.3 (0.00-2.3) | 5.5 (3.4-8.8) |
| Central | 325 | 1.5 (0.6-4.1) | 5.2 (3.3-8.2) |
| Southern | 334 | 2.4 (1.2-4.8) | 4.5 (2.7-7.3) |
| **National** | **968** | **1.8 (1.0-3.2)** | **4.9(3.6-6.6)** |

*Data are weighted to account for survey design; Confidence Interval, of the under five children with data on weight for height, there was no missing data on sex, SES, residence and region*

## 4.2 Anthropometric Status of School-aged children

### 4.2.1 Mean weight and height

Out of the 758 school-aged children, 698 had valid height measurements and 696 had weight measurements. Mean values of height and weight for the school-aged children are reported by various demographic characteristics in Table 4-4.

**Table 4-4 Mean height and weight in school-aged children (6-12 years)**

| Characteristics of school-aged children | N | Mean height ± SD (cm) | N | Mean weight ± SD (kg) |
|---|---|---|---|---|
| **Age group (years)** | | | | |
| 6-7 | 230 | 112.1 ± 10.2 | 229 | 19.6 ± 3.1 |
| 8-9 | 206 | 122.4 ± 12.5 | 205 | 23.9 ± 4.2 |
| 10-11 | 178 | 130.9 ± 12.4 | 178 | 28.1 ± 5.7 |
| 12 | 84 | 136.8 ± 8.9 | 84 | 31.0 ± 5.9 |
| **Education (years)** | | | | |
| **0** | 59 | 115.2 ± 14.5 | 59 | 20.8 ± 6.6 |
| **1** | 237 | 115.1 ± 11.3 | 235 | 20.8 ± 3.6 |
| **2** | 145 | 123.4 ± 13.0 | 145 | 24.7 ± 4.4 |
| **3** | 138 | 130.1 ± 12.5 | 138 | 27.7 ± 4.9 |
| **4** | 71 | 135.3 ± 7.6 | 71 | 29.8 ± 4.7 |
| **5** | 22 | 136.8 ± 6.1 | 22 | 30.1 ± 3.9 |
| **6-8** | 24 | 142.7 ± 9.2 | 24 | 35.1 ± 8.5 |
| **Sex** | | | | |
| Male | 349 | 123.2 ± 15.9 | 348 | 24.8 ± 5.6 |
| Female | 339 | 122.5 ± 12.6 | 338 | 23.9± 6.3 |
| **SES** | | | | |
| Low | 285 | 123.8 ± 12.7 | 285 | 24.7 ±6.3 |
| Moderate | 221 | 121.7 ± 14.7 | 219 | 23.7 ±5.5 |
| High | 190 | 122.9 ± 16.5 | 190 | 24.7 ±6.0 |
| **Residence** | | | | |
| Urban | 78 | 124.9 ± 12.4 | 78 | 24.8 ± 6.6 |
| Rural | 6208 | 122.7 ± 14.6 | 618 | 24.4 ± 5.9 |
| **Region** | | | | |
| Northern | 223 | 124.9 ±18.4 | 223 | 25.5 ± 10.5 |
| Central | 241 | 121.3 ± 13.4 | 241 | 23.8 ± 5.1 |
| Southern | 234 | 123.9 ± 12.5 | 232 | 24.7 ± 5.2 |
| **National** | **698** | **122.9 ± 14.4** | **696** | **24.4 ± 6.0** |

*Mean ± SD are weighted to account for survey design, SD- Standard Deviation, of the school-aged children that had valid height measurements, there were missing values for education (2), sex (10), SES (2); of the school-aged children that had valid weight measurements, there were missing values for education (n=2), SES (n=2), sex (n=10)*

### 4.2.2 Prevalence of stunting in school-aged children

A total of 684 out of 758 school-aged children had valid height measurements and age data to calculate height-for-age z-scores (HAZ). The prevalence of stunting (HAZ<-2 SD) was 31.0% and the prevalence of severe stunting (HAZ<-3SD) was 8.8%. The school-aged children had an overall HAZ mean of -1.3 which was lower than the international reference mean of 0.0. As a measure of data quality (refer to Methods section 2.11.10), the unweighted HAZ standard deviation was 1.4. A Z-score SD >1.3 is suggestive of inaccurate anthropometric measurements and/or inaccurate age information.

Significant differences in the prevalence of stunting were found by age, education, SES, residence and region. The prevalence of stunting increased with age but decreased with an increase in the level of education and SES. The prevalence of stunting was higher in rural compared with urban areas and in the Central and Southern region compared with the Northern region, Table 4-5.

**Table 4-5 Height-for-age Z-score (HAZ) summary statistics for school-aged children**

| **Characteristics** | N | Using 2007 WHO reference growth charts Prevalence, % (CI) | |
|---|---|---|---|
| | | <-3SD | <-2SD |
| **Age group (years)** | | | |
| 6-7 | 228 | 7.6 (4.3-13.1)* | 27.3 (20.8-34.9)* |
| 8-9 | 201 | 7.2 (3.8-13.2) | 28.8 (21.6-37.1) |
| 10-11 | 175 | 7.7 (4.5-12.8) | 29.5 (22.6-37.6) |
| 12 | 80 | 19.1 (11.9-29.2) | 50.7 (39.0-62.3) |
| **Education (years)** | | | |
| **0** | 57 | 20.4 (12.0-32.6)* | 42.3 (29.7-56.6)* |
| **1** | 234 | 10.3 (6.9-15.2) | 37.6 (31.3-44.4) |
| **2** | 139 | 7.6(4.0-14.1) | 29.7 (21.2-39.9) |
| **3** | 137 | 4.9(1.8-12.6) | 25.3(18.3-33.9) |
| **4** | 67 | 2.5 (0.5-11.4) | 18.2 (9.7-31.6) |
| **5** | 22 | 5.0 (0.7-28.8) | 11.7 (3.5-32.9) |
| **6-8** | 24 | 0 | 14.3(3.9-40.8) |
| **Sex** | | | |
| Male | 339 | 8.3 (5.4-12.5) | 32.4(26.7-38.7) |
| Female | 345 | 9.5 (6.2-14.2) | 29.6 (24.3-35.4) |
| **SES** | | | |
| Low | 278 | 12.2 (8.1-18.1)* | 36.7(29.5-44.2)* |
| Moderate | 217 | 9.5 (6.0-14.9) | 33.5 (26.4-41.4) |
| High | 187 | 2.8 (1.1-6.8) | 19.1 (13.0-27.1) |
| **Residence** | | | |
| Urban | 77 | 4.2 (1.0-16.5) | 18.0 (10.0-30.2)* |
| Rural | 607 | 9.4 (6.8-13.0) | 32.7 (28.4-37.3) |
| **Region** | | | |
| Northern | 220 | 5.5 (3.1-9.4) | 19.1 (14.0-25.5)* |
| Central | 234 | 11.5 (7.0-18.4) | 38.9 (31.0-47.4) |
| Southern | 230 | 7.4 (4.6-11.7) | 27.4 (22.8-32.5) |
| **National** | **684** | **8.8 (6.4-12.1)** | **31.0 (27.0-35.4)** |

*Data are weighted to account for survey design; CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, for school-aged children with height-for-age data there missing values for SES (2), and education (4))*

### 4.2.3 Prevalence of underweight in school-aged children

A total of 520 out of 758 school-aged children who were aged between 6 and 12 years had valid weight measurements and age data to calculate weight-for-age z-scores (WAZ). The prevalence of underweight (WAZ<-2 SD) was 14.4% and the prevalence of severe underweight (WAZ<-3SD) was 3.8%. The school-aged children had an overall WAZ mean of -0.9 which was lower than the international reference

mean of 0.0. As a measure of data quality (refer to Methods section 2.11.10), the unweighted WAZ standard deviation was 1.2.

Significant differences in the prevalence of underweight were found by age, education, residence and region. The proportion of underweight school-aged children decreased with an increase in the level of education and SES, but increased with age. The proportion of underweight school-aged children was higher in rural compared with urban areas, and in the Central region compared with the Northern and Southern region, Table 4-6. There were very few children who had WAZ>2 (0.4%) and WAZ>3 (0.08%).

**Table 4-6 Weight-for-age Z-score (WAZ) summary statistics for school-aged children**

| **Characteristics** | N | Using 2007 WHO reference growth charts Prevalence, % (CI) (n=523) | |
|---|---|---|---|
| | | <-3SD | <-2SD |
| **Age group (years)** | | | |
| 6-7 | 228 | 2.4 (1.0-5.8) | 10.0 (6.3-15.4)* |
| 8-9 | 201 | 4.1 (2.1-8.1) | 16.5 (10.9-24.1) |
| 10 | 91 | 6.3 (2.6-14.4) | 20.9 (12.9-31.9) |
| | | | |
| **Education (years)** | | | |
| **0** | 51 | 9.2 (3.8-20.8) | 22.4 (13.2-35.4)* |
| **1** | 223 | 4.4 (2.2-8.6) | 18.3(13.1-24.9) |
| **2** | 112 | 2.4 (0.6-9.1) | 10.5 (5.7-18.6) |
| **3** | 86 | 1.8 (0.2-12.1) | 6.2 (2.3-15.5) |
| **4** | 32 | 0 | 4.9 (0.7-28.5) |
| **5** | 8 | 0 | 0 |
| **6-8** | 5 | 0 | 0 |
| **Sex** | | | |
| Male | 250 | 5.0 (2.6-9.5) | 15.1 (9.8-22.6) |
| Female | 270 | 2.5 (1.1-5.8) | 13.6 (9.4-19.4) |
| **SES** | | | |
| Low | 204 | 5.3 (2.3-11.6) | 17.5 (11.6-25.3) |
| Moderate | 171 | 5.0 (2.5-9.7) | 15.4 (9.9-23.2) |
| High | 143 | 0 | 7.9(3.4-17.2) |
| **Residence** | | | |
| Urban | 62 | 0 | 2.9 (0.6-12.4)* |
| Rural | 458 | 4.3 (2.4-7.6) | 15.9 (12.0-20.7) |
| **Region** | | | |
| Northern | 185 | 2.4 (0.9-5.9) | 7.7(4.7-12.2)* |
| Central | 169 | 4.3 (2.0-9.2) | 20.0 (13.7-28.3) |
| Southern | 166 | 3.6 (1.2-10.1) | 10.8 (6.6-17.3) |
| **National** | **520** | **3.8 (2.1-6.7)** | **14.4 (10.8-18.9)** |

*Data are weighted to account for survey design; CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, for school-aged children with height-for-age data there missing values for SES (2), and education (3)*

### 4.2.4 Body Mass Index in school-aged children

There were 1.7% school-aged children who were thin (BAZ<-2 SD) and 0.2% of the school-aged children were extremely thin (BAZ<-3 SD). There were significant differences in the prevalence of thinness by age, Table 4-7. The prevalence of obesity in school-aged children (BAZ>2SD) was 0.8%. Due to the small numbers, variation in obesity across the socio-demographic characteristics was not assessed.

**Table 4-7 Distribution of Body Mass Index by age according to demographic characteristics in school-aged children (6-12 years)**

| **Characteristics of school-aged children,** | **N** | **Using WHO 2006 reference growth charts Prevalence, % (CI)** |
|---|---|---|
| | | <-2 SD |
| **Age group (years)** | | |
| 6-7 | 227 | 0.7 (0.2-3.3)* |
| 8-9 | 199 | 2.8 (1.1-6.7) |
| 10-11 | 176 | 0.8 (0.1-5.5) |
| 12 | 80 | 4.2 (1.4-12.1) |
| **Education (years)** | | |
| 0 | 56 | 2.2 (0.3-14.7) |
| 1 | 232 | 2.1 (0.8-5.5) |
| 2 | 140 | 1.2 (0.3-5.2) |
| 3 | 137 | 2.0 (0.6-6.4) |
| 4 | 67 | 1.9 (0.3-12.6) |
| 5 | 22 | 0 |
| 6 | 24 | 0 |
| **Sex** | | |
| Male | 344 | 1.2 (0.4-3.4) |
| Female | 338 | 2.3 (1.0-5.4) |
| **SES** | | |
| Low | 278 | 1.9 (0.6-5.7) |
| Moderate | 215 | 2.6 (1.1-6.3) |
| High | 187 | 0.5 (0.1-1.8) |
| **Residence** | | |
| Urban | 77 | 3.7 (0.7-17.6) |
| Rural | 605 | 1.5 (0.7-3.2) |
| **Region** | | |
| Northern | 220 | 1.8 (0.7-4.7) |
| Central | 233 | 1.7 (0.4-6.6) |
| Southern | 229 | 1.8 (0.7-4.4) |
| **National** | **682** | **1.7 (0.9-3.5)** |

*Survey Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, for school-aged children with height-for-age data there missing values for SES (2), and education (4)*

## 4.3 Anthropometric Status of Non-pregnant Women of Childbearing Age

### 4.3.1 Mean weight and height

Among non-pregnant women of childbearing age, information on height was collected on 577 women and weight was collected on 576 women. Mean values of weight and height by various characteristics are in Table 4-8.

**Table 4-8 Mean height and weight among non-pregnant women of child bearing age (15-49 years)**

| Characteristics of women | N | Mean height ± SD | N | Mean weight ± SD |
|---|---|---|---|---|
| **Age groups (years)** | | | | |
| 15-19 | 95 | 155.4 ± 780 | 94 | 5097 ± 6.5 |
| 20-29 | 238 | 155.8 ± 5.8 | 239 | 54.0 ± 7.5 |
| 30-39 | 154 | 156.2 ± 7.4 | 153 | 56.1 ± 8.8 |
| 40-49 | 90 | 157.3 ± 4.4 | 90 | 56.2 ± 9.5 |
| **Education (years)** | | | | |
| None | 76 | 157.8 ± 4.6 | 77 | 56.6 ± 7.8 |
| 1-5 | 184 | 155.1 ± 6.5 | 183 | 52.8 ± 6.0 |
| 6-8 | 187 | 155.9 ± 6.3 | 188 | 53.6 ± 9.2 |
| >8 | 113 | 156.8 ± 7.8 | 111 | 57.2 ± 10.1 |
| **SES** | | | | |
| Low | 226 | 155.3 ± 6.1 | 224 | 52.9 ±7.3 |
| Moderate | 168 | 155.8 ± 6.7 | 167 | 53.8 ±7.4 |
| High | 183 | 157.3 ± 6.5 | 185 | 56.8 ±9.5 |
| **Residence** | | | | |
| Urban | 103 | 157.3 ± 8.1 | 103 | 58.4 ± 10.6 |
| Rural | 474 | 155.9 ± 6.1 | 473 | 53.7 ± 7.6 |
| **Region** | | | | |
| Northern | 189 | 154.8± 9.7 | 188 | 54.9 ± 13.6 |
| Central | 205 | 156.3 ± 6.3 | 204 | 54.9 ± 7.2 |
| Southern | 183 | 156.2 ± 5.1 | 184 | 53.8 ± 7.2 |
| **National** | **577** | **156.0 ± 6.5** | **576** | **54.4 ± 8.3** |

*Mean ± SD are weighted to account for survey design, for nonpregnant women who had height and weight measurements there were missing values for education (17)*

### 4.3.2 Body Mass Index (BMI) in Non-Pregnant Women

Body mass index (BMI) was calculated for 571 non-pregnant women of childbearing age (15-49 years) (Section 2.8.2). The proportion of women who were underweight (BMI <18.5) was low (5.2%) according to WHO recommendations. The prevalence of obesity (BMI >30.0) was also low (2.5%). All BMI calculations by various demo-

graphic characteristics are displayed in Table 4-9. There were significant differences in the distributions of BMI by age and residence. The proportion of women who were overweight or obese increased with age and there were more overweight and obese women in the urban than rural areas.

**Table 4-9 Body mass index (BMI) data among non-pregnant women of child-bearing age (15-49 years)**

| Characteris-tics of women | N | <18.5 kg/m² | 18.5-24.9 kg/m² | 25.0-29.9 kg/m² | >30.0 kg/m² | Mean± SD kg/m² |
|---|---|---|---|---|---|---|
| **Age groups* (years)** | | | | | | |
| 15-19 | 93 | 11.1 (5.7-20.7) | 84.1 (73.0-91.2) | 3.4 (1.1-10.2) | 1.3 (0.2-9.0) | 21.1 ± 3.3 |
| 20-29 | 237 | 4.6 (2.4-8.6) | 79.9 (73.7-85.0) | 14.6 (10.2-20.3) | 1.0 (0.3-3.0) | 22.2 ±2.7 |
| 30-39 | 152 | 1.8 (0.4-7.0) | 78.8 (70.3-85.4) | 16.1 (10.6-23.6) | 3.4 (1.0-10.3) | 22.9 ±3.2 |
| 40-49 | 89 | 6.4 (2.5-15.4) | 76.6 (65.0-85.3) | 10.4 (5.3-19.4) | 6.6 (2.9-14.4) | 22.7 ±3.7 |
| **Education (years)** | | | | | | |
| None | 76 | 6.1 (1.9-17.7) | 73.2 (60.7-82.9) | 16.1 (9.3-26.4) | 4.6 (1.5-13.1) | 22.7 ±3.0 |
| 1-5 | 182 | 6.7 (3.7-12.0) | 82.5 (74.9-88.2) | 10.2 (6.4-15.9) | 0.6 (0.0-4.3) | 22.0 ±2.8 |
| 6-8 | 185 | 5.6 (2.8-11.1) | 79.9 (71.9-86.1) | 12.8 (8.0-19.8) | 1.7 (0.6-4.6) | 21.9 ±2.9 |
| >8 | 111 | 1.4 (0.2-9.1) | 77.7(68.0-85.2) | 15.2 (8.9-24.7) | 5.7 (2.2-14.3) | 23.3 ±4.2 |
| **SES** | | | | | | |
| Low | 224 | 4.2 (2.1-8.3) | 84.7 (78.5-89.4) | 10.0 (6.5-15.2) | 1.0 (0.3-3.2) | 21.9±2.4 |
| Moderate | 166 | 5.6 (2.8-10.9) | 80.7 (71.7-87.3) | 11.0 (6.7-17.5) | 2.7 (1.0-7.1) | 22.3 ±3.5 |
| High | 181 | 5.9 (3.2-10.7) | 72.6 (65.1-79.0) | 17.2 (11.7-24.6) | 4.3 (2.0-8.90 | 22.8 ±3.6 |
| **Residence*** | | | | | | |
| Urban | 102 | 4.0 (1.6-9.9) | 71.3 (60.6-80.1) | 19.0 (12.7-27.5) | 5.7 (2.0-14.9) | 23.5 ±4.5 |
| Rural | 469 | 5.4 (3.5-8.1) | 81.4 (76.7-85.2) | 11.3 (8.4-15.2) | 2.0 (0.9-4.1) | 22.1 ±2.8 |
| **Region** | | | | | | |
| Northern | 188 | 0 | 81.9 (77.0-86.0) | 13.8 (10.6-17.8) | 4.3 (2.3-7.8) | 22.8 ±5.0 |
| Central | 203 | 4.4 (2.6-7.6) | 81.3 (74.3-86.7) | 11.3 (7.8-16.3) | 3.0 (1.1-7.8) | 22.5 ±3.1 |
| Southern | 180 | 7.2 (4.2-12.1) | 77.8 (70.5-83.7) | 13.3 (8.7-20.0) | 1.7 (0.5-5.0) | 21.9 ±2.5 |
| **National** | **571** | **5.2 (3.5-7.6)** | **79.8 (75.5-83.5)** | **12.5 (9.7-16.0)** | **2.5 (1.4-4.6)** | **22.3 ±3.2** |

*Mean ± SD and proportions are weighted to account for survey design; * p<0.05 test signifies difference in the distribution of BMI by indicated characteristic, for nonpregnant women who had height and weight measurements there were missing values for education (17)*

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# 5. MORBIDITY-PREVALENCE, KNOWLEDGE AND PREVENTION

This chapter provides results from the malaria assessment of all subjects, intestinal parasite data and the urinary schistosomiasis data of school-aged children (6-12 years) and health history information from all subjects. Household-level malaria prevention data were also collected. The organization of this chapter is as follows:

- Malaria Thick Smear Results
    - Under five children
    - School-aged children
    - Women of childbearing age
    - Men
- Household prevention of malaria (mosquito bed nets)
- Intestinal parasites – stool samples:
    - School-aged children
- Knowledge of Intestinal Parasites
    - School-aged children
- Urinary schistosomiasis – urine samples
    - School-aged children
    - Women of childbearing age
- Knowledge of Urinary schistosomiasis
    - School-aged children
    - Women of childbearing age
- Health History from questionnaire
    - Under five children
    - School-aged children
    - Women of childbearing age
    - Men
- Health history and infection

## 5.1 Prevalence of malaria

### 5.1.1 Prevalence of malaria in under five children

There were 916 out of 1,094 children who were tested for malaria. Children under five years of age had the highest prevalence of malaria parasitemia, with 21.9% of the subjects having trophozoites present in their blood samples, indicating malaria infection at the time of the survey (Table 5-1). Very few under five children (0.9%) had gametocytes detected in their blood. Significant differences in the prevalence of malaria parasitemia were found by SES, residence and region. The prevalence of parasitemia decreased significantly with an increase in SES. Children under five years of age living in rural areas had a significantly higher prevalence of malaria parasitemia (24.2%) compared to under five children living in urban areas (4.0%). Under five children in the Central region had a significantly higher prevalence of malaria parasitemia (32.9%) compared with the Northern and Southern regions (13.8% and 14.3%) respectively.

**Table 5-1 Prevalence of malaria parasitemia among under five children (6-59 months)**

| Characteristics of under five children | N | Prevalence of malaria parasitemia, % (CI) |
|---|---|---|
| **Age group (months)** | | |
| 6-11 | 116 | 14.7 (9.3-22.4) |
| 12-23 | 215 | 20.5 (13.9-29.2) |
| 24-35 | 200 | 23.7 (17.8-30.8) |
| 36-47 | 223 | 21.4 (15.6-28.6) |
| 48-59 | 162 | 27.6 (19.8-36.9) |
| **Sex** | | |
| Male | 427 | 22.2 (17.3-28.0) |
| Female | 476 | 22.4 (17.3-28.6) |
| **SES** | | |
| Low | 368 | 29.1 (23.0-36.1)* |
| Moderate | 321 | 19.6 (14.4-26.2) |
| High | 227 | 12.7 (7.9-19.9) |
| **Residence** | | |
| Urban | 113 | 4.0 (1.2-12.0)* |
| Rural | 803 | 24.2 (19.9-29.2) |
| **Region** | | |
| Northern | 297 | 13.8 (8.5-21.6)* |
| Central | 298 | 32.9 (25.1-41.7) |
| Southern | 321 | 14.3 (10.0-20.2) |
| **National** | **916** | **21.9 (17.9-26.6)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, for under five children who were tested for malaria, there were missing values for sex (13)*

The level of parasitemia usually correlates with severity of disease such that individuals with high levels of parasitemia usually develop severe clinical disease. However, in some cases individuals with low levels of parasitemia do experience severe disease as a result of sequestration of parasites in organs. The level of parasitemia for under five children is reported in detail in Table 5-2. There were significant differences in the level of parasitemia by SES, residence and region. Parasite levels decreased with an increase with SES. Under five children living in rural areas had significantly higher parasite levels compared with children in urban areas; children in the Central region has significantly higher parasite levels compared with the Northern and Southern regions respectively.

**Table 5-2 Malaria parasitemia levels in under five children (6-59 months)**

| **Characteristics of under five children** | **N** | **Level of parasitemia in under five children with malaria parasitemia, % (CI)** | | | |
|---|---|---|---|---|---|
| | | **+1** | **+2** | **+3** | **+4** |
| **Age group (months)** | | | | | |
| 6-11 | 116 | 6.5(3.1-13.1) | 2.3(0.6-8.6) | 2.5 (0.7-8.5) | 3.4 (1.1-9.9) |
| 12-23 | 215 | 13.0 (7.7-21.0) | 2.4 (0.9-5.9) | 3.0 (1.1-8.0) | 2.2 (0.8-5.7) |
| 24-35 | 200 | 10.1 (6.2-15.9) | 6.3 (3.5-11.3) | 4.1 (1.7-9.4) | 3.3 (1.2-8.9) |
| 36-47 | 223 | 11.8(7.7-17.8) | 3.4 (1.6-7.2) | 3.9 (1.8-8.5) | 2.2 (0.9-5.7) |
| 48-59 | 162 | 12.6 (7.7-19.8) | 8.1 (4.6-13.9) | 4.4 (1.8-10.5) | 2.5 (0.8-7.7) |
| **Sex** | | | | | |
| Male | 427 | 10.7(7.5-15.2) | 4.6 (2.8-7.4) | 3.8 (2.1-6.6) | 3.1(1.7-5.7) |
| Female | 476 | 12.0 (8.6-16.4) | 4.5(2.9-7.1) | 3.7 (1.8-7.4) | 2.3 (1.0-5.1) |
| **SES** | | | | | |
| Low | 368 | 14.8 (10.6-20.3) | 5.7 (3.6-8.8) | 4.9 (2.8-8.4) | 3.8 (2.1-7.1)* |
| Moderate | 321 | 10.7(7.3-15.4) | 4.4 (2.4-7.9) | 2.6 (1.1-5.9) | 2.1 (0.7-5.7) |
| High | 227 | 5.7 (2.8-11.4) | 2.6 (1.1-6.3) | 3.1 91.2-7.5) | 1.4 (0.4-.4.7) |
| **Residence** | | | | | |
| Urban | 113 | 1.2 (0.2-7.3) | 0 | 2.8 (0.5-12.9) | 0* |
| Rural | 803 | 12.5 (9.4-16.3) | 5.1 (3.6-7.0) | 3.8 (2.4-5.9) | 3.0 (1.7-5.2) |
| **Region** | | | | | |
| Northern | 297 | 9.1 (5.0-16.1) | 2.7 (1.2-6.1) | 1.4 (0.5-3.4) | 0.7 (0.0-4.8)* |
| Central | 298 | 18.5 (12.9-25.7) | 3.7 (2.1-6.4) | 7.4 (4.6-11.8) | 3.4 (1.6-7.0) |
| Southern | 321 | 5.3 (3.2-8.7) | 5.6(3.5-8.9) | 0.9 (0.3-2.7) | 2.5 (1.0-6.2) |
| **National** | **916** | **11.2 (8.4-14.7)** | **4.5 (3.2-6.2)** | **3.6 (2.4-5.6)** | **2.6 (1.5-4.6)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, for under five children who were tested for malaria, there were missing values for sex (13)*

### 5.1.2 Malaria in School-aged children

There were 604 out of 758 children who were tested for malaria. The prevalence of malaria parasitemia in school-aged children was 17.5% (Table 5-3). Only 0.2% of school-aged children had gametocytes present in their blood. There were no significant differences in the prevalence of malaria parasitemia by age, education, sex, and residence, but there was a significant difference by SES and region. The proportion of school-aged children with malaria parasitemia decreased with SES. School-aged children in the Central region had the highest prevalence of malaria parasitemia compared with the Northern and Southern regions respectively.

**Table 5-3 Prevalence of malaria parasitemia among school-aged children (6-12 years)**

| Characteristics of school-aged children | N | Prevalence of malaria parasitemia, % (CI) |
|---|---|---|
| **Age group (years)** | | |
| 6-7 | 198 | 17.7 (12.7-24.1) |
| 8-9 | 169 | 15.0 (9.2-23.4) |
| 10-11 | 164 | 18.7 (12.9-26.4) |
| 12 | 73 | 20.1 (11.6-32.6) |
| **Education (years)** | | |
| 0 | 56 | 29.1 (17.8-43.8) |
| 1 | 195 | 18.2 (12.6-25.5) |
| 2 | 120 | 14.4 (9.1-22.1) |
| 3 | 125 | 12.7 (7.2-21.5) |
| 4 | 66 | 21.7 (12.2-35.6) |
| 5 | 20 | 15.1 (5.4-35.4) |
| 6 -8 | 22 | 10.6 (2.6-34.8) |
| **Sex** | | |
| Male | 307 | 15.9 (11.5-21.6) |
| Female | 288 | 19.4 (14.5-25.8) |
| **Socioeconomic status** | | |
| Low | 248 | 21.4 (16.0-28.2)* |
| Medium | 191 | 18.9 (13.5-25.8) |
| High | 163 | 9.7 (5.8-15.9) |
| **Residence** | | |
| Urban | 63 | 8.4 (3.0-21.2) |
| Rural | 541 | 18.6 (14.7-23.3) |
| **Region** | | |
| Northern | 199 | 12.6 (6.8-22.0)* |
| Central | 194 | 26.3 (19.1-35.0) |
| Southern | 211 | 11.9 (8.0-17.1) |
| **National** | **604** | **17.5 (13.9-21.8)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, for school-aged children who were tested for malaria, there were missing values for SES (2), and sex (9)*

### 5.1.3 Malaria in women of childbearing age (15-49 years)

There were 453 out of 651 non-pregnant women and 61 out of 77 pregnant women who were tested for malaria. The prevalence of malaria parasitemia in pregnant women was 5.1% and in non-pregnant women was 4.5%. For the non-pregnant women, there were no significant differences in the prevalence of parasitemia by age, education, residence and region but by SES (Table 5-4). The proportion of women with malaria parasitemia was significantly higher among women in low SES group. Only 0.3% of the non-pregnant women who were tested for malaria had gametocytes detected in their blood.

**Table 5-4 Prevalence of malaria parasitemia among non-pregnant women of childbearing age (15-49 years)**

| Characteristics of non-pregnant women | N | Prevalence of malaria parasitemia, %, (CI) |
|---|---|---|
| **Age group (years)** | | |
| 15-19 | 76 | 2.1 (0.5-9.0) |
| 20-29 | 191 | 4.0 (1.8-8.1) |
| 30-39 | 113 | 6.0 (2.6-13.2) |
| 40-49 | 73 | 6.0 (2.3-14.5) |
| **Education (years)** | | |
| None | 53 | 5.6 (1.8-16.7) |
| 1-5 | 150 | 5.1 (2.4-10.5) |
| 6-8 | 152 | 4.7 (2.2-9.9) |
| >8 | 86 | 1.9 (0.4-9.2) |
| **SES** | | |
| Low | 180 | 8.2 (4.9-13.5)* |
| Moderate | 133 | 3.9 (1.7-8.8) |
| High | 140 | 0 |
| **Residence** | | |
| Urban | 78 | 0 |
| Rural | 375 | 5.3(3.4-8.0) |
| **Region** | | |
| Northern | 143 | 4.9 (2.2-10.8) |
| Central | 154 | 5.8 (3.3-10.3) |
| Southern | 156 | 3.2 (1.4-7.3) |
| **National** | **453** | **4.5 (2.9-6.9)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, for non-pregnant women who were tested for malaria, missing values: education (12)*

### 5.1.4 Malaria in Men

There were 125 men tested for malaria. The prevalence of malaria parasitemia in men was 5.4%. There were no significant differences in prevalence of malaria parasitemia by age, education level, SES, residence and region (Table 5-5).

**Table 5-5 Prevalence of malaria parasitemia in men (20-55 years)**

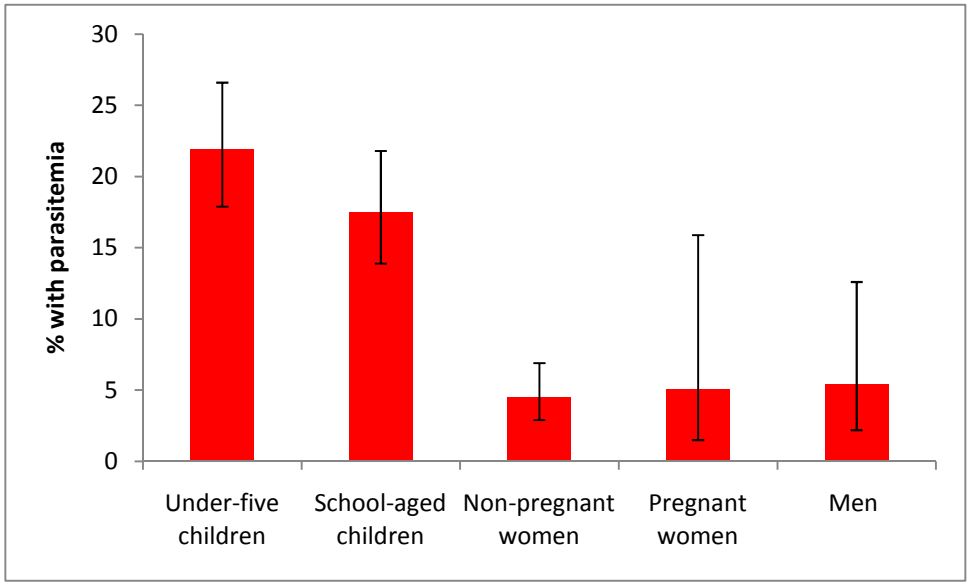
| Characteristics of men | N | Prevalence of malaria parasitemia, % (CI) |
|---|---|---|
| **Age group (years)** | | |
| 20-29 | 48 | 7.8 (2.2-24.0) |
| 30-39 | 45 | 0.7 (0.0-5.2)) |
| 40-49 | 25 | 6.5 (1.2-28.1) |
| 50-55 | 7 | 12.4 (1.6-55.7) |
| **Education (years)** | | |
| None | 0 | -- |
| 1-5 | 31 | 4.4 (0.8-19.9) |
| 6-8 | 50 | 4.4 (0.8-20.5) |
| >8 | 36 | 7.9 (1.8-28.6) |
| **SES** | | |
| Low | 49 | 3.6 (0.9-13.5) |
| Moderate | 41 | 2.5 (0.3-16.4) |
| High | 35 | 10.6(2.8-32.4) |
| **Residence** | | |
| Urban | 15 | 0 |
| Rural | 110 | 6.1 (2.5-14.0) |
| **Region** | | |
| Northern | 47 | 6.4(1.9-19.2) |
| Central | 44 | 4.6 (1.1-17.6) |
| Southern | 34 | 5.9 (1.5-20.9) |
| **National** | **125** | **5.4 (2.2-12.6)** |

*Data are weighted to account for survey design, CI-Confidence Interval, for men who were tested for malaria there were missing values for education (8), and none for SES, residence and region*

### 5.1.5 Malaria Thick Smear Summary Results

The prevalence of malaria parasitemia (presence of trophozoites) by target group is shown in Figure 5.1. Under five children had the highest prevalence at 21.9%, followed by school-aged children (17.5%), then men (5.4%), pregnant women (5.1%), and lastly non-pregnant women (4.5%).

**Figure** 5-1 **Prevalence of malaria parasitemia by age group**




## 5.2 Household prevention of malaria (mosquito bed nets)

A total of 1672 heads of households answered questions regarding household mosquito bed net. The questions included ownership of bed nets, number of bed nets in a households and individuals who sleep under the bed net. There was a high level of knowledge about mosquito bed nets; 97.3% heads of households who responded to the question had heard of a mosquito bed net. However, the reported use of bed nets was lower at 75.3%. There were significant differences in household bed net awareness by SES and residence and in use by SES, residence and region. Almost all the houses in the high SES group reported awareness about bed nets and using a bed net in comparison to households in the moderate and low SES groups respectively. There was also a significant difference by residence; the knowledge levels and use of bed nets was significantly higher in urban compared with rural areas. Use of bed nets was significantly low in the Central compared with the Northern and Southern region respectively (Table 5-6).

**Table 5-6 Awareness and use of mosquito bed nets in households**

| | Awareness of mosquito bed nets | | Use mosquito bed net in households | |
|---|---|---|---|---|
| | **N** | **% (CI)** | **N** | **% (CI)** |
| **SES** | | | | |
| Low | 709 | 95.8 (93.5-97.3)* | 681 | 63.5 (58.9-67.9)* |
| Moderate | 513 | 98.0 (95.7-99.1) | 504 | 77.0 (72.3-81.0) |
| High | 449 | 99.1 (97.2-99.7) | 446 | 92.3 (89.1-94.6) |
| **Residence** | | | | |
| Urban | 280 | 98.3 (95.7-99.4)* | 276 | 87.7 (80.6-92.4)* |
| Rural | 1392 | 97.2 (95.6-98.2) | 1356 | 73.0 (69.6-76.1) |
| **Region** | | | | |
| Northern | 561 | 98.8 (97.2-99.4) | 553 | 78.5 (73.6-82.7)* |
| Central | 554 | 96.8 (94.5-98.1) | 536 | 70.3 (65.1-75.1) |
| Southern | 557 | 97.5 (95.0-98.8) | 543 | 78.8 (73.8-83.1) |
| **National** | **1672** | **97.3 (96.0-98.2)** | **1632** | **75.3 (72.1-78.2)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, for households that responded to questions on bed nets there were missing values for SES (1)*

Less than half of households (46.4%) had one net, 31.0% had two bed nets, 13.3% had three bed nets and 9.4% had more than 3 bed nets. Significant differences in ownership were found by SES and residence. Most of the households in the low SES group possessed fewer mosquito bed nets compared with the high SES group. Rural households also had significantly less bed nets than urban households, Table 5-7.

**Table 5-7 Ownership of mosquito bed nets in households that reported using households**

| | N | Number of bed nets in the household, % (CI) | | | |
|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **≥4** |
| **SES*** | | | | | |
| Low | 394 | 63.6 (57.7-69.2) | 28.1 (23.1-33.7) | 6.6 (4.3-10.2) | 1.6 (0.7-3.7) |
| Moderate | 362 | 47.6 (42.1-53.2) | 32.5 (27.5-38.0) | 13.5 (10.1-17.7) | 6.4 (3.8-10.5) |
| High | 386 | 27.6 (22.1-33.8) | 32.4 (27.5-37.8) | 19.9 (15.5-25.3) | 20.1 (15.4-25.8) |
| **Residence*** | | | | | |
| Urban | 224 | 29.3 (22.2-37.5) | 34.4 (27.7-41.7) | 13.9 (9.5-19.9) | 22.5 (16.3-30.2) |
| Rural | 918 | 50.2 (46.5-53.9) | 30.2 (27.0-33.6) | 13.2 (10.9-15.9) | 6.4 (4.7-8.6) |
| **Region** | | | | | |
| Northern | 405 | 40.5 (35.1-46.2) | 34.1 (29.2-39.4) | 16.1 (12.5-20.3) | 9.4 (6.8-12.8) |
| Central | 330 | 47.9 (41.3-54.6) | 30.3 (26.2-34.8) | 12.1(9.3-15.7) | 9.7 (5.7-16.1) |
| Southern | 407 | 46.7 (41.3-52.2) | 30.7(26.1-35.8) | 13.5 (10.3-17.6) | 9.1 (6.4-12.7) |
| **National** | **1142** | **46.4 (42.6-50.1)** | **31.0 (28.1-34.1)** | **13.3 (11.2-15.7)** | **9.4 (7.2-12.1)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, of the households that indicated that they use bed nets, there were missing values on number of bed nets (n=97)*

In households where a mosquito bed net was reportedly used, the head of the household was asked to report who in the household sleeps under the bed net i.e. the father, mother and/or children under 5 years old. In households that reported using

bed nets, 61.6% of the fathers, 77.4% of the mothers and 54.2% of the children under the age of 5, sleep under a mosquito bed net. There were significant differences in bed net use by fathers by SES and residence; and in under five children by residence. There were significantly less fathers sleeping under mosquito bed nets in the low SES group compared with the moderate and high SES groups respectively, and in rural compared with urban areas. There were significantly less under 5 children sleeping under mosquito bed nets in urban than rural areas as shown in Table 5-8.

**Table 5-8 Household members using mosquito bed nets in households that reported using bed nets**

| Household characteristics | Household members reporting sleeping under a mosquito bed net | | | | | |
|---|---|---|---|---|---|---|
| | Father | | Mother | | Under 5 children | |
| | N | % | N | % | N | % |
| **SES** | | | | | | |
| Low | 444 | 46.0 (40.2-51.8)* | 444 | 75.6 (70.2-80.2) | 444 | 54.5 (48.6-60.2) |
| Moderate | 388 | 66.0 (60.1-71.4) | 388 | 78.2 (72.2-83.1) | 388 | 55.7 (50.1-61.1) |
| High | 407 | 74.5 (69.2-79.2) | 407 | 78.7 (73.3-83.3) | 407 | 52.5(46.9-58.1) |
| **Residence** | | | | | | |
| Urban | 243 | 68.2 (61.4-74.3)* | 243 | 77.4 (69.9-83.4) | 996 | 44.4 (38.5-50.4)* |
| Rural | 996 | 60.1 (55.8-64.3) | 996 | 77.4 (73.7-80.8) | 243 | 56.5 (52.6-60.3) |
| **Region** | | | | | | |
| Northern | 434 | 57.6 (52.0-63.1) | 434 | 80.4 (76.4-83.9) | 434 | 58.5 (53.8-63.1) |
| Central | 377 | 63.4 (56.4-69.8) | 377 | 77.5 (70.6-83.1) | 377 | 52.0(45.5-58.4) |
| Southern | 428 | 61.2 (55.8-66.4) | 428 | 76.6 (72.3-80.5) | 428 | 54.9 (50.3-59.5) |
| **National** | **1239** | **61.6 (57.8-65.3)** | **1239** | **77.4 (74.1-80.4)** | **1239** | **54.2 (50.8-57.7)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups*

## 5.3 Intestinal parasites in school-aged children

There were 528 out of 807 school-aged children whose stool was examined. From the analysis of the stool samples of school-aged children, it was found that none had tapeworm infection, 1.5% (0.6-3.6) had hookworm infection and 1.3% (0.3-5.1) had *Schistosoma mansoni* infection. There was no significant difference in the prevalence of *Schistosoma mansoni* infection by age, education level, SES, residence and region. However, there was a significant difference in the prevalence of hookworm infection by age. The prevalence of hookworm infection increased with age [6-7 y (n=175): 0.2 (0.0-1.7), 8-9 y (n=151): 0.1 (0.2-5.0), 10-11 y (n=139): 0.6 (0.0-4.2), 12 y (n=63): 7.9 (2.2-24.6)] .

### 5.3.1 Knowledge of Intestinal Parasites in School-Aged Children

There were 753 out of 807 school-aged children who responded to the question on knowledge about intestinal parasites. Half (52.3%) of the school-aged children reported to having ever heard of intestinal worms, of whom 35.5% reported having ever been infected with intestinal worms and 15.2% reported having intestinal worm infection at the time of the survey. Of those who reported having ever been infected with worms, (67.5%) reported receiving treatment for the infection. There were no significant differences in the level of knowledge by sex, SES, residence and region but there were significant differences in the level of knowledge by age and education level. The level of knowledge significantly increased with age and level of education, Table 5-10.

**Table 5-9 Knowledge about intestinal parasites in school-aged children (6-12 years)**

| Characteristics of school-aged children | N | Percentage of school-aged children who know about intestinal para-sites |
|---|---|---|
| **Age group (years)*** | | **% (CI)** |
| 6-7 | 245 | 42.1 (35.6-48.8) |
| 8-9 | 224 | 50.0 (41.8-58.1) |
| 10-11 | 193 | 59.9 (52.1-67.3) |
| 12 | 91 | 69.1 (57.4-78.8) |
| **Education (years)*** | | |
| 0 | 63 | 30.5 (18.7-45.6) |
| 1 | 256 | 43.3 (36.4-50.5) |
| 2 | 155 | 58.2 (48.8-67.1) |
| 3 | 152 | 57.0 (47.4-66.1) |
| 4 | 76 | 71.0 (61.7-78.8) |
| 5 | 22 | 53.3 (31.6-73.9) |
| 6 -8 | 28 | 94.0 (81.8-98.2) |
| **Sex** | | |
| Male | 375 | 51.6 (45.0-58.1) |
| Female | 368 | 52.0(46.2-57.8) |
| **Socioeconomic status** | | |
| Low | 308 | 53.1 (45.8-60.2) |
| Medium | 231 | 50.3 (42.5-58.1) |
| High | 212 | 53.4 (44.3-62.2) |
| **Residence** | | |
| Urban | 100 | 51.3 (37.0-65.5) |
| Rural | 653 | 52.4 (47.5-57.3) |
| **Region** | | |
| Northern | 240 | 55.4 (48.5-62.1) |
| Central | 257 | 46.3 (38.3-54.5) |
| Southern | 256 | 56.6 (50.0-63.1) |

| | | |
|---|---|---|
| **National** | **753** | **47.7 (43.1-52.4)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, for school-aged children who responded to the question on knowledge on intestinal parasites, there were missing values for sex (10), education(1)*

Some of the school-aged children reported knowledge on symptoms of intestinal worms. The most commonly reported symptoms included stomach pain (44.5%) and passing worms in stool (24.3%). Almost a third (28.2%) of the school-aged children who had ever heard of intestinal worms did not know any symptoms of intestinal worm infestation. Knowledge on the transmission of worm infection was low with 60.6% of the children responding as "don't know" when asked about the mode of transmission of intestinal worms. The most common route of transmission mentioned was eating unwashed food (21.4%). Knowledge on prevention of intestinal worm infection was also low with 58.9% "don't know" responses (Table 5-11).

**Table 5-10 Knowledge on intestinal worm infection symptoms, mode of transmission and prevention in school-aged children (6-12 years) n=401***

| **Responses by school-aged children** | **N** | **% (CI)** |
|---|---|---|
| **Symptoms and signs** | | |
| Stomach pains | 180 | 44.5 (37.8-51.3) |
| Pass worms in stools | 101 | 24.3 (19.0-30.5) |
| Fever | 33 | 6.3 (4.1-9.6) |
| Weakness | 28 | 6.2 (3.4-10.9) |
| Diarrhoea | 21 | 4.5 (2.5-7.9) |
| Other | 58 | 17.2 (12.9-22.7) |
| Don't know | 110 | 28.2 (22.5-34.8) |
| **Mode of transmission** | | |
| Eating unwashed food | 84 | 21.4 (16.3-27.7) |
| Drinking untreated water | 64 | 14.6 (10.4-20.2) |
| Walking barefoot | 12 | 3.2 (1.6-6.3) |
| Other | 38 | 8.1 (5.5-11.8) |
| Don't know | 237 | 60.6 (54.1-66.7) |
| **Prevention of intestinal worms** | | |
| Eating balanced diet | 65 | 15.6 (10.9-21.7) |
| Washing hands before eating | 45 | 11.0 (8.1-14.8_ |
| Washing food before eating | 33 | 7.1 (4.7-10.7) |
| Using latrines | 30 | 7.6 (4.3-13.1) |
| Wearing shoes | 17 | 4.5 (2.3-8.6) |
| Other | 58 | 14.2 (10.6-18.8) |
| Don't know | 226 | 58.9 (52.6-64.9) |

*Data are weighted to account for survey design, CI-Confidence Interval*
**Question asked only in school-aged children who had ever heard about intestinal worms*
*Note: survey participants could provide multiple responses to the questions*

## 5.4 Urinary schistosomiasis (Bilharzia) in school-aged children

There were 582 school-aged children who had results on examination of blood in urine and 576 has results on microscopy of urine. Bilharzia was detected by examining urine for the presence of blood and examining urine under the microscope for the presence of *Schistosoma hematobium* eggs. Examining urine samples for the presence of blood consistently underestimated the prevalence of Bilharzia compared with microscopy as shown in Table 5-12. Bilharzia infection in the study population sample was not localized to one region but was detected in various districts in all three regions. There was no significant difference in the prevalence of blood in urine by age, education level, sex, SES, residence and region. There was no significant difference in the prevalence of bilharzia diagnosed using microscopy by age, education, sex, SES status and residence. But there was a significant difference by region; children from the Northern region were significantly less likely to have bilharzia compared with the Central and Southern regions, Table 5-12.

**Table 5-11 Prevalence of Bilharzia among school-aged children (6-12 years)**

| **Characteristics of school-aged children** | N | **Blood in urine (dipstick result)** | **N** | **Presence of *Schistosoma haematobium* eggs** |
|---|---|---|---|---|
| **Age group (years)** | | % (CI) | | % (CI) |
| 6-7 | 183 | 7.0 (3.6-13.1) | 178 | 14.2 (8.5-22.8) |
| 8-9 | 173 | 12.0 (6.6-20.9) | 172 | 21.0 (13.5-31.2) |
| 10-11 | 154 | 10.3(5.6-18.1) | 154 | 19.2(12.5-28.2) |
| 12 | 72 | 10.9 (3.5-28.8) | 72 | 24.6 (13.5-40.5) |
| **Education (years)** | | | | |
| 0 | 47 | 5.6 (1.5-18.6) | 46 | 21.6 (9.5-42.0) |
| 1 | 182 | 10.4 (5.0-20.1) | 180 | 21.8 (14.4-31.6) |
| 2 | 117 | 10.3 (5.4-18.6) | 115 | 24.4 (15.5-36.2) |
| 3 | 126 | 9.0 (4.4-17.3) | 126 | 11.5 (6.3-19.9) |
| 4 | 64 | 10.6 (4.3-24.1) | 63 | 13.4 (6.1-26.9) |
| 5 | 22 | 17.1 (6.0-39.9) | 22 | 16.4 (9.5-42.0) |
| 6-8 | 22 | 9.5 (1.3-45.7 | 22 | 18.9 (13.5-26.0) |
| **Sex** | | | | |
| Male | 282 | 9.2 (5.3-15.8) | 279 | 21.1 (14.3-29.9) |
| Female | 291 | 10.8 (6.8-16.7) | 288 | 16.8 (11.9-23.4) |
| **Socioeconomic status** | | | | |
| Low | 229 | 7.8 (4.5-13.3) | 228 | 17.7 (11.7-25.9) |
| Medium | 187 | 6.8 (2.4-18.3) | 187 | 18.6(9.7-32.7) |
| High | 164 | 15.2 (8.1-26.8) | 159 | 20.0 (12.1-31.2) |
| **Residence** | | | | |
| Urban | 61 | 5.3 (1.8-14.7) | 56 | 13.5 (4.4-34.3) |
| Rural | 521 | 10.4 (6.6-16.0) | 520 | 19.5 (13.7-27.0) |
| **Region** | | | | |
| Northern | 189 | 5.3 (2.5-11.0) | 189 | 2.1 (0.8-55.9)* |

| | | | | |
|---|---|---|---|---|
| Central | 190 | 8.4 (4.4-15.6) | 184 | 15.8 (8.9-26.5) |
| Southern | 203 | 12.3 (6.6-22.0) | 203 | 26.1 (17.0-37.9) |
| **National** | **582** | **9.9 (6.4-14.9)** | **576** | **18.9 (13.5-25.8)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, for children who whose urine was examined, there were missing values for education (2), sex (9) and SES (2)*

### 5.4.1 Knowledge of Bilharzia among School-aged Children

There were 755 out of 758 school-aged children who responded to the question on knowledge of bilhazia. Of the school-aged children interviewed, 59.5% had ever heard of bilharzia. Of these, 34.5% reported a history of bilharzia infection of whom 34.0% had bilharzia at the time of the survey and 68.7 % had been treated for bilharzia. There were no significant differences in the level of knowledge by SES, residence and region but there were significant differences in the level of knowledge by age, education, sex and region. The level of knowledge significantly increased with age and level of education, more boys reported having heard about Bilharzia compared with girls and more children in the Southern region had heard about bilharzia compared with children in the Central and Northern regions respectively, Table 5-13.

**Table 5-12 Knowledge about Bilharzia in school-aged children (6-12 years)**

| **Characteristics of school-aged children** | **N** | **Percentage of school-aged children who know about bilharzias** |
|---|---|---|
| **Age group (years)*** | | **% (CI)** |
| 6-7 | 246 | 40.5 (33.6-47.8) |
| 8-9 | 225 | 62.7 (55.3-69.6) |
| 10-11 | 193 | 71.4 (63.4-78.2) |
| 12 | 91 | 83.0 (72.7-90.0) |
| **Education (years)*** | | |
| 0 | 63 | 35.4 (23.3-49.7) |
| 1 | 257 | 46.8(39.7-54.1) |
| 2 | 156 | 69.0 (59.6-77.1) |
| 3 | 152 | 70.8 (62.0-78.3) |
| 4 | 76 | 80.4 (67.3-89.2) |
| 5 | 22 | 68.9 (45.7-85.5) |
| 6 -8 | 28 | 91.3 (66.0-98.3) |
| **Sex*** | | |
| Male | 376 | 66.2 (60.2-71.7) |
| Female | 369 | 53.3 (47.2-59.3) |
| **Socioeconomic status** | | |
| Low | 308 | 59.7 (53.3-65.7) |
| Medium | 231 | 58.9 (52.3-65.2) |
| High | 214 | 62.0 (53.3-69.9) |
| **Residence** | | |
| Urban | 102 | 52.3 (38.2-66.1) |
| Rural | 653 | 61.4 (56.7-65.9) |

| | | |
|---|---|---|
| **Region** | | |
| Northern | 243 | 55.6 (47.4-63.4) |
| Central | 257 | 58.4 (50.5-65.9) |
| Southern | 255 | 63.1 (56.6-69.3) |
| **National** | **755** | **60.2 (55.7-64.5)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, for school-aged children who responded to the question on knowledge on bilhazia, there were missing values for sex (10), education(2) and SES (2)*

The most common symptoms of bilharzia reported were blood in urine (66.7%) and pain when urinating (35.1%). Knowledge on transmission of bilharzia was also assessed. Almost half of the school-aged children (49.0%) reported that bilharzia is transmitted through contact with contaminated water. However, 39.5% of the children did not know how bilharzia is transmitted and 44.4% of the children did not know how bilharzia can be prevented (Table 5-14).

**Table 5-13 Knowledge about Bilharzia in school-aged children (6-12 years) n=449***

| **Responses by school-aged children** | **N** | **% (CI)** |
|---|---|---|
| **Symptoms and signs** | | |
| Blood in urine | 305 | 66.7 (61.5-71.5) |
| Pain when urinating | 165 | 35.1 (29.5-41.2) |
| Abdominal pain | 42 | 9.5 (6.1-14.6) |
| Fever | 10 | 2.0 (0.9-4.2) |
| Itching skin | 5 | 1.3 (0.5-3.1) |
| Other | 22 | 5.6 (3.4-9.3) |
| Don't know | 87 | 20.8 (16.8-25.5) |
| **Mode of transmission** | | |
| Contact with contaminated water (swimming in lake) | 218 | 49.0 (42.7-55.4) |
| Snails | 21 | 3.1 (1.8-5.2) |
| Other | 57 | 13.0 (10.1-16.7) |
| Don't know | 178 | 39.5 (34.1-45.2) |
| **Prevention of intestinal worms** | | |
| Stop bathing in a lake/river | 137 | 32.7 (27.4-38.5) |
| Increase access to protected water sources | 73 | 12.9 (8.9-18.2) |
| Prevent defecating and urinating outside of latrine | 46 | 9.9 (6.8-14.2) |
| Clear vegetation | 6 | 1.3 (0.6-3.1) |
| Other | 54 | 13.4 (9.9-18.0) |
| Don't know | 201 | 44.4 (38.7-50.2) |

*Data are weighted to account for survey design, CI-Confidence Interval*
**Question asked only in school-aged children who had ever heard about bilharzia*
*Note: survey participants could provide multiple responses to the questions*

## 5.5 Urinary schistosomiasis (Bilharzia) in women of childbearing age

There were 559 women who had results on examination of blood in urine and 552 has results on microscopy of urine. Similar to what was found in school-aged children, examining urine samples for the presence of blood in most cases underestimated the prevalence of bilharzia compared to microscopy as shown in Table 5-14. Bilharzia infection in women was also not localized to one place; the infection was detected in various districts in all three regions. The prevalence of bilharzia by examining blood for urine was 6.1% and by microscopy was 10.3%. There was no significant difference in the prevalence of blood in urine by age, education level, SES and residence. However, there was a significant difference by region; women in the Central region has a significantly low prevalence of blood in urine compared with women from the Southern and Northern regions respectively. There was no significant difference in the prevalence of bilharzia diagnosed using microscopy by residence and SES. However, there was a significant difference by age and region. Younger women and women living had a significantly higher prevalence of bilharzia. Women living in the Northern region had significantly lower prevalence of bilharzia compared with the Southern and Central region respectively (Table 5-14).

**Table 5-14 Prevalence of Bilharzia among women of childbearing age (15-49 years)**

| **Characteristics of women of childbearing age** | **N** | **Blood in urine (dipstick result)** | **N** | **Presence of Schistosoma haematobium eggs** |
|---|---|---|---|---|
| **Age group (years)*** | | % (CI) | | % (CI) |
| 15-19 | 92 | 11.7 (5.4-23.6) | 91 | 15.8 (9.0-26.2)* |
| 20-29 | 240 | 5.4 (2.8-10.1) | 238 | 14.0 (9.7-19.8) |
| 30-39 | 151 | 5.3 (2.1-12.8) | 149 | 3.6 (1.0-11.8) |
| 40-49 | 76 | 3.3 (1.0-10.2) | 74 | 5.2 (1.7-15.1) |
| **Education (years)** | | | | |
| None | 65 | 5.4 (1.2-20.9) | 65 | 19.4 (9.7-34.9) |
| 1-5 | 180 | 6.6 (3.4-12.7) | 179 | 8.5 (4.7-15.2) |
| 6-8 | 193 | 6.6 (3.7-11.5) | 191 | 7.3 (4.1-12.8) |
| >8 | 107 | 5.3 (2.0-13.3) | 103 | 12.6 (6.8-22.4) |
| **Socioeconomic Status** | | | | |
| Low | 205 | 4.9 (1.5-14.8) | 205 | 10.1 (5.8-16.8) |
| Moderate | 170 | 6.8 (3.3-13.3) | 170 | 9.0 (5.2-15.3) |
| High | 184 | 6.8 (3.0-14.8) | 177 | 11.8 (6.4-20.7) |
| **Residence** | | | | |
| Urban | 92 | 6.5 (2.1-18.7) | 84 | 6.0 (1.6-20.3) |
| Rural | 467 | 6.0 (3.3-10.5) | 468 | 10.9 (7.7-15.3) |
| **Region** | | | | |
| Northern | 191 | 7.3 (4.2-12.5)* | 191 | 1.1 (0.3-4.2)* |
| Central | 191 | 0.5 (0.0-3.7) | 184 | 8.2 (4.1-15.5) |

| | | | | |
|---|---|---|---|---|
| Southern | 177 | 10.7(5.8-19.2) | 177 | 14.7 (9.9-21.3) |
| **National** | **559** | **6.1 (3.6-9.9)** | **552** | **10.3 (7.3-14.2** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, missing values: age (n=14), education (n=27)*

### 5.5.1 Knowledge about Bilharzia among Women of Childbearing Age

There were 753 out of 754 who responded to the question on knowledge about bilhazia. Of the women interviewed, 90.0% had heard of Bilharzia (Table 5-15). There was no significant difference in the knowledge by age, SES, residence and region. However, there was a significant difference by education. The level of knowledge significantly increased with education level.

**Table 5-15 Knowledge about Bilharzia in women of childbearing age (15-49 years)**

| **Characteristics of women of childbearing age** | **N** | **Percentage of women who know about Bilharzia** |
|---|---|---|
| **Age group (years)** | | **% (CI)** |
| 15-19 | 130 | 91.2 (84.2-95.3) |
| 20-29 | 327 | 91.8 (87.5-94.7) |
| 30-39 | 185 | 85.1 (78.1-90.1) |
| 40-49 | 111 | 91.7 (83.7-95.9) |
| **Education (years)*** | | |
| None | 88 | 80.8 (70.6-88.1) |
| 1-5 | 245 | 87.1 (80.7-91.6) |
| 6-8 | 248 | 93.4 (89.1-96.1) |
| >8 | 152 | 98.7 (93.7-99.8) |
| **Socioeconomic Status** | | |
| Low | 272 | 89.1 (83.3-93.0) |
| Moderate | 225 | 89.8 (83.9-93.7) |
| High | 256 | 91.2 (85.5-94.8) |
| **Residence** | | |
| Urban | 151 | 95.3 (85.7-98.6) |
| Rural | 602 | 88.8 (85.2-91.6) |
| **Region** | | |
| Northern | 264 | 93.2 (89.0-95.9) |
| Central | 248 | 87.5 (80.4-92.3) |
| Southern | 241 | 91.3 (87.2-94.2) |
| **National** | **753** | **90.0 (86.8-92.5)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, of the women who responded to the question on knowledge about bilhazia, there were missing value for education (21)*

Knowledge on symptoms and signs, transmission and prevention of ilharzia were also assessed among women who had ever heard of bilharzia. Most of the women knew about symptoms and signs of Bilharzia with only 7.0% of the women reporting a "don't know" response. The most commonly reported symptoms were blood in urine (81.2%) and pain when urinating (55.1%). The most common method of transmission reported was contact with contaminated water (66.9%) and the mostly commonly reported method of prevention was stopping bathing in lakes or rivers (32.9%), Table 5-16.

**Table 5-16 Knowledge about Bilharzia in women of childbearing age (15-49 years)**
**n=684***

| **Responses by women of childbearing age** | **N** | **% (CI)** |
|---|---|---|
| **Symptoms and signs** | | |
| Blood in urine | 122 | 81.2 (77.7-84.3) |
| Pain when urinating | 384 | 55.1 (50.4-59.7) |
| Abdominal pain | 150 | 22.8 (19.0-27.1) |
| Fever | 40 | 5.3 (3.5-7.8) |
| Itching skin | 27 | 3.8 (2.5-5.9) |
| Other | 61 | 10.1 (7.5-13.4) |
| Don't know | 51 | 7.6 (5.5-10.5) |
| **Mode of transmission** | | |
| Contact with contaminated water (swimming in lake) | 223 | 66.9 (62.5-71.0) |
| Snails | 57 | 5.5 (4.0-7.6) |
| Other | 97 | 14.9 (11.5-19.2) |
| Don't know | 161 | 24.4 (21.0-28.0) |
| **Prevention of intestinal worms** | | |
| Stop bathing in a lake/river | 200 | 32.9 (28.8-37.3) |
| Increase access to protected water sources | 208 | 25.9 (21.5-30.7) |
| Prevent defecating and urinating outside of latrine | 121 | 17.0(13.8-20.8) |
| Clear vegetation | 11 | 2.1 (1.1-4.1) |
| Other | 77 | 13.7 (10.9-17.2) |
| Don't know | 156 | 23.1 (19.1-27.6) |

*Data are weighted to account for survey design, CI-Confidence Interval*
**Question asked only among women who had ever heard about bilharzia*
*Note: survey participants could provide multiple responses to the questions*

## 5.6 Health History of Selected Symptoms

The self-reported health status of each subject in the 2 weeks prior to the survey is reported in Table 5-17. All subjects (in the case of under five children, the parents or guardians) were asked about a history of fever, diarrhoea, blood in stool, and blood in urine in the two weeks prior to the survey. Under five children had the highest reported prevalence of fever and diarrhoea, whilst school-aged children had the highest reports of presence of blood in stool and urine.

**Table 5-17 Health history reports of symptoms in the previous two weeks prior to the survey by target group**

| | Under five children, 6-59 months (n=1124) | School-aged children, 6-12 years (n=807) | Women, 15-49 years (n=804) | Men, 20-55 years (n=197) |
|---|---|---|---|---|
| **Illness in past 2 weeks** | **% (CI)** | **% (CI)** | **% (CI)** | **% (CI)** |
| Fever | 55.4 (51.2-50.6) | 35.2 (31.2-39.4) | 36.4 (32.2-40.8) | 33.9 (26.3-42.5) |
| Diarrhoea | 22.5 (19.6-25.6) | 19.2 (16.0-22.9) | 9.4 (7.3-12.1) | 8.0 (4.3-14.2) |
| Blood in stool | 5.5 (4.1-7.4) | 7.9 (5.8-10.8) | 1.7 (0.8-3.3) | 1.4 (0.3-5.4) |
| Blood in urine | 1.3 (0.7-2.4) | 15.1 (11.0-20.3) | 2.6 (1.6-4.3) | 5.4 (2.0-9.9) |

*Data are weighted to account for survey design, CI-Confidence interval, missing values: under five children (fever (n=2), diarrhoea (n=1), blood in stool (n=11), blood in urine (n=15); school aged children (fever (n=1), diarrhoea (n=4), blood in stool (n=9), blood in urine (n=19); women (fever (n=1), diarrhoea (n=1), blood in stool (n=1), blood in urine (n=5)); men (fever (n=25), diarrhoea (n=24), blood in stool (n=2)*

## 5.7 Health history and infection

The association between reported symptoms of fever two weeks prior to the survey and corresponding malaria infection was examined for all subjects, excluding pregnant women. For school-aged children the relationship between hookworm infection and reported blood in the stool and between Bilharzia and reported blood in urine was also assessed.

### 5.7.1 Malaria parasitemia and reported fever

The association between the malaria infection diagnosed using microscopy and the presence of fever two weeks prior to the survey was examined to compare reported symptoms to the presence of infection in individuals. The only significant association was between reported fever and malaria infection in under five children, there was no association in the other age groups i.e. school-aged children, non-pregnant women and men. Of the under five children who had malaria parasitemia, 65.3% also had a reported fever 2 weeks prior to the survey which was significantly higher than 53.0% children who did not have malaria parasitemia (Table 5-18).

**Table 5-18 Association between reported fever and malaria parasitemia by target group**

| Target group | Malaria parasitemia | N | Prevalence of fever in the past 2 weeks, % (CI) |
|---|---|---|---|
| Under five children | Yes | 185 | 65.3 (58.9-71.1)* |
| | No | 729 | 53.0 (48.2-57.7) |
| School-aged children | Yes | 101 | 41.0 (31.6-51.1) |
| | No | 502 | 35.0 (29.7-40.8) |
| Non-pregnant women | Yes | 17 | 43.5 (20.7-69.4) |
| | No | 412 | 34.2 (29.0-39.8) |
| Men | Yes | 7 | 21.6 (3.8-65.5) |
| | No | 118 | 33.8 (25.0-43.9) |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, missing values: under five children (n=2), school-aged children (n=1), non-pregnant women (n=24),*

### 5.7.2 Worm infections and reported illness

The association between reported presence of blood in stool and hookworm infection diagnosed using microscopy was examined. There was no significant difference in the prevalence of reported blood in stool 2 weeks prior to the survey between school-aged children who had hookworm infection and those who did not have the infection (Table 5-19).

**Table 5-19 Association between reported symptoms of blood in stool and hookworm infection**

| Parasitic infection | | N | Prevalence of blood in stool in the past 2 weeks, % (CI) |
|---|---|---|---|
| Hookworm | Yes | 10 | 5.4 (0.8-29.3) |
| | No | 512 | 8.2 (5.5-12.1) |

*Data are weighted to account for survey design, CI-Confidence Interval, missing values (n=6)*

### 5.7.3 Urinary Schistosomiaisis and reported illness

Of the school-aged children who had urinary schistosomiasis diagnosed by microscopy, 37.9% reported having blood in their urine in the 2 weeks prior to the survey (Table 5-20), which was significantly higher than the school-aged children without urinary schistosomiasis (10.5%). There was no significant difference in the proportion of women who had schistosomiasis between women who had reported having blood in their urine that those who did not report blood in their urine.

**Table 5-20 Association between reported blood in urine and urinary schistosomiasis**

| Target group | Urinary Schistosomiasis | N | Prevalence of blood in urine in the past 2 weeks, % (CI) |
|---|---|---|---|
| School-aged children | Yes | 83 | 37.9 (26.5-50.8)* |
| | No | 478 | 10.5 (7.1-15.2) |
| Women of childbearing age | Yes | 42 | 4.8 (1.1-18.4) |
| | No | 473 | 1.4 (0.6-3.3) |

*Data are weighted to account for survey design, Confidence Interval, * p<0.05 test signifies variable differs across groups, missing values: school-aged children (n=15), women (n=37)*

# 6. FOOD CONSUMPTION

This chapter provides results from the Fortification Rapid Assessment Tool (FRAT) a modified 24-hour recall. The organization of this chapter is as follows:

- FRAT Results
- Breastfeeding Results

## 6.1 Fortification Rapid Assessment Tool (FRAT)

The FRAT survey was carried out to gather information about the availability and consumption of centrally processed foods in Malawi. Foods investigated included centrally processed wheat flour, maize flour, sugar, and cooking oil. The FRAT is designed to give a measure of the amount of food consumed by the respondents. Because it is very difficult for people to estimate the amount of each food consumed in terms of grams, portion sizes were reported in terms of household measures, using common household utensils as aids. Per FRAT Guidelines, household measures were calibrated by Bunda College to transcribe the portion sizes into equivalent gram measures of the raw food vehicle. [31]

### 6.1.1 Standard Consumption

For the purposes of the survey, respondents were asked to describe their food consumption either the prior day or on a typical day. Overall, 79% of men, 69% of women, and 72% of children reported their intake of food the prior day was typical. The remaining respondents reported unusual intake the prior day, but were asked to answer consumption questions as if food intake had been typical.

Although respondents were asked whether they had consumed each staple the prior day via a simple yes/no recall, based on experience in other FRAT surveys, this self-reporting was judged less accurate than an analysis of the ingredients in specific foods respondents reported consuming the prior day. As a result, the latter approach was used to determine the fraction of respondents consuming each staple (see table 6-1).

[31] FRAT Guidelines (2003).
http://www.micronutrient.org/CMFiles/PubLib/FRATguidelines2003_Nov_20081PKE-1222008-1386.pdf

**Table 6-1 Respondents reporting consumption of staple in prior day**

| **Centrally Processed Food** | **Men** n = 173 | **Women** n = 234 | **Children Under Five** n = 166 |
|---|---|---|---|
| Cooking Oil | 61±8% | 53±7% | 57±8% |
| Wheat Flour | 33±7% | 17±5% | 26±7% |
| Sugar | 55±8% | 58±7% | 61±8% |
| Maize Flour | 7±4% | 4±3% | 7±4% |
| Complementary Food | -- | -- | 4±3% |
| *National figures calculated from regional totals weighted to account for survey design. | | | |

The distribution of amount eaten among those who reported consumption was calculated for each group and each staple. Due to a limited number of responses (n = 6), the results for complementary food are omitted. For the same reason, results for maize flour should be considered interpreted with caution (see table 6-2).

**Table 6-2 Distribution of reported consumption of staple**

| **Centrally Processed Food** | **Men** | | | | **Women** | | | | **Children Under Five** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **n** | **Amount (g)** | | | **n** | **Amount (g)** | | | **n** | **Amount (g)** | | |
| | | **5%** | **50%** | **95%** | | **5%** | **50%** | **95%** | | **5%** | **50%** | **95%** |
| Cooking Oil | 103 | 2 | 7 | 37 | 125 | 5 | 18 | 49 | 102 | 1 | 5 | 19 |
| Wheat Flour | 51 | 12 | 50 | 431 | 38 | 25 | 75 | 632 | 50 | 10 | 31 | 139 |
| Sugar | 109 | 11 | 26 | 74 | 138 | 11 | 28 | 88 | 110 | 6 | 18 | 43 |
| Maize Flour | 17 | 46 | 93 | 409 | 13 | 93 | 205 | 1178 | 20 | 43 | 102 | 463 |
| **National figures calculated from regional totals weighted to account for survey design.*<br>*Amounts in 5%, 50% and 95% columns are consumption percentiles: 5%, 50% (median) and 95% of respondents, respectively, reported consuming up to that amount (g) of each food.* | | | | | | | | | | | | |

In general, neither the fraction of respondents consuming a given food during the prior week nor the average number of times a given food was consumed varied significantly across respondent groups. The exception is the large difference observed between men and women in terms of amount of cooking oil consumed (see table 6-3).

**Table 6-3 Reported frequency of consumption of staple in prior week**

| Centrally Processed Food | Men n = 173 | | Women n = 234 | | Children Under Five N = 166 | |
|---|---|---|---|---|---|---|
| | Consumed prior week | Average days consumed | Consumed prior week | Average days consumed | Consumed prior week | Average days consumed |
| Cooking Oil | 73±7% | 3.5±0.8 | 51±7% | 2.4±0.6 | 61±8% | 2.6±0.8 |
| Wheat Flour | 49±8% | 1.6±0.6 | 40±6% | 1.2±0.4 | 55±8% | 1.3±0.5 |
| Sugar | 76±7% | 3.4±0.8 | 70±6% | 3.5±0.7 | 75±7% | 3.3±0.8 |
| Maize Flour | 9±5% | 0.4±0.4 | 5±3% | 0.3±0.3 | 9±5% | 0.4±0.4 |
| **National figures calculated from regional totals weighted to account for survey design.* | | | | | | |

Very few respondents reported consuming any of the staple foods solely during the rainy season. The fact that this behavior was reported most frequently for centrally processed maize flour may reflect that, during the rainy season, it serves as a substitute for locally processed maize for some segments of the population (see table 6-4).

**Table 6-4 Reported consumption of staple by season**

| Centrally Processed Food | Men n = 173 | Women n = 234 | Children Under Five n = 166 |
|---|---|---|---|
| **Cooking Oil** | | | |
| All seasons | 59±8% | 41±7% | 41±8% |
| Harvest seasons | 22±6% | 13±5% | 26±7% |
| Rainy season only | 1±2% | 0% | 0% |
| Other / No response | 18±6% | 46±7% | 33±7% |
| **Wheat Flour** | | | |
| All seasons | 39±8% | 35±6% | 33±7% |
| Harvest seasons | 21±6% | 14±5% | 21±7% |
| Rainy season only | 0% | 1±2% | 2±2% |
| Other / No response | 40±8% | 50±7% | 44±8% |
| **Sugar** | | | |
| All seasons | 53±8% | 55±7% | 49±8% |
| Harvest seasons | 27±7% | 22±6% | 29±7% |
| Rainy season only | 0% | 2±2% | 1±2% |
| Other / No response | 20±6% | 21±5% | 21±7% |
| **Maize Flour** | | | |

| | | | |
|---|---|---|---|
| All seasons | 4±3% | 6±3% | 6±4% |
| Harvest seasons | 3±3% | 5±3% | 6±4% |
| Rainy season only | 16±6% | 9±4% | 8±4% |
| Other / No response | 77±7% | 80±5% | 80±6% |
| **National figures calculated from regional totals weighted to account for survey design.* | | | |

### 6.1.2 Household Consumption Patterns

In addition to questions about consumption, women (typically the primary cooks) were asked a series of additional questions about their households' use of the target staple foods.

Of the women queried, 75% reported usual use of cooking oil, while 22% cited lack of money as the main reason preventing usual use. Oil from a container (Oyeza) and Kazinga were the two most-cited types in use (see table 6-5).

**Table 6-5 Cooking oil usage by brand as reported by women (primary cook)**

| **Brand of Centrally Processed Cooking Oil** | **Fraction Usually Using Oil**<br>n = 185 |
|---|---|
| From container (Oyeza) | 44±7% |
| Kazinga (vitamin A fortified 5 mg/kg)** | 43±7% |
| Repackaged/No brand name/Sausage | 4±3% |
| Kukoma (vitamin A fortified 3 mg/kg)** | 3±3% |
| All others | 6±4% |
| **National figures calculated from regional totals weighted to account for survey design.*<br>*** Fortificant levels for 2009 were obtained by UNICEF but not validated.* | |

In addition to the brand of cooking oil purchased, women were asked about how the oil was stored in the home. 27% reported leaving the oil in the container in which it was purchased; only 2% reported using a covered tin, which would protect against sunlight and air (see table 6-6).

**Table 6-6 Reported oil storage method as by reported by women (primary cook)**

| **Type of Storage Employed** | **Fraction of Respondents**<br>n = 234 |
|---|---|
| Same bottle in which purchased | 27±6% |

| | |
|---|---|
| Same sachet in which purchased | 16±5% |
| Improvised bottle | 24±6% |
| Tin with lid | 2±2% |
| Other | 8±4% |
| No response | 23±6% |
| **National figures calculated from regional totals weighted to account for survey design.* | |

Women were also asked about the presence of centrally processed wheat flour in the home; only 5% reported having wheat flour on hand at the time of the survey. Relative brand popularity was not calculated for wheat flour due to the limited number of responses recorded (n = 15).

For sugar, 78% of women reported usual use while 5% cited lack of money as the main impediment to usual use. When asked about the presence of sugar in the home, 56% reported it was usually in the house the entire year while 20% reported it was usually present only during harvest seasons. The most frequently reported types were Illovo, and loose from a sack (Oyeza; see table 6-7).

**Table 6-7 Reported sugar usage by brand**

| **Brand of Centrally Processed Sugar** | **Fraction Usually Using Sugar**<br>n = 189 |
|---|---|
| Illovo | 73±7% |
| Loose from open sack (Oyeza) | 24±6% |
| Repackaged/No brand name | 2±2% |
| All others | 1±1% |
| **National figures calculated from regional totals weighted to account for survey design.* | |

In addition to the brand of sugar purchased, women were asked about how the sugar was stored in the home. The most common response was that the sugar was stored in the plastic bags in which it was purchased, however 20% report using a covered tin, which would protect against sunlight and air (see table 6-8).

**Table 6-8 Reported sugar storage method**

| **Type of Storage Employed** | **Fraction of Respondents**<br>n = 234 |
|---|---|
| Factory plastic bag | 49±7% |
| Container with lid | 20±5% |
| Container without lid | 3±3% |
| Other | 7±4% |

| | |
|---|---|
| No response | 21±5% |
| **National figures calculated from regional totals weighted to account for survey design.* | |

Only 4 women (~1%) reported purchasing pre-processed maize flour, while 95% reported processing maize in local hammer mills.

Women were also asked about the frequency of purchase of the different staple foods, with the exception of wheat flour. Purchase frequency was not calculated for maize flour due to the limited number (n = 4) of women reporting purchase. Responses for cooking oil and sugar show that almost half of households purchase these products at least weekly (see table 6-9).

**Table 6-9 Reported purchase frequency of staples**

| **Purchase Frequency** | **Cooking Oil** n = 234 | **Sugar** n = 234 |
|---|---|---|
| Everyday | 15±5% | 18±5% |
| Every other day | 20±5% | 17±5% |
| Once a week | 14±5% | 20±5% |
| Every two weeks | 7±4% | 6±3% |
| Once a month | 13±5% | 12±4% |
| Other / No response | 31±6% | 27±6% |
| **National figures calculated from regional totals weighted to account for survey design.* | | |

The type of pot used for food preparation was also ascertained as part of the survey. Aluminum was by far the most common type reported (69%), while only 11% reported use of iron pots, which could potentially increase iron intake (see table 6-10).

**Table 6-10 Reported cooking pot usage by type**

| **Type of Cooking Pot Used** | **Fraction of Respondents** n = 234 |
|---|---|
| Aluminum | 69±6% |
| Iron | 11±4% |
| Stainless Steel | 11±4% |
| Clay | 1±1% |
| Other / Don't know | 1±1% |
| No Response | 7±3% |
| **National figures calculated from regional totals weighted to account for survey design.* | |

## 6.2 Breastfeeding

There were 713 women who responded to the question on breastfeeding. Of these, 36.2% reported that they were breastfeeding at the time of the survey of whom 2.2% were pregnant, 97.3% were not pregnant and 0.5% did not know whether they were pregnant or not. The proportion of women who ever breastfed was not collected during the survey.

### 6.2.1 Exclusive breastfeeding

The caretakers of the under five children in the survey were asked about their breastfeeding practices or their knowledge on the breastfeeding practices that were used on the child. The caretakers were asked the age when the children were introduced to solid foods or drink to complement breast milk in order to estimate the duration of exclusive breastfeeding. It was found that 18.5% of the children were introduced to solid foods before 6 months, 63.4% were introduced at 6 months and 17.5% after 6 months, (Table 6-11). There were significant differences in the duration of exclusive breastfeeding by region; the Central region had a significantly shorter duration of exclusive breastfeeding compared with the South and North regions respectively.

**Table 6-11 Duration of exclusive breastfeeding in under five children**

| Duration of Exclusive Breast-feeding (months) | Northern | | Central | | Southern | | National | |
|---|---|---|---|---|---|---|---|---|
| | N | %, (CI) | N | %, (CI) | N | %, (CI) | N | %, (CI) |
| 0 | 3 | 0.9(0.3-2.6) | 4 | 1.1 (0.4-2.9) | 0 | --* | **7** | **0.6 (0.3-1.3)** |
| 1 | 6 | 1.7 (0.7-4.1) | 2 | 0.6 (0.1-2.3) | 3 | 0.8 (0.3-2.6) | **11** | **0.8 (0.4-1.7)** |
| 2 | 8 | 2.3 (1.1-4.7) | 8 | 2.3 (1.0-5.4 | 1 | 0.3 (0.0-2.0) | **17** | **1.4 (0.7-2.6)** |
| 3 | 5 | 1.4 .6-3.2) | 9 | 2.6 (1.4-4.6) | 11 | 3.1 (1.9-5.8) | **25** | **2.7 (1.6-4.4)** |
| 4 | 22 | 6.3 (3.8-10.3) | 23 | 6.6 (4.0-10.6) | 12 | 3.3 (1.9-5.8) | **57** | **5.1 (3.6-7.0)** |
| 5 | 31 | 8.8 (6.4-12.0) | 33 | 9.4 (6.4-13.7) | 28 | 7.8 (5.3-11.4) | **92** | **8.6 (6.8-10.9)** |
| 6 | 235 | 67.0 (60.7-72.6) | 202 | 57.4 (51.0-63.7) | 244 | 68.0 (62.9-72.7) | **681** | **63.4 (59.7-66.9)** |
| ≥7 | 41 | 11.7 (8.8-15.4) | 70 | 20.0 (14.9-26.3) | 60 | 16.7 (13.2-20.9) | **171** | **17.5 (14.7-20.7)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, missing values (n=33). Denominators included only children with an age (months) ≥ to the duration of exclusive breastfeeding (months).*

### 6.2.2 Duration of Breastfeeding

Overall 34.9% of all the under five children in the survey were still being breastfed at the time of the survey. Of the ones who had stopped breastfeeding, 2.0% stopped between 0-6 months, 7.3% stopped breastfeeding at 6-12 months and 76.2% stopped breast-feeding between 12-24 months (Table 6-12). There was a significant

difference in the duration of breastfeeding across the three regions with the shortest duration of breastfeeding in the Central region.

**Table 6-12 Breastfeeding duration of under five children who had stopped breastfeeding at the time of the survey**

| Region | N | Range of months of exclusive breastfeeding * | | |
|---|---|---|---|---|
| | | **0-6 months** %, (CI) | **6-12 months** %, (CI) | **12-24 months** %, (CI) |
| Northern | 186 | 1.9 (0.6-5.8) | 6.0 (3.2-11.2) | 78.2 (71.3-83.9)* |
| Central | 165 | 2.4 (1.0-5.3) | 9.4 (6.3-13.9) | 65.7 (59.2-71.7) |
| Southern | 220 | 1.7 (0.5-5.3) | 5.9 (3.6-9.3) | 84.5 (80.5-87.9) |
| **National** | **571** | **2.0(1.0-3.7)** | **7.3 (5.5-9.7)** | **76.2 (72.7-79.4)** |

*Data are weighted to account for survey design, CI- Confidence Interval, * p<0.05 test signifies variable differs across group. Denominators included only children with an age (months) ≥ to the lowest range in months of exclusive breastfeeding.*

# 7. IODINE STATUS

This chapter provides estimates of urinary iodine deficiency, the coverage of iodised salt, and knowledge of iodine deficiency disorders (IDD) and iodised salt. The organization of this chapter is as follows:

- Urinary Iodine results
  - School-aged children
  - Women of childbearing age
- Household iodised salt usage
  - Type of salt used in households
  - Salt storage methods
  - Rapid test kit results
  - Salt titration results
- Knowledge of iodised salt and iodine deficiency
  - Among women of childbearing age
  - Among school-aged children

## 7.1 Urinary Iodine Results in school-aged children

Urinary iodine is used as an indicator to monitor and evaluate the impact of salt iodization on the target population. The goals for intervention programs are that fewer than 50% of school-age children should have a urinary iodine concentration less than 100 µg/l and fewer than 80% of school-aged children should have a urinary iodine concentration less than 50 µg/l.

Urinary iodine levels were measured in 641 school-aged children. There were 11.2% of the school-aged children who had urinary iodine levels less than 50 µg/L, 28.6% had urinary iodine levels less than 100 µg/L and 21.1% had urinary iodine levels greater than 300 µg/L, (Table 7-1). The urinary iodine levels in the survey population are within WHO recommendations indicating optimal iodine nutrition. There was no significant difference noted in the urinary iodine levels by age, education level, gender, SES and residence. The only significant difference was noted by residence; there were significantly more people with urinary iodine levels greater than 300µg/L in rural than urban areas.

**Table 7-1 Urinary iodine levels among school-aged children**

| **Characteristics of school-aged children** | N | School-aged children with urinary iodine levels <50µg/L | School-aged children with urinary iodine levels <100µg/L | School-aged children with urinary iodine levels >300µg/L | Median (IQR) levels of urinary iodine (µg/L) |
|---|---|---|---|---|---|
| **Age group (years)** | | %, (CI) | %, (CI) | %, (CI) | |
| 6-7 | 207 | 11.1 (6.7-18.0) | 28.2 (20.8-36.9) | 23.2 (16.7-31.2) | 175 (85-290) |
| 8-9 | 190 | 10.3 (6.5-16.0) | 30.2 (23.2-38.2) | 19.6 (14.3-26.2) | 170 (80-260) |
| 10-11 | 165 | 12.1 (7.5-19.1) | 26.6 (19.2-35.7) | 20.9 (14.2-29.7) | 185 (95-270) |
| 12 | 79 | 11.3 (5.8-20.7) | 29.8 (20.0-41.9) | 20.3 (12.6-30.6) | 165 (90-295) |
| **Education (years)** | | | | | |
| 0 | 51 | 7.2 (2.6-18.2) | 22.4 (9.9-43.2) | 15.9 (8.4-28.1) | 180 (105-240) |
| 1 | 211 | 12.6 (8.2-18.9) | 31.8 (24.0-40.7) | 23.4 (17.1-31.1) | 160 (70-290) |
| 2 | 126 | 8.1 (4.1-15.4) | 28.6 (20.2-38.8) | 13.0 (7.9-20.5) | 175 (85-240) |
| 3 | 136 | 13.5 (8.1-2.1 | 27.9 (20.7-36.5) | 24.1 (16.9-33.2) | 185 (85-297.5) |
| 4 | 68 | 11.6 (5.4-23.2) | 25.3 (15.6-38.2) | 23.4 (12.9-38.7) | 210 (90-285) |
| 5 | 21 | 16.7 (5.7-39.9) | 29.9 (12.1-57.0) | 26.0 (10.8-50.6) | 195 (90-260) |
| 6-8 | 23 | 5.3 (1.4-18.3) | 15.6 (6.0-34.8) | 23.4 10.3-44.8) | 200 (100-320) |
| **Sex** | | | | | |
| Male | 323 | 9.9 (6.3-15.2) | 27.4 (21.1-34.7) | 22.7 (17.0-29.8) | 190 (90-290) |
| Female | 308 | 12.7 (8.3-18.8) | 29.7 (23.5-36.7) | 20.1 (15.4-25.9) | 170 (80-262.5) |
| **Socioeconomic status** | | | | | |
| Low | 264 | 11.9 (7.7-18.0) | 32.5 (25.2-40.8) | 17.7 (12.6-24.4) | 157.5 (80-240) |
| Moderate | 204 | 9.2 (5.1-16.1) | 26.0 (18.0-35.8) | 25.7 (17.9-35.3) | 180 (92.5-300) |
| High | 171 | 11.9 (6.5-20.7) | 25.1 (17.0-35.4) | 21.3 (14.3-30.5) | 180 (90-280) |
| **Residence** | | | | | |
| Urban | 68 | 15.5 (6.3-33.5) | 35.4 (21.2-52.7) | 6.4 (2.4-15.8)* | 125 (67.5-212.5) |
| Rural | 573 | 10.7 (7.4-15.2) | 27.8 (22.5-33.8) | 22.8 (18.2-28.2) | 180 (85-285) |
| **Region** | | | | | |
| Northern | 211 | 11.5 (7.0-18.3)* | 28.2 (21.1-36.6) | 20.6 (13.5-30.1) | 195 (100-310) |
| Central | 214 | 16.8 (10.2-26.4) | 34.6 (25.9-44.4) | 14.0 (9.4-20.5) | 130 (65-220) |
| Southern | 216 | 6.1 (3.6-10.2) | 23.4 (16.6-31.9) | 27.6 (19.8-37.0) | 195 (100-310) |
| **National** | **641** | **11.2 (8.0-15.4)** | **28.6 (23.5-34.2)** | **21.1 (16.8-26.2)** | **175 (85-275)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, missing values: education (n=5), sex (10) and SES (n=2)*

## 7.2 Urinary iodine results in women of childbearing age

Data on urinary iodine was available for 529 non-pregnant women. Only 12.0% of the non-pregnant women had urinary iodine levels of less than 50 µg/L, 25.7% had urinary iodine levels less than 100 µg/L and 22.6% of the non-pregnant women had urinary iodine levels more than 300 µg/L. The median urinary iodine level was 180 µg/L (IQR 95-295). Therefore the urinary iodine levels indicate that the survey population is within WHO recommendations. There was no significant difference noted in the urinary iodine levels by age, education level, gender, SES and residence.

However, there was a significant different by region among women with urinary iodine levels >300 µg/L, Table 7-2.

Data on urinary iodine was available for 65 pregnant women; 10.1% had urinary iodine levels less than 50µg/L, 28.1% had urinary iodine levels less than 100µg /L, 54.2% had urinary iodine levels less than 150µg/L and 5.5% had urinary iodine levels more than 500µg/L. The median urinary iodine level was 137.5 µg/L (IQR 75-230). The data indicates that the iodine intake among pregnant women is insufficient according to the WHO recommendations.

**Table 7-2 Urinary iodine levels among non-pregnant women of childbearing age**

| **Characteristics of women of childbearing age** | N | Women of childbearing age with urinary iodine levels <50µg/L | Women of childbearing age with urinary iodine levels <100µg/L | Women of childbearing age with urinary iodine levels >300µg/L | Median (IQR) levels of urinary iodine (µg/L) |
|---|---|---|---|---|---|
| **Age group (years)** | | | | | |
| 15-19 | 90 | 11.0 (5.8-19.8) | 30.9 (21.8-41.9) | 25.0 (16.2-36.6) | 182.5 (90-320) |
| 20-29 | 231 | 10.2 (6.1-16.3) | 24.0 (17.5-32.0) | 23.0 (16.5-31.3) | 170 (95-270) |
| 30-39 | 135 | 15.1 (9.1-24.1) | 25.6 (17.5-35.9) | 22.8 (15.8-31.6) | 200 (95-295) |
| 40-49 | 73 | 13.8 (6.5-26.9) | 24.9 (14.6-39.1) | 17.8 (10.1-29.5) | 180 (100-330) |
| **Education (years)** | | | | | |
| None | 64 | 14.6 (7.6-26.3) | 21.5 (12.4-34.6) | 16.5 (8.2-30.3) | 165 (106.5-260) |
| 1-5 | 167 | 12.6 (7.3-20.8) | 25.2 (18.2-33.7) | 20.1 (13.8-28.4) | 170 (90-280) |
| 6-8 | 178 | 13.1 (7.7-20.9) | 29.8 (21.8-39.3) | 25.4 (18.2-34.3) | 180 (85-300) |
| >8 | 106 | 8.9 (3.6-20.2) | 23.5 (14.1-36.4) | 29.2 (19.3-41.4) | 190 (105-370) |
| **Socioeconomic Status** | | | | | |
| Low | 204 | 13.7 (8.7-20.9) | 29.6 (22.1-38.4) | 20.6 (14.0-29.2) | 170 (80-280) |
| Moderate | 161 | 12.6 (7.6-20.2) | 22.8 (15.7-31.9) | 21.4 (14.3-30.7) | 175 (100-300) |
| High | 164 | 9.3 (4.7-17.5) | 23.7 (16.5-32.8) | 26.5 (19.7-34.8) | 192.5 (100-320) |
| **Residence** | | | | | |
| Urban | 92 | 6.8 (1.8-22.5) | 23.9 (14.8-36.3) | 30.3 (19.6-43.6) | 190 (102.5-350) |
| Rural | 437 | 13.0 (9.1-18.3) | 26.0 (20.4-32.6) | 21.2 (16.0-27.5) | 175 (95-290) |
| **Region** | | | | | |
| Northern | 180 | 10.6 (6.7-16.2) | 25.0 (17.2-34.9) | 27.8 (19.5-37.9)* | 200 (97.5-325) |
| Central | 178 | 16.9 (10.2-26.5) | 29.2 (21.1-38.9) | 14.0 (9.2-20.8) | 157.5 (85-250) |
| Southern | 171 | 8.2 (4.2-15.3) | 22.8 (15.7-32.0) | 28.7 (20.0-39.3) | 180 (100-325) |
| **National** | **529** | **12.0 (8.5-16.8)** | **25.7 (20.7-31.5)** | **22.6 (17.8-28.2)** | **180 (95-295)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, missing values: education (n=14)*

## 7.3 Household Iodised Salt Usage

Information was collected on the type of brands of salt used by the households, storage methods and the iodine content of salt in the households.

### 7.3.1 Type of salt used in households

Of the 1,791 households included in the survey, 119 households were missing data on whether salt was available at the time of the survey. Of the 1,672 households with data on household salt, most (89.6%, n=1,499) had salt in the household at the time of the survey. There was a wide range of salt brands that were used by the households (Table 7-3). There was a significant difference in the use of repackaged salt by region. Most of the households (75.0%) reported using salt which was bought in a loose package.

**Table 7-3 Salt brand use by region**

| Salt Brand | North | | Central | | South | | National | |
|---|---|---|---|---|---|---|---|---|
| | N | % (CI) | N | % (CI) | N | % (CI) | N | % (CI) |
| Tambala | 62 | 11.2 (8.0-15.4) | 29 | 5.3 (2.3-11.4) | 23 | 4.4 (2.5-7.8) | 114 | 5.6 (3.8-8.2) |
| Cerebos | 13 | 2.4 (1.2-4.7) | 7 | 1.3 (0.4-4.5) | 2 | 0.4 (0.0-2.8) | 22 | 1.0 (0.5-2.2) |
| Astor | 4 | 0.7 (0.3-1.9) | 3 | 0.5 (0.2-1.7) | 2 | 0.4 (0.0-2.8) | 9 | 0.5 (0.2-1.2) |
| Family Pride | 12 | 2.2 (1.2-3.9) | 6 | 1.1 (0.4-3.3) | 5 | 1.0 (0.4-2.7) | 23 | 1.2 (0.6-2.1) |
| Rab Proces-sors | 17 | 3.1 (1.6-5.8) | 16 | 2.9 (1.3-6.2) | 8 | 1.5 (0.7-3.5) | 41 | 2.3 (1.4-3.8) |
| Anapuna | 25 | 4.5 (2.9-7.0) | 15 | 2.7(1.4-5.3) | 28 | 5.4 (3.5-8.2) | 68 | 4.1 (3.0-5.7) |
| Loose from open sack | 368 | 66.3 (58.9-73.0) | 407 | 73.9 (64.8-81.3) | 431 | 78.2 (72.8-82.8) | 1206 | 75.0 (70.6-79.0) |
| Repackaged | 124 | 22.4 (18.5-26.9) | 75 | 13.6 (9.8-18.6) | 121 | 23.0 (19.0-27.6)* | 320 | 19.0 (16.3-21.9) |
| Other | 92 | 16.7 (10.7-25.1) | 29 | 5.3 (3.5-7.9) | 17 | 3.3 (1.7-6.2)* | 138 | 5.7 (4.3-7.5) |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, missing values: Tambala (n=36), Cerebos (n=38), Astor (n=38), Family pride (n=38), Rab Processor (n=38), Anapuna (n=36), Loose pack (n=6), Repackaged (n=32), Other (n=41)*

### 7.3.2 Salt Storage

Of the households included in the survey with data on salt storage method, half (51.0%) reported that they store salt in a container with a lid. There was a significant difference in the reporting of how salt is stored by region (Table 7-4).

**Table 7-4 Salt storage method by region**

| Method of Salt Storage | North | | Central | | South | | National | |
|---|---|---|---|---|---|---|---|---|
| | N | % (CI) | N | % (CI) | N | % (CI) | N | % |
| Container with lid | 274 | 51.5 (46.2-56.8) | 225 | 42.0 (35.9-48.3) | 327 | 58.6 (53.3-63.7)* | 826 | 51.0 (47.4-54.6) |
| Container without lid | 37 | 7.0 (4.7-10.2) | 23 | 4.3(2.8-6.6) | 30 | 5.4 (3.5-8.2) | 90 | 5.1 (3.9-6.7) |
| Packet used on purchase | 176 | 33.1 (26.6-40.3) | 201 | 37.5 (32.1-43.2) | 166 | 29.8 (25.2-34.8) | 543 | 33.3 (30.0-36.7) |
| Other | 45 | 8.5 (5.7-12.3) | 87 | 16.2(12.2-21.4) | 35 | 6.3 (4.2-9.2) | 167 | 10.6 (8.5-13.1) |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, missing values (n=165)*

## 7.4 Rapid Test Results

Of the 1,499 households with salt available, 1,369 had salt tested for iodine using a rapid test. Most (94.4%) households had iodine detected in their salt. There was no significant difference in the proportion of households that had iodised salt by residence, SES and region (Table 7-5).

**Table 7-5 Proportion of households with iodised salt as measured by rapid test**

| Characteristics of house-holds (n=1791) | N | % (CI) |
|---|---|---|
| **Socioeconomic Status** | | |
| Low | 548 | 94.6 (91.3-96.7) |
| Moderate | 441 | 93.4 (89.5-95.9) |
| High | 378 | 95.1 (91.9-97.1) |
| **Residence** | | |
| Urban | 228 | 97.0(93.9-98.6) |
| Rural | 1141 | 93.9 (91.5-95.6) |
| **Region** | | |
| Northern | 472 | 94.9 (91.6-97.0) |
| Central | 417 | 93.1 (88.9-95.7) |
| Southern | 480 | 95.2 (92.1-97.1) |
| **National** | **1369** | **94.4 (92.3-95.9)** |

*Data are weighted to account for survey design, CI-Confidence Interval. , * p<0.05 test signifies variable differs across groups, missing values (n=130)*

## 7.5 Salt Titration Results

Salt titration was performed on the salt collected from all the odd numbered house-holds (n=745). Overall, 95.2% of salt samples contained some iodine (>0 ppm). For international comparisons, the indicator used to assess the coverage of the salt iodization intervention, is the percentage of households using salt with at least 15

ppm iodine.[32] The target coverage rates for the elimination of iodine deficiency are that 90% of all households should be using food grade salt with an iodine content of at least 15 ppm. In this survey we found that 82.6% of households had salt with at least 15 ppm of iodine.

A subsample of 60 salt samples were sent to Chancellor College for titration analysis, the correlation of iodine concentrations between Chancellor and CHSU was 0.71.

**Table 7-6 Iodine content in household salt (ppm) based on salt titration analysis**

| Household characteristics | N | Percentage of households with various levels of iodine (ppm) salt | | | |
|---|---|---|---|---|---|
| | | <15ppm | 15-39.9 ppm | 40-100ppm | >100ppm |
| **SES** | | | | | |
| Low | 311 | 19.0(14.9-23.8) | 23.9 (19.5-29.0) | 41.5 (35.9-47.3) | 15.7 (11.3-21.3) |
| Moderate | 227 | 16.5 (12.1-22.2) | 25.5 (19.6-32.5) | 41.8 (35.1-48.8) | 16.2 (11.3-22.9) |
| High | 207 | 16.5 (12.1-22.1) | 20.7 (14.9-28.1) | 42.5 (36.6-48.6) | 20.3(15.3-26.3) |
| **Residence** | | | | | |
| Urban | 121 | 14.6 (8.9-23.2) | 19.0 (11.6-29.5) | 46.0 (40.6-51.5) | 20.4 (12.9-30.7) |
| Rural | 624 | 17.9 (14.9-21.3) | 24.3 (20.8-28.2) | 41.5 (37.4-45.8) | 16.3 (13.1-20.1) |
| **Region** | | | | | |
| Northern | 225 | 19.6 (13.8-27.0) | 20.4 (15.3-26.7) | 39.6 (34.3-45.1) | 20.4 (15.1-27.1)* |
| Central | 245 | 20.4 (15.8-26.0) | 23.7 (19.3-28.7) | 46.1 (40.9-51.4) | 9.8 (7.0-13.5) |
| Southern | 275 | 14.6 (11.0-18.9) | 24.0 (18.7-30.2) | 39.6 (33.8-45.8) | 21.8 (16.6-28.2) |
| **National** | **745** | **17.4 (14.7-20.5)** | **23.5 (20.2-27.2)** | **42.2 (38.6-45.9)** | **16.9 (13.9-20.4)** |

*Data are weighted to account for survey design, CI-Confidence Interval. * p<0.05 test signifies variable differs across groups. No missing values*

## 7.6 Knowledge of iodised salt and iodine– School-aged children

Only 17.8% of the school-aged children reported to have ever heard of iodised salt (Table 7-7). There were no significant differences in the level of awareness of iodised salt by age, gender, SES, education and residence. However, there was a significant difference noted by region. Children from the Central region were less likely to report that they had heard of iodised salt compared with the Northern and Southern regions respectively.

[32] Assessment of iodine deficiency disorders and monitoring their elimination: A Guide for Programme Managers. WHO/UNICEF/ICCIDD, 3rd Edition, 2007

**Table 7-7 Proportion of school-aged children who had ever heard of iodised salt**

| Characteristics of school-aged children | N | Percent reporting having heard of iodised salt, % (CI) |
|---|---|---|
| **Age group (years)** | | |
| 6-7 | 238 | 13.8 (9.2-20.0) |
| 8-9 | 214 | 20.0 (14.0-27.7) |
| 10-11 | 191 | 20.5 (13.5-30.1) |
| 12 | 91 | 17.1 (10.2-27.3) |
| **Education (years)** | | |
| 0 | 58 | 10.3 (3.6-26.1) |
| 1 | 249 | 17.8 (11.5-26.5) |
| 2 | 152 | 18.1 (11.3-27.6) |
| 3 | 151 | 17.4 (11.5-25.6) |
| 4 | 73 | 17.5 (9.7-29.5) |
| 5 | 22 | 32.6 (15.4-56.3) |
| 6-8 | 28 | 26.7 (12.5-48.0) |
| **Sex** | | |
| Male | 369 | 18.8 (13.6-25.5) |
| Female | 356 | 16.4 (11.7-22.6) |
| **SES** | | |
| Low | 297 | 15.7 (10.6-22.5) |
| Moderate | 225 | 22.1 (13.9-33.1) |
| High | 210 | 16.2 (10.3-24.6) |
| **Residence** | | |
| Urban | 101 | 14.9 (7.9-26.4) |
| Rural | 633 | 18.3 (13.5-23.1) |
| **Region** | | |
| Northern | 239 | 18.0(12.8-24.7)* |
| Central | 250 | 11.2 (5.8-20.5) |
| Southern | 245 | 23.7 (16.5-32.) |
| **National** | **734** | **17.8 (13.5-23.1)** |
| | | |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, missing values: education (n=1), sex (n=9), SES (n=2),*

The school-aged children who indicated they had heard of "iodised" salt were further asked to indicate why people use iodised salt. Over a third of the school-aged children (35.2%) did not know why people use iodised salt (Table 7-8). In general, it appears that knowledge of iodised salt and the reasons for its use were not widely known by school-aged children at the time of the survey.

**Table 7-8 Responses to why people use iodised salt, school-aged children (6-12 years)**
**(n=130)**

| Listed responses to why people use iodised salt* | N | % (CI) |
|---|---|---|
| Prevent goiter development | 58 | 37.4 (25.8-50.6) |
| Prevent still births, spontaneous abortions and infant deaths | 8 | 4.7 (1.2-16.9) |
| Prevent growth failure | 24 | 16.7 (10.2-26.1) |
| Other | 21 | 17.1 (9.9-27.8) |
| Don't know | 39 | 35.2 (24.8-47.2) |

*Data are weighted to account for survey design. CI-Confidence Interval, Note: survey participants could provide multiple responses, *Question asked only of women who had heard of iodised salt*

## 7.7 Knowledge of iodised salt and iodine– Women

The women were interviewed to find out their awareness on iodised salt and if they purchase iodised salt. Of the women who responded to the question, 68.5% reported having ever heard of "iodised" salt (Table 7-9). There were significant differences in the awareness of iodised salt by age, education level, SES and region. The awareness of iodised salt increased with age, education level and SES. Furthermore, significantly more women in the Northern and Southern regions were aware of iodised salt compared with women in the Central region. Of the women who reported to have ever heard of iodised salt, 90.6% reported that they buy iodised salt (Table 7-9). There were significant differences noted in the proportion of women who purchase iodised salt by residence. Women in urban areas were significantly more likely to buy iodised salt compared to their rural counterparts.

The women were also asked why people use iodised salt and knowledge levels on the functions of iodine were low. Less than half (45.0%) responded that people use iodised salt to prevent goiter, and 22.2% reported that they did not know why people use iodised salt, Table 7-10.

**Table 7-9 Proportion of women of childbearing age (15-49 years) having heard of iodised salt or reported buying iodised salt**

| Characteristics of women | Women reporting having heard of iodised salt | | Women reporting buying iodised salt** | |
|---|---|---|---|---|
| | N | % | N | % |
| **Age group (years)** | | | | |
| 15-19 | 130 | 52.2 (41.8-62.3)* | 53 | 84.3 (69.9-92.6) |
| 20-29 | 327 | 72.3 (66.6-77.3) | 166 | 90.6 (83.5-94.9) |
| 30-39 | 185 | 71.0 (63.0-77.9) | 78 | 91.7 (82.6-96.2) |
| 40-49 | 112 | 71.6 (62.1-79.6) | 50 | 94.2 (81.2-98.4) |
| **Education (years)** | | | | |
| None | 88 | 60.5 (49.0-71.0)* | 30 | 100 |
| 1-5 | 245 | 58.5 (51.6-65.1) | 82 | 87.9 (79.1-93.3) |
| 6-8 | 248 | 68.7 (62.0-74.8) | 110 | 87.9(86.9-98.1) |
| >8 | 152 | 90.7 (81.8-95.5) | 113 | 94.9 (86.9-98.1) |
| **SES** | | | | |
| Low | 273 | 59.2 (52.3-65.4)* | 103 | 88.5 (78.7-94.2) |
| Moderate | 225 | 73.7 (66.8-79.7) | 107 | 88.1 (79.0-93.6) |
| High | 256 | 73.8 (66.3-80.2) | 137 | 94.3 (87.9-97.4) |
| **Residence** | | | | |
| Urban | 151 | 81.7 (69.5-89.7)* | 95 | 98.1 (91.2-99.6)* |
| Rural | 603 | 65.4 (60.8-69.8) | 252 | 87.9 (81.9-92.1) |
| **Region** | | | | |
| Northern | 264 | 72.0 (63.4-79.2)* | 108 | 89.8 (80.4-95.0) |
| Central | 249 | 57.8 (48.7-66.4) | 94 | 86.2 (75.0-92.8) |
| Southern | 241 | 76.8 (71.2-81.6) | 145 | 93.1 (85.8-96.8) |
| **National** | **754** | **68.5 (64.0-72.7)** | **347** | **90.6 (85.7-93.9)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, **Percent based on women who had reported having heard of iodised salt, missing values awareness: education (n=21),; missing values purchasing salt education (12)*

**Table 7-10 Responses to why people use iodised salt, women of childbearing age (15-49 years)**
**n=519**

| Listed responses by women of childbearing age to: why do people use iodised salt? * | N | % , (CI) |
|---|---|---|
| Prevent goiter development | 248 | 45.0 (38.3-50.9) |
| Prevent still births, spontaneous abortions and infant deaths | 48 | 7.2 (5.1-10.1) |
| Prevent growth failure | 102 | 18.8 (15.0-23.2) |
| Other | 129 | 28.5 (23.9-33.6) |
| Don't know | 115 | 22.2 (18.3-2.67) |

*Data are weighted to account for survey design. Note: survey participants could provide multiple responses to why people use iodised salt, *Questions were asked only in women who had heard of iodised salt*

# 8. VITAMIN A STATUS

A number of different indicators related to vitamin A were collected in this survey. The organization of this chapter is as follows:

- Retinol binding protein levels and prevalence of vitamin A deficiency
- Comparison of vitamin A deficiency among groups
- Vitamin A and Malaria
- Vitamin A supplementation
    - Under five children
    - Women of childbearing age
- Knowledge of vitamin A deficiency and its prevention
    - School-aged children
    - Women of childbearing age

## 8.1 Retinol binding protein levels and vitamin A deficiency

Due to the need to further investigate RBP data, Vitamin A deficiency results will be provided in a separate report.

## 8.2 Vitamin A and Malaria

Due to the need to further investigate RBP data, results showing the relationship between malaria parasitemia and vitamin A deficiency will be provided in a separate report.

## 8.3 Vitamin A supplementation in under five children

Vitamin A is essential for the functioning of the immune system and the healthy growth and development of children.[33] Vitamin A deficiency is primarily caused by an inadequate intake of vitamin A in the diet and is very common in developing countries. One of the most widely implemented interventions for the control of vitamin A deficiency is vitamin A supplementation. Most vitamin A supplementation programs are targeted at under five children and post-partum women up to eight weeks following delivery to increase stores of vitamin A and in turn, the concentration of vitamin A in breast milk.

A history of vitamin A supplementation was obtained from caretakers of under five children included in the survey. The caretakers reported that 91.8% of under five children had ever received a vitamin A supplement. Of these, 60.8% had received the supplementation in the previous six months and 15.5% had received the sup-

[33] Sommer A, Davidson FR; Annecy Accords. Assessment and control of vitamin A deficiency: the Annecy Accords. *J Nutr.* 2002 Sep;132(9 Suppl):2845S-2850S.

plementation in the previous 7 to 12 months prior to the survey. There was a significant difference in the proportion of under five children who received Vitamin A supplementation by age, but there were no significant differences across all the other socio-demographic characteristics (Table 8-1). There were significant differences in the timing of supplementation by age and region; the duration of supplesupplementation in relation to the time of survey was shorter in younger children.

**Table 8-1 The percentage of under five children (6-59 months) who had ever received a vitamin A supplement and months since last supplementation**

| Characteristics of under five children | N | Percentage of under five children who had ever received vitamin A supplementation | Months since last dose of Vitamin A supplementation | |
|---|---|---|---|---|
| | | | **0-6 months** | **7-12 months** |
| **Age group (months)** | | | | |
| 6-11 | 142 | 70.6 (61.5-78.3)* | 63.5 (54.7-71.5) | 4.5 (1.9-10.0)* |
| 12-23 | 246 | 93.5 (88.7-96.3) | 66.7 (60.3-72.5) | 16.8 (12.2-22.7) |
| 24-35 | 261 | 95.3 (90.6-97.7) | 58.6 (51.2-65.6) | 20.6 (15.8-26.4) |
| 36-47 | 248 | 96.5 (93.1-98.3) | 57.6 (50.9-64.1) | 16.7 (12.6-21.9) |
| 48-59 | 190 | 96.0 (90.5-98.4) | 58.7 (50.9-66.0) | 13.1 (8.7-19.1) |
| **Sex** | | | | |
| Male | 515 | 9.18(88.2-94.4) | 62.1 (56.9-67.0) | 15.5 (11.7-20.2) |
| Female | 559 | 92.8 (89.9-94.5) | 59.2 (54.0-64.2) | 15.7 (12.6-19.5) |
| **SES** | | | | |
| Low | 429 | 91.5 (86.9-94.5) | 61.2 (55.1-66.9) | 14.7 (11.2-19.2) |
| Moderate | 379 | 92.0 (88.6-94.5) | 60.8 (54.4-66.9) | 17.3 (13.0-22.5) |
| High | 279 | 93.5 (88.9-96.3) | 60.2 (54.6-65.6) | 14.3 (10.0-20.0) |
| **Residence** | | | | |
| Urban | 147 | 91.4 (83.9-95.6) | 50.8 (42.8-58.7) | 16.5 (9.2-28.0) |
| Rural | 940 | 92.3(89.8-94.2) | 62.2 (58.1-66.1) | 15.4 (12.8-18.4) |
| **Region** | | | | |
| Northern | 368 | 94.0 (90.8-96.2) | 54.1 (47.8-60.2) | 12.8 (8.8-18.2) |
| Central | 355 | 92.7 (89.3-95.0) | 64.4 (56.9-71.2) | 15.0 (11.3-19.6) |
| Southern | 364 | 91.2 (86.8-94.2) | 59.3 (54.8-63.8) | 16.8 (12.9-21.5) |
| **National** | **1087** | **91.8 (89.5-93.6)** | **60.8 (57.0-64.5)** | **15.5 (13.0-18.4)** |

*Data are weighted to account for survey design, CI-Confidence Interval, missing value sex (n=13),*
** p<0.05 test signifies variable differs across groups*

### 8.3.1 Source of Vitamin A supplementation in under five children

Among those who had received supplementation, most of the under five children had received Vitamin A supplementation during routine visit to health facilities followed by the child health day campaign, (Table 8-2)

**Table 8-2 Source of Vitamin A supplementation for under five children among those who had reported receiving supplementation**

| Source of vitamin A supplementation | N | Number of children, % (CI) |
|---|---|---|
| Routine visit to health facility | 525 | 49.6 (44.6-54.8) |
| Sick child visit to health facility | 70 | 6.1 (4.3-8.4) |
| Child health day/campaign | 297 | 32.7 (28.1-37.7) |
| School | 35 | 3.6 (2.4-5.4) |
| Other | 70 | 7.9 (5.8-10.7) |

*Data are weighted to account for survey design, CI-Confidence Interval*

## 8.4 Vitamin A supplementation in women of childbearing age

Women reporting having one or more previous pregnancies were shown a sample of the vitamin A tablet and asked if they had received vitamin A supplementation in the first two months after delivery. Out of the 804 women of childbearing age (15-49 years) who were recruited in the study, 618 (83.5%) reported a previous pregnancy and were eligible to respond to this question. However, only 371 women responded to the question thus results should be interpreted with caution. Of those who responded to the question, 93.0% reported having received a vitamin A supplement within 2 months of their last delivery (Table 8-3). There were no significant difference in Vitamin A supplementation by age, education, SES, residence and region.

**Table 8-3 Among women (15-49 years) with a previous pregnancy, percentage who received vitamin A supplementation in the first two months after their last delivery**

| Characteristics of women | N | Percent of women reporting having received Vitamin A supplement within 2 months of delivery |
|---|---|---|
| **Age group (years)** | | |
| 15-19 | 22 | 86.2 (61.4-96.1) |
| 20-29 | 182 | 93.3 (88.7-96.2) |
| 30-39 | 101 | 94.8 (87.8-97.9) |
| 40-49 | 66 | 91.1 (80.2-96.3) |
| **Education (years)** | | |
| None | 62 | 91.8 (81.6-96.5) |
| 1-5 | 129 | 90.6 (83.1-94.9) |
| 6-8 | 113 | 95.9 (89.4-98.5) |
| >8 | 60 | 93.8 (84.2-97.7) |
| **SES** | | |
| Low | 130 | 92.4 (85.9-96.1) |
| Moderate | 120 | 94.5 (86.6-97.9) |
| High | 121 | 91.9 (85.9-95.5) |
| **Residence** | | |
| Urban | 65 | 93.1 (81.7-97.6) |
| Rural | 306 | 92.9 (89.5-95.3) |
| **Region** | | |
| Northern | 76 | 94.7 (87.1-98.0) |
| Central | 139 | 93.5 (88.3-96.5) |
| Southern | 156 | 92.3 (87.2-95.5) |
| **National** | **371** | **93.0 (89.8-95.2)** |

*Data are weighted to account for survey design, CI-Confidence Interval*

## 8.5 Knowledge of vitamin A deficiency

As part of the survey, school-aged children and women were asked a series of questions on vitamin A that included questions on consequences of vitamin A deficiency, prevention of vitamin A deficiency and sources of vitamin A.

### 8.5.1 Knowledge of vitamin A deficiency among school-aged children

Of the 758 school-aged children who were surveyed, 42.2% reported they had ever heard about vitamin A (Table 8-4). Older children were significantly more likely to report having heard of vitamin, and similarly knowledge increased with level of education. The level of knowledge was significantly low in the Central compared with the North and Southern regions respectively.

**Table 8-4 Percentage of school-aged children (6-12 years) who had ever heard of vitamin A**

| Characteristics of school-aged children | N | Percent of children reporting having ever heard of vitamin A |
|---|---|---|
| **Age group (years)** | | |
| 6-7 | 246 | 30.0 (23.4-37.6)* |
| 8-9 | 224 | 45.8 (37.0-54.8) |
| 10-11 | 193 | 49.1 (40.9-57.3) |
| 12 | 91 | 51.1 (39.5-62.5) |
| **Education (years)** | | |
| 0 | 63 | 22.6 (12.3-37.6)* |
| 1 | 257 | 35.2 (27.7-43.4) |
| 2 | 155 | 44.0 (35.1-53.2) |
| 3 | 152 | 45.8 (36.5-55.4) |
| 4 | 76 | 65.1 (51.7-76.4) |
| 5 | 22 | 42.7 (23.1-65.0) |
| 6-8 | 28 | 74.7 (52.0-88.9) |
| **Sex** | | |
| Male | 375 | 43.6 (37.2-50.3) |
| Female | 369 | 40.0(32.9-47.5) |
| **Socioeconomic status** | | |
| Low | 308 | 41.5 (33.6-49.8) |
| Medium | 231 | 43.1 (34.2-52.5) |
| High | 213 | 42.0 (33.1-51.5) |
| **Residence** | | |
| Urban | 102 | 35.8 (22.2-52.2) |
| Rural | 652 | 43.1 (37.2-49.3) |
| **Region** | | |
| Northern | 242 | 46.7 (40.2-53.3)* |
| Central | 257 | 33.9 (26.0-42.7) |
| Southern | 255 | 48.2 (39.1-57.5) |
| **National** | **754** | **42.2 (36.7-47.8)** |

*Data are weighted to account for survey design, CI-Confidence Interval, * p<0.05 test signifies variable differs across groups, missing values , education 1), sex (n=10), SES (n=2)*

Of the 758 school-aged children surveyed, only 323 reported to have heard of vitamin A and were asked a number of questions concerning vitamin A and vitamin A deficiency. In terms of the functions of vitamin A in the body, the most commonly reported function was for growth (28.2%) and making a person strong (22.9%). Knowledge of prevention was not very widespread as only 30.5% said that eating a balanced diet prevents against vitamin A deficiency and 31.8% said that yellow fruits and vegetables were a source of vitamin A, whereas 40.3% indicated that they did not know the consequences of vitamin A deficiency (Table 8-5).

**Table 8-5 Among school-aged children (6-12 years) who reported having heard of vitamin A, responses to questions concerning vitamin A use and consequences of deficiency (n=323)***

| | N | % |
|---|---|---|
| **Use of vitamin A in the body** | | |
| Good growth | 102 | 28.2 (21.5-36.0) |
| Makes your skin nice | 21 | 4.5 (2.3-8.6) |
| Makes a person strong | 69 | 22.9(17.2-29.7) |
| Helps a person see | 17 | 4.7 (2.7-8.3) |
| Prevents oedema | 4 | 1.1 (0.3-3.2) |
| Protects from disease | 65 | 16.7 (12.3-22.3) |
| Other | 33 | 11.8 (8.3-16.6) |
| Don't know | 109 | 34.7 (28.3-41.7) |
| **Consequences of vitamin A deficiency** | | |
| Night blindness | 22 | 4.9 (2.8-8.6) |
| Bad skin | 27 | 8.2 (5.5-12.0) |
| Weakness | 65 | 19.7 (14.4-26.3) |
| Always sick | 115 | 34.8 (27.1-43.3) |
| Loss of appetite | 6 | 0.8(0.4-1.6) |
| Anaemia | 21 | 5.1 (3.0-8.4) |
| Other | 21 | 7.4(5.0-10.9) |
| Don't know | 129 | 40.3 (33.4-47.6) |
| **Prevention of vitamin A deficiency** | | |
| Vitamins from hospital | 65 | 19.0 (13.9-25.6) |
| Eat diversified meal | 100 | 30.5 (23.9-38.0) |
| Eat enough food | 52 | 13.7 (9.1-20.1) |
| Eat fruit rich in vitamin A | 41 | 12.8 (8.6-18.5) |
| Other | 18 | 5.7 (3.0-10.4) |
| Don't know | 124 | 38.7 (31.6-46.3) |
| **Sources of vitamin A** | | |
| Dark leafy vegetables | 118 | 32.7 (26.1-40.1) |
| Yellow fruits/vegetables | 104 | 31.8 (25.5-38.7) |
| Groundnuts | 37 | 10.7 (7.0-16.2) |
| Meat | 71 | 23.1 (16.9-30.9) |
| Eggs | 25 | 7.7 (5.0-11.6) |
| Pills/syrup/capsule/medicine | 8 | 2.4 (1.2-5.1) |
| Cooking oil | 17 | 5.6 (3.3-9.4) |
| Sugar | 4 | 1.1 (0.4-3.2) |
| Margarine | 7 | 1.5 (0.6-3.6) |
| Other | 36 | 12.4 (8.5-17.9) |
| Don't know | 95 | 30.2 (24.2-36.9) |

*Data are weighted to account for survey design*
*Note: survey participants could provide multiple responses to questions*

### 8.5.2 Knowledge of vitamin A deficiency among women of child bearing age

Overall, 89.0% of the women reported having heard of vitamin A (Table 8-6). There was no significant difference in the level of knowledge about vitamin A by education, SES, residence and region However, there was a significant difference by age; the level of knowledge significantly increased with age.

**Table 8-6 Percentage of women of child bearing age (15-49 years) having ever heard of vitamin A**

| Characteristics of women | N | Percent of women reporting having ever heard of Vitamin A |
|---|---|---|
| **Age group (years)** | | |
| 15-19 | 130 | 78.1(69.7-84.7)* |
| 20-29 | 327 | 90.3 (85.9-93.3) |
| 30-39 | 185 | 93.6 (88.5-96.6) |
| 40-49 | 112 | 90.0 (81.2-94.8) |
| **Education (years)** | | |
| None | 88 | 87.8 (78.9-93.2) |
| 1-5 | 245 | 87.2 (81.6-91.3) |
| 6-8 | 248 | 90.0(85.0-93.5) |
| >8 | 152 | 90.6 (82.1-95.3) |
| **SES** | | |
| Low | 273 | 88.7 (84.4-91.9) |
| Moderate | 225 | 88.8 (83.0-92.8) |
| High | 256 | 89.6 (84.6-93.1) |
| **Residence** | | |
| Urban | 597 | 87.9 (80.1-92.9) |
| Rural | 157 | 89.3 (86.3-91.7) |
| **Region** | | |
| Northern | 264 | 90.5 (86.3-93.6) |
| Central | 249 | 88.8 (84.3-92.1) |
| Southern | 241 | 88.8 (84.1-92.2) |
| **National** | **754** | **89.0 (86.3-91.2)** |

*Data are weighted to account for survey design, * p<0.05 test signifies variable differs across groups, missing values:, education (n=21)*

Women of childbearing age (15-49 years) had a higher level of knowledge of vitamin A than the school-aged children in general. Around a third of women knew that vitamin A makes a person strong (31.3%), helps with good growth (31.2%) and protects from diseases (27.9%). Only 11.2% knew that vitamin A helps a person to see. Always being sick was known as a consequence of vitamin A deficiency by 36.8% of the women. Over a third of the women (40.7%) reported that eating a balanced diet was the best way of preventing of vitamin A deficiency and 40.8% of the women stated that yellow fruits and vegetables were sources of vitamin A (Table 8-7).

**Table 8-7 Among women of childbearing age (15-49 years) who reported having heard of vitamin A, responses to questions concerning vitamin A use and consequences of deficiency (n=675)**

| | N | % |
|---|---|---|
| **Use of vitamin A in the body** | | |
| Good growth | 237 | 31.2 (27.0-35.8) |
| Makes your skin nice | 51 | 6.0 (4.3-8.1) |
| Makes a person strong | 207 | 31.3 (27.2-35.8) |
| Helps a person see | 70 | 11.2 (8.6-14.6) |
| Prevents oedema | 8 | 1.3 (0.6-2.7) |
| Protects from disease | 202 | 27.9 (23.9-32.4) |
| Other | 47 | 7.5 (5.4-10.2) |
| Don't know | 166 | 25.7 (21.9-29.9) |
| **Consequences of vitamin A deficiency** | | |
| Night blindness | 117 | 15.8 (12.7-19.6) |
| Bad skin | 83 | 12.2 (9.5-15.6) |
| Weakness | 234 | 35.9 (32.2-39.8) |
| Always sick | 256 | 36.8 (32.0-42.0) |
| Loss of appetite | 31 | 3.0 (2.0-4.6) |
| Anaemia | 77 | 10.2 (7.6-13.7) |
| Other | 701 | 11.3 (9.0-14.2) |
| Don't know | 150 | 23.3 (19.3-27.8) |
| **Prevention of vitamin A deficiency** | | |
| Vitamins from hospital | 224 | 34.5 (30.3-38.9) |
| Eat diversified meal | 289 | 40.7 (36.1-45.4) |
| Eat enough food | 137 | 16.3 (13.4-19.7) |
| Eat fruit rich in vitamin A | 123 | 18.1 (14.3-22.6) |
| Other | 35 | 5.6 (3.7-8.5) |
| Don't know | 144 | 22.6 (19.3-26.3) |
| **Sources of vitamin A** | | |
| Dark leafy vegetables | 396 | 55.2 (50.5-59.9) |
| Yellow fruits/vegetables | 284 | 40.8 (36.1-45.7) |
| Groundnuts | 80 | 11.5 (9.0-14.6) |
| Meat | 145 | 22.7 (18.8-27.1) |
| Eggs | 71 | 10.8 (8.6-13.4) |
| Pills/syrup/capsule/medicine | 19 | 3.0 (1.6-5.5) |
| Cooking oil | 79 | 12.9 (10.0-16.5) |
| Sugar | 2 | 0.1 (0.0-0.4) |
| Other | 118 | 19.7 (16.6-23.3) |
| Don't know | 91 | 14.6 (11.3-18.6) |

*Data are weighted to account for survey design*
*Note: survey participants could provide multiple responses to questions*

# 9. Anaemia and Iron deficiency

A number of different indicators related to anaemia, iron deficiency and iron deficiency anaemia were collected in this survey. The organization of this chapter is as follows:

- **Anaemia**
    - Hemoglobin
    - Under five children
    - School-aged children
    - Women of childbearing age
    - Men
    - Comparison of anaemia among groups
- **Iron Deficiency**
    - TfR and Ferritin
    - Under five children
    - School-aged children
    - Non-pregnant women
    - Men
- **Iron Deficiency Anaemia**
    - TfR and Hb
    - Ferritin and Hb
    - Under five children
    - School-aged children
    - Non-pregnant women
    - Men
- **Anaemia, iron deficiency anaemia and infection**
    - Malaria parasitemia and Anaemia and Iron Deficiency Anaemia
    - Under five children
    - School-aged children
    - Men
- Intestinal Parasites and Anaemia
    - School-aged children
- Urinary Schistosomiasis and Anaemia
    - School-aged children
- **Use of iron supplements**
    - Women of childbearing age
- **Knowledge of anaemia and its prevention**
    - School-aged children
    - Women of childbearing age

## 9.1 Anaemia

The prevalence of anaemia was based on haemoglobin data from capillary blood samples analyzed using the HemoCue instrument (HemoCue AB, Angelholm, Sweden). All haemoglobin levels presented were adjusted for pregnancy, altitude and smoking as described in Methods Table 2-10.

### 9.1.1 Anaemia in under five children

The cut-off level for anaemia in under five children was haemoglobin levels <11.0 g/dL. The mean haemoglobin level was 10.6 g/dL. As a measure of data quality, the unweighted haemoglobin standard deviation was 1.7. The prevalence of anaemia in under five children was 54.8%. The prevalence of anaemia was significantly different by age and SES (Table 9-1). The prevalence of anaemia decreased with age. The prevalence of anemia was significantly low in the high SES group compared to the other groups.

**Table 9-1 Prevalence of anaemia and mean haemoglobin§ levels among under five children (6-59 months)**

| Characteristics of under five children | N | Percent anemic** | Mean haemoglobin (g/dl ±SD) |
|---|---|---|---|
| **Age group (months)** | | | |
| 6-11 | 129 | 81.0 (71.3-87.9)* | 9.7 ±1.6 |
| 12-23 | 227 | 70.4 (62.0-77.6) | 10.0 ±1.7 |
| 24-35 | 233 | 50.9 (43.7-58.1) | 10.8 ± 1.7 |
| 36-47 | 232 | 44.0 (35.4-52.3) | 11.0 ±1.6 |
| 48-59 | 182 | 36.6 (29.1-45.0) | 11.4 ±1.4 |
| **Sex** | | | |
| Male | 475 | 55.7 (49.8-61.4) | 10.5 ± 1.7 |
| Female | 515 | 53.8 (48.3-59.2) | 10.8 ± 1.7 |
| **SES** | | | |
| Low | 399 | 58.8 (52.8-64.5)* | 10.5 ±1.8 |
| Moderate | 353 | 59.7 (52.6-66.5) | 10.4 ± 1.7 |
| High | 251 | 41.4 (34.9-48.2) | 11.1 ±1.5 |
| **Residence** | | | |
| Urban | 123 | 49.7 (41.4-58.0) | 10.9 ±1.6 |
| Rural | 880 | 55.5 (50.2-60.6) | 10.6 ±1.7 |
| **Region** | | | |
| Northern | 332 | 46.4 (38.0-55.0) | 10.9 ±2.5 |
| Central | 333 | 62.2 (54.1-69.6) | 10.4 ±1.6 |
| Southern | 338 | 50.3 (43.3-57.2) | 10.8 ±1.5 |
| **National** | **1003** | **54.8 (50.0-60.0)** | **10.6±1.7** |

*Mean±SD and proportions are weighted to account for survey design. * p<0.05 test signifies variable differs across groups, **Under five children: anaemia (<11.0 g/dL), missing values: sex (n=13), § Haemoglobin levels were adjusted for altitude*

### 9.1.2 Anaemia in School-aged children

The cut off level for anaemia in school-aged children was <11.5 g/dL. The mean haemoglobin level was 12.2 g/dL. As a measure of data quality, the unweighted haemoglobin standard deviation was 1.4. The prevalence of anemia in school-aged children was (25.4%). The prevalence of anaemia was not significantly different across all demographic characteristics except for age (Table 9-2).

**Table 9-2 Prevalence of anaemia and mean haemogolobin§ levels among school-aged children (6-12 years)**

| Characteristics of school-aged children | N | Percent anemic** | Mean haemoglobin (g/dl ±SD) |
|---|---|---|---|
| **Age group (months)** | | | |
| 6-7 | 221 | 33.7 (27.6-40.5)* | 11.9 ±1.3 |
| 8-9 | 198 | 25.4 (19.3-32.7) | 12.3 ±1.4 |
| 10-11 | 171 | 18.8 (12.3-27.5) | 12.4 ± 1.4 |
| 12 | 81 | 30.5 (21.0-42.0) | 12.4 ± 1.6 |
| **Education (years)** | | | |
| 0 | 56 | 45.3 (33.8-57.4) | 11.6 ± 1.6 |
| 1 | 223 | 30.4 (24.6-36.9) | 12.0 ±1.3 |
| 2 | 142 | 21.7 (14.7-30.9) | 12.4 ±1.4 |
| 3 | 136 | 26.3 (17.6-37.5) | 12.2 ±1.5 |
| 4 | 68 | 12.9 (6.1-25.2) | 12.7 ±1.2 |
| 5 | 21 | 27.9(12.0-52.3) | 12.6 ±1.8 |
| 6-8 | 23 | 12.0 (2.4-42.6) | 13.2 ±1.1 |
| **Sex** | | | |
| Male | 32931 | 30.1 (24.6-36.2) | 12.2 ±1.4 |
| Female | 332 | 23.9(18.3-30.7) | 12.2 ±1.4 |
| **SES** | | | |
| Low | 275 | 28.8 (22.3-36.3) | 12.1 ±1.5 |
| Moderate | 212 | 25.9 (19.6-33.3) | 12.2 ±1.4 |
| High | 182 | 25.4 (18.3-34.1) | 12.3 ±1.4 |
| **Residence** | | | |
| Urban | 71 | 13.0 (6.4-24.5) | 12.6 ±1.2 |
| Rural | 600 | 28.7 (24.0-34.0) | 12.2 ±1.5 |
| **Region** | | | |
| Northern | 212 | 18.4 (12.3-26.7) | 12.4 ± 1.9 |
| Central | 235 | 31.5 (24.0-40.1) | 12.0 ± 1.4 |
| Southern | 224 | 25.5 (19.2-32.9) | 12.3 ± 1.2 |
| **National** | **671** | **25.4 (19.2-32.9)** | **12.2 ±1.4** |

*Mean±SD and proportion are weighted to account for survey design. * p<0.05 test signifies variable differs across groups, missing values: education (n=2), sex (n=10), SES (n=2), **School-aged children: anaemia (<11.5 g/dL), § Haemoglobin levels were adjusted for altitude*

### 9.1.3 Anaemia in Women of Childbearing Age

The cut off level for anaemia in non-pregnant women was <12.0g/dL. The mean haemoglobin level was 12.6 g/dL. As a measure of data quality, the unweighted haemoglobin standard deviation was 1.7. The prevalence of anemia in non-pregnant women was 32.0% (Table 9-3). There was no significant difference in the prevalence of anaemia by education level, SES, residence and region but age. The prevalence was significantly low in women aged between 30 and 30 years compared with other ages.

The cut off level for anaemia in pregnant women was <11.0g/dL. There were 68 pregnant women with haemoglobin measured. The mean haemoglobin level was 12.7 g/dL (95%CI 12.3-13.1). As a measure of data quality, the unweighted haemoglobin standard deviation was 1.6. The prevalence of anemia in pregnant women was 13.0% (95% CI 6.3-24.9). Due to the small numbers, we could not assess the variation in the prevalence of anaemia across the sociodemographic characteristics.

**Table 9-3 Prevalence of anaemia and mean haemoglobin§ levels among non-pregnant women of child bearing age (15-49 years)**

| Characteristics of non-pregnant women | N | Percent anemic** | Mean haemoglobin (g/dl ±SD) |
|---|---|---|---|
| **Age group (years)** | | | |
| 15-19 | 94 | 34.1 (24.5-45.3)* | 12.6 ±1.8 |
| 20-29 | 223 | 35.6 (28.7-43.1) | 12.5 ±1.7 |
| 30-39 | 153 | 22.0 (16.1-29.4) | 12.8 ±1.6 |
| 40-49 | 91 | 36.8 (25.6-49.7) | 12.6 ±1.6 |
| **Education (years)** | | | |
| None | 74 | 30.0 (21.8-39.6) | 12.7 ±1.5 |
| 1-5 | 179 | 28.9 (22.7-36.0) | 12.7 ±1.5 |
| 6-8 | 188 | 34.3 (26.9-42.6) | 12.6 ±1.7 |
| >8 | 113 | 35.7 (24.5-48.9) | 12.6 ±2.0 |
| **SES** | | | |
| Low | 224 | 34.9 (28.4-42.1) | 12.6 ±1.7 |
| Moderate | 166 | 30.0 (21.7-39.9) | 12.7 ±1.6 |
| High | 181 | 30.1 (22.2-39.3) | 12.6 ±1.7 |
| **Residence** | | | |
| Urban | 102 | 34.0 (21.8-48.7) | 12.5 ±2.1 |
| Rural | 469 | 31.6 (26.3-37.4) | 12.7 ±1.6 |
| **Region** | | | |
| Northern | 184 | 28.8 (22.1-36.6) | 12.6 ±2.6 |
| Central | 205 | 31.2 (24.8-38.4) | 12.7 ±1.6 |
| Southern | 182 | 33.5 (25.1-43.2) | 12.5 ±1.4 |
| **National** | **571** | **32.0 (27.1-37.3)** | **12.6 ±1.7** |

*Mean±SD and proportions are weighted to account for survey design, missing values: education (n=17), **Women: anaemia (<12.0 g/dL), § Haemoglobin levels were adjusted for pregnancy, altitude and smoking status*

### 9.1.4 Anaemia in Men

The cut off level for anaemia in men was <13.0g/dL. The mean haemoglobin level was 15.0 g/dL. As a measure of data quality, the unweighted haemoglobin standard deviation was 1.7. The prevalence of anemia in men was 12.2%. There was no significant difference in the prevalence of anaemia by age, education, SES, residence and region, (Table 9-4).

**Table 9-4 Prevalence of anaemia and mean hemoglobin§ levels among men (20-55 years)**

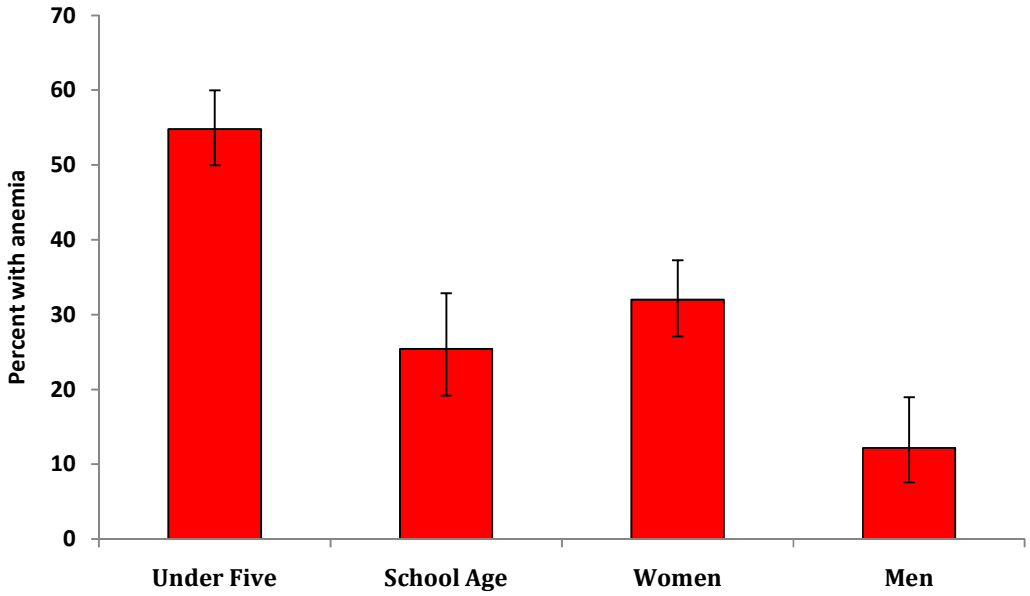
| Characteristics of men | N | Percent anemic** | Mean haemoglobin (g/dl ±SD) |
|---|---|---|---|
| **Age group (months)** | | | |
| 20-29 | 57 | 11.0 (4.4-24.7) | 15.2 ±1.5 |
| 30-39 | 50 | 7.9 (2.5-22.4) | 15.0 ±1.6 |
| 40-49 | 31 | 14.8 (5.4-34.8) | 14.8 ±1.8 |
| 50-55 | 8 | 33.0 (10.3-68.0) | 14.3 ±1.1 |
| **Education (years)** | | | |
| 1-5 | 38 | 10.2 (4.0-23.5) | 15.1 ±1.4 |
| 6-8 | 59 | 16.4 (7.8-31.3) | 14.9 ±1.7 |
| >8 | 40 | 11.2 (3.7-29.6) | 14.7 ±1.7 |
| **SES** | | | |
| Low | 47 | 8.9 (3.3-21.7) | 15.1 ±1.5 |
| Moderate | 51 | 14.0 (7.1-25.7) | 14.7 ±1.7 |
| High | 48 | 13.6 (5.4-30.3) | 15.1 ±1.6 |
| **Residence** | | | |
| Urban | 18 | 20.3 (6.6-47.7) | 14.5 ± 2.6 |
| Rural | 128 | 11.3 (6.7-18.6) | 15.0 ±1.5 |
| **Region** | | | |
| Northern | 55 | 10.9 (4.9-22.5) | 15.1 ±3.1 |
| Central | 56 | 16.1 (9.0-27.0) | 14.8 ±1.6 |
| Southern | 35 | 8.6 (2.9-22.6) | 15.1 ±1.0 |
| **National** | **146** | **12.2 (7.6-19.0)** | **15.0 ±1.6** |

*Mean±SD and proportions are weighted to account for survey design. *p<0.05, missing values: education (n=9) **Adult men: anaemia (<13.0 g/dL), § Haemoglobin levels were adjusted for altitude and smoking status.*

### 9.1.5 Summary of anaemia by target group

The highest prevalence of anaemia was found in under five children (54.8%) followed by non-pregnant women (32.0%), school-aged children (25.4%) and men (12.2%), Figure 9.1. The WHO classifications of anaemia as a public health problem as applied to Malawi shows that there is a severe anaemia problem (≥40%) in under five children and a moderate problem (20.0%-39.9%) in women and school-aged children and a mild problem (5.0–19.9%) in men.

**Figure 9-1 Prevalence of anaemia by target group**




*Data are weighted to account for survey design*

## 9.2 Iron deficiency

Iron deficiency was assessed using two methods, TfR and serum ferritin. The cut-off for iron deficiency using was TfR was >8.3mg/L for all age groups. The cut-off for iron deficiency using ferritin was <12µg/L for under five children and <15µg/L for all other groups. The prevalence of iron deficiency was examined using both indicators. As described in Methods Section 2.11.15.3, prevalence of iron deficiency ≥10% using TfR and <20% using serum ferritin is interpreted as both iron deficiency and inflammation are prevalent. All target groups fit these criteria. Thus, iron deficiency results based only on TfR are reported.

For comparison purposes, iron deficiency results using serum ferritin are provided in appendices 18-20 and characteristics of those with elevated CRP and AGP are provided in appendices 21-24.

### 9.2.1 Iron Deficiency in under five children

For under five children, the prevalence iron deficiency measured by TfR was 50.9% while the prevalence iron deficiency measured by serum ferritin was 10.3% (appendix 18). Thus, as described above, iron deficiency results based on TfR are reported (Table 9-5). There was no significant difference in the prevalence of iron deficiency by age, sex and residence but there was a significant difference in the prevalence iron deficiency by SES and region. The prevalence of iron deficiency decreased significantly with an increase in SES. The prevalence of iron deficiency was significantly higher in the Central region compared with the Southern and Northern regions respectively.

**Table 9-5 Prevalence of iron deficiency in under five children (6-59 months)**

| | **Serum transferrin receptor (TfR)** | |
|---|---|---|
| **Characteristics of under five children** | **N** | **Percent iron deficient (CI)** |
| **Age (months)** | | |
| 6-11 | 122 | 54.9 (45.5-64.0) |
| 12-23 | 226 | 50.1 (42.1-58.1) |
| 24-35 | 234 | 45.2 (37.8-52.9) |
| 36-47 | 225 | 52.3 (44.9-59.6) |
| 48-59 | 173 | 55.1 (47.2-62.8) |
| **Sex** | | |
| Male | 464 | 48.3 (41.9-54.8) |
| Female | 505 | 53.3 (47.8-58.8) |
| **SES** | | |
| Low | 319 | 58.9(52.6-64.8)* |
| Moderate | 345 | 46.4 (40.2-52.7) |
| High | 244 | 43.6 (36.0-51.4) |
| **Residence** | | |
| Urban | 121 | 49.7 (41.5-64.8) |
| Rural | 859 | 51.0 (45.9-56.2) |
| **Region** | | |
| Northern | 321 | 36.1 (29.8-43.0)* |
| Central | 327 | 60.6 (52.6-68.0) |
| Southern | 332 | 45.8 (39.3-52.4) |
| **National** | **980** | **50.9 (46.3-55.5)** |

*Data are weighted to account for survey design, * p<0.05 test signifies variable differs across groups, Iron deficiency is TfR >8.3mg/L, missing values: sex (n=11)*

### 9.2.2 Iron Deficiency in School-aged children

For school-aged children, the prevalence iron deficiency measured by TfR was 29.6% while the prevalence iron deficiency measured by serum ferritin was 3.7% (appendix 19). Thus, as described above, iron deficiency results based on TfR are reported (Table 9-6). There was no significant difference in the prevalence of iron deficiency measured using TfR by age, sex, region and residence but there was a significant difference in the prevalence of iron deficiency by education and SES.

**Table 9-6 Prevalence of iron deficiency in school-aged children (6-12 years)**

| | **Serum transferrin receptor (TfR)** | |
|---|---|---|
| **Characteristics of school-aged children** | **N** | **Percent iron deficient (CI)** |
| **Age group (years)** | | |
| 6-7 | 205 | 31.3 (24.1-39.4) |
| 8-9 | 186 | 30.6 (22.6-40.0) |
| 10-11 | 166 | 23.3 (16.4-31.9) |
| 12 | 79 | 36.4 (26.4-47.9) |
| **Education (years)** | | |
| 0 | 53 | 47.8 (33.8-62.2)* |
| 1 | 210 | 34.8 (26.6-43.9) |
| 2 | 135 | 25.9 (17.2-36.9) |
| 3 | 132 | 20.6 (13.4-36.9) |
| 4 | 61 | 11.8 (5.3-24.2) |
| 5 | 19 | 42.9 (20.5-68.7) |
| 6-8 | 22 | 22.4 (7.7-49.9) |
| **Sex** | | |
| Male | 308 | 30.8 (23.9-38.7) |
| Female | 318 | 29.4 (23.2-36.4) |
| **SES** | | |
| Low | 274 | 35.8 (28.6-43.8* |
| Moderate | 198 | 28.5 (21.3-37.1) |
| High | 162 | 20.2 (12.3-31.4) |
| **Residence** | | |
| Urban | 53 | 22.8 (11.4-40.5) |
| Rural | 583 | 30.2 (24.5-36.5) |
| **Region** | | |
| Northern | 214 | 14.5 (9.1-22.4) |
| Central | 235 | 37.5 (28.2-47.7) |
| Southern | 187 | 26.2 (19.1-34.8) |
| **National** | **636** | **29.6 (24.3-35.7)** |

*Data are weighted to account for survey design, * p<0.05 test signifies variable differs across groups*
*Iron deficiency is TfR >8.3mg/L,, missing values: education (n=4), SES (n=2)*

### 9.2.3 Iron Deficiency in non-pregnant Women of Childbearing Age

For non-pregnant women, the prevalence iron deficiency measured by TfR was 26.1% while the prevalence iron deficiency measured by serum ferritin was 10.4% (appendix 20). Thus, as described above, iron deficiency results based on TfR are reported (Table 9-7). There were no significant differences in the prevalence of iron deficiency by age, education level, SES, residence and region.

**Table 9-7 Prevalence of iron deficiency among non-pregnant women (15-49 years)**

| | **Serum transferrin receptor (TfR)** | |
|---|---|---|
| **Characteristics of women** | **N** | **Percent iron deficient (CI)** |
| **Age group (years)** | | |
| 15-19 | 84 | 36.2 (26.2-47.6) |
| 20-29 | 209 | 25.5 (18.6-34.0) |
| 30-39 | 139 | 25.0 (18.3-33.3) |
| 40-49 | 77 | 18.6 (10.5-30.8) |
| **Education (years)** | | |
| None | 65 | 20.8 (11.5-34.6) |
| 1-5 | 163 | 25.5 (17.7-35.2) |
| 6-8 | 170 | 29.6 (21.0-40.0) |
| >8 | 97 | 247 (16.1-36.0) |
| **SES** | | |
| Low | 197 | 25.2 (18.6-33.2) |
| Moderate | 153 | 30.8 (22.7-40.2) |
| High | 159 | 22.8 (15.8-31.7) |
| **Residence** | | |
| Urban | 87 | 22.9 (14.5-34.2) |
| Rural | 422 | 26.7 (21.5-32.6) |
| **Region** | | |
| Northern | 165 | 20.6 (13.6-30.0) |
| Central | 177 | 25.4 (19.1-33.0) |
| Southern | 167 | 28.1 (20.6-37.2) |
| **National** | **509** | **26.1 (21.5-31.4)** |

*Data are weighted to account for survey design, Iron deficiency is TfR >8.3mg/L, missing values: education (n=14)*

### 9.2.4 Iron Deficiency in Men

For men, the prevalence iron deficiency measured by TfR was 7.1%. There was no significant difference in the prevalence of iron deficiency by age, education level, SES, residence and region (Table 9-8).

**Table 9-8 Prevalence of iron deficiency among men (20-55 years)**

| | Serum transferrin receptor (TfR) | |
|---|---|---|
| **Characteristics of men** | **N** | **Percent iron deficient (CI)** |
| **Age group (years)** | | |
| 20-29 | 49 | 9.8 (4.3-20.6) |
| 30-39 | 46 | 6.9 (2.0-21.4) |
| 40-49 | 32 | 4.2 (0.6-25.7) |
| 50-55 | 7 | -- |
| **Education (years)** | | |
| 1-5 | 32 | 8.0 (2.4-23.8) |
| 6-8 | 57 | 9.1 (3.4-22.5) |
| >8 | 36 | 1.7 (0.4-6.9) |
| **SES** | | |
| Low | 47 | 10.32 (4.5-21.7) |
| Moderate | 45 | 6.3 (2.1-17.6) |
| High | 42 | 4.4 (0.6-26.4) |
| **Residence** | | |
| Urban | 18 | 10.2 (2.2-36.4) |
| Rural | 116 | 6.7 (3.3-13.3) |
| **Region** | | |
| Northern | 48 | 12.5 (5.8-24.8) |
| Central | 55 | 9.1 (3.9-19.7) |
| Southern | 31 | 3.2 (0.4-20.2) |
| **National** | **134** | **7.1 (3.7-13.1)** |

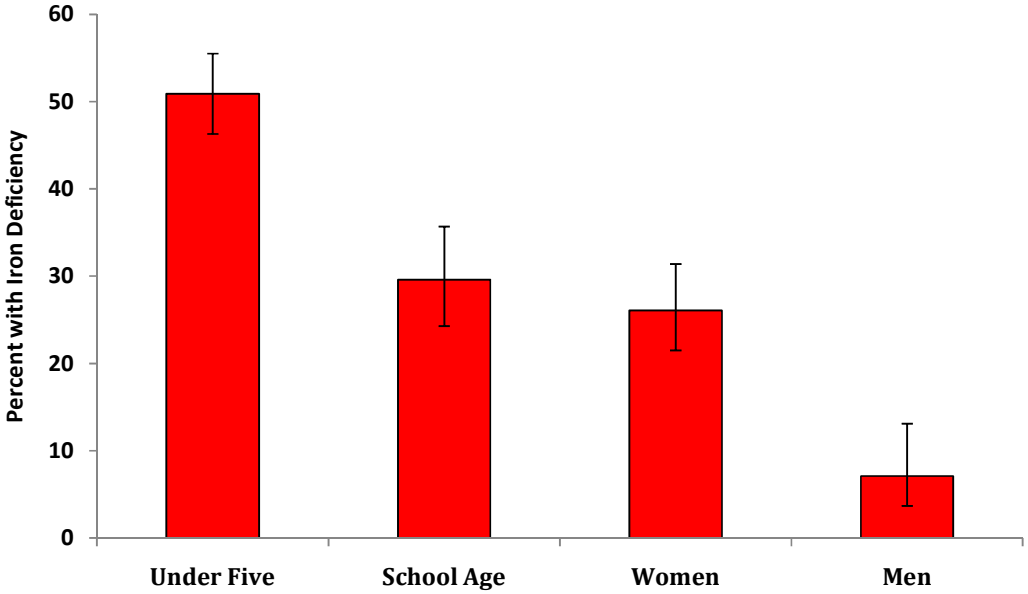
*Data are weighted to account for survey design, *p<0.05, ** Iron deficiency is TfR >8.3mg/L*

### 9.2.5 Summary of Iron Deficiency by target group

Figure 9.2 displays the prevalence of iron deficiency by target group. The highest prevalence of iron deficiency using TfR was found in under five children (50.9%) followed by school-aged children (29.6%), nonpregnant women (26.1%), and men (7.1%). Based on WHO recommendations[34], iron deficiency is prevalent and inflammation is prevalent among under five children, school-aged children and non-pregnant women (TfR≥10% and serum ferritin <20%), but iron deficiency is not prevalent in men (TfR<10% and serum ferritin <20%).

[34] Joint World Health Organization/Centers for Disease Control and Prevention Technical Consultation on the Assessment of Iron Status at the Population Level (2004 : Geneva, Switzerland).

**Figure 9-2 Prevalence of iron deficiency by target group**




*Data are weighted to account for survey design. Iron deficiency determined by TfR>8.3 mg/L.*

## 9.3 Iron Deficiency Anaemia

Two indicators were utilized to assess iron deficiency anaemia (IDA); combination of elevated TfR levels >8.3mg/L (iron deficiency) and low haemoglobin (anaemia). For comparison purposes results of iron deficiency anemia based on low Ferritin <12 µg/L for under five children or <15 µg/L for all other groups (iron deficiency) and low haemoglobin (anaemia) are provided in appendices 25-28.

### 9.3.1 Iron Deficiency Anaemia in under five children

The prevalence of IDA using a combination of TfR and haemoglobin levels was 30.6%. There was no significant difference in the prevalence of IDA by age and sex. There was a significant difference by SES, residence and region. The prevalence of IDA was higher in under five children in the lower SES status, living in rural areas, and in the Central region compared with the Northern and Southern regions respectively but decreased with age.

**Table 9-9 Prevalence of iron deficiency anaemia among under five children**

| Characteristics of under five children | N | Percent with iron deficiency anaemia (CI) |
|---|---|---|
| **Age group (months)** | | |
| 6-11 | 113 | 39.2 (29.9-49.3) |
| 12-23 | 206 | 34.2 (26.2-43.2) |
| 24-35 | 210 | 30.0 (23.6-37.2) |
| 36-47 | 215 | 27.8 (20.5-36.4) |
| 48-59 | 161 | 24.8 (18.0-33.1) |
| **Sex** | | |
| Male | 426 | 30.2 (24.8-36.2) |
| Female | 469 | 30.9 (25.3-37.3) |
| **SES** | | |
| Low | 360 | 37.3 (30.2 -45.0)* |
| Moderate | 322 | 30.8 (25.6-36.5) |
| High | 223 | 18.8 (13.4-25.8) |
| **Residence** | | |
| Urban | 106 | 21.8 (15.2-30.2)* |
| Rural | 799 | 31.6 (26.6-37.1) |
| **Region** | | |
| Northern | 289 | 19.8 (14.6-26.0)* |
| Central | 305 | 42.3 (33.5-51.6) |
| Southern | 311 | 22.5 (17.5 -28.4) |
| **National** | **905** | **30.6 (26.0-35.6)** |

*Data are weighted to account for survey design, ** p<0.05 test signifies variable differs across groups, Iron deficiency anaemia defined as TfR>8.3mg/L and haemoglobin<11.0g/dL. Missing values: : sex (n=10)*

### 9.3.2 Iron Deficiency Anaemia in School-aged children

The prevalence of IDA measured using a combination of TfR and hemoglobin was 12.0%. There were no significant differences in the prevalence of IDA by age, education level, sex, SES, residence and region Table 9-10.

**Table 9-10 Prevalence of iron deficiency anaemia among school-aged children (6-12 years)**

| Characteristics of school-aged children | N | Percent with iron deficiency anaemia (CI) |
|---|---|---|
| **Age group (years)** | | |
| 6-7 | 197 | 14.4 (9.2-21.9) |
| 8-9 | 179 | 10.0 (5.5-17.5) |
| 10-11 | 160 | 8.5 (5.0-14.2) |
| 12 | 77 | 17.8 (10.1-29.4) |
| **Education (years)** | | |
| 0 | 50 | 25.2 (14.8-39.6) |
| 1 | 20 | 11.7 (6.9-19.0) |
| 2 | 130 | 11.2 (6.1-19.9) |
| 3 | 129 | 8.1 (4.3-14.8) |
| 4 | 61 | 3.3 (0.7-15.0) |
| 5 | 19 | 25.9 (8.4-56.9) |
| 6-8 | 20 | 15.2 (3.1-49.8) |
| **Sex** | | |
| Male | 297 | 10.1 (6.4-15.7) |
| Female | 306 | 14 (9.8-19.6) |
| SES | | |
| Low | 262 | 14.9 (10.4-20.9) |
| Moderate | 197 | 10.0 (5.8-16.6) |
| High | 152 | 9.6 (5.3-16.7) |
| **Residence** | | |
| Urban | 54 | 7.5 (2.3-23.0) |
| Rural | 561 | 12.4 (9.0-16.8) |
| **Region** | | |
| Northern | 203 | 3.5 (1.7-6.7) |
| Central | 228 | 18.0 (11.9-26.3) |
| Southern | 182 | 8.2 (5.2-12.8) |
| **National** | **613** | **12.0 (8.7-16.3)** |

*Data are weighted to account for survey design, * p<0.05 test signifies variable differs across groups, Iron deficiency anaemia defined as TfR>8.3mg/L and haemoglobin<11.5g/dL, Missing values: education (n=4), SES (n=2)*

### 9.3.3 Iron Deficiency Anaemia in Non-Pregnant Women (15-49 years)

The prevalence of IDA measured using a combination of TfR and hemoglobin was 9.3%. There was no significant difference in the prevalence of IDA by age, education level, SES, residence and regions (Table 9-11).

**Table 9-11 Prevalence of iron deficiency anaemia among non-pregnant women of childbearing age (15-49 years)**

| Characteristics of childbearing women | N | Percent with iron deficiency anaemia (CI) |
|---|---|---|
| **Age group (years)** | | |
| 15-19 | 74 | 7.6 (3.2-17.2) |
| 20-29 | 191 | 10.5 (6.2-17.1) |
| 30-39 | 128 | 10.5 (5.9-18.2) |
| 40-49 | 73 | 5.6 (2.1-14.6) |
| **Education (years)** | | |
| None | 64 | 7.7 (3.0-18.4) |
| 1-5 | 150 | 11.0 (6.0-19.4) |
| 6-8 | 155 | 6.3(3.2-12.2) |
| >8 | 85 | 8.3 (3.6-18.1) |
| **SES** | | |
| Low | 187 | 9.2 (5.3-15.7) |
| Moderate | 140 | 9.6 (5.3-16.9) |
| High | 139 | 9.0 (4.7-16.4) |
| **Residence** | | |
| Urban | 70 | 4.5 (1.4-13.6) |
| Rural | 396 | 10.0 (6.7-14.5) |
| **Region** | | |
| Northern | 146 | 6.2 (3.1-12.0) |
| Central | 161 | 9.9 (5.8-16.5) |
| Southern | 159 | 9.4 (5.1-16.7) |
| **National** | **466** | **9.3 (6.3-13.4)** |

*Data are weighted to account for survey design, Iron deficiency anaemia defined as TfR>8.3mg/L and haemoglobin<12.0g/dL, missing values: age education (n=12)*

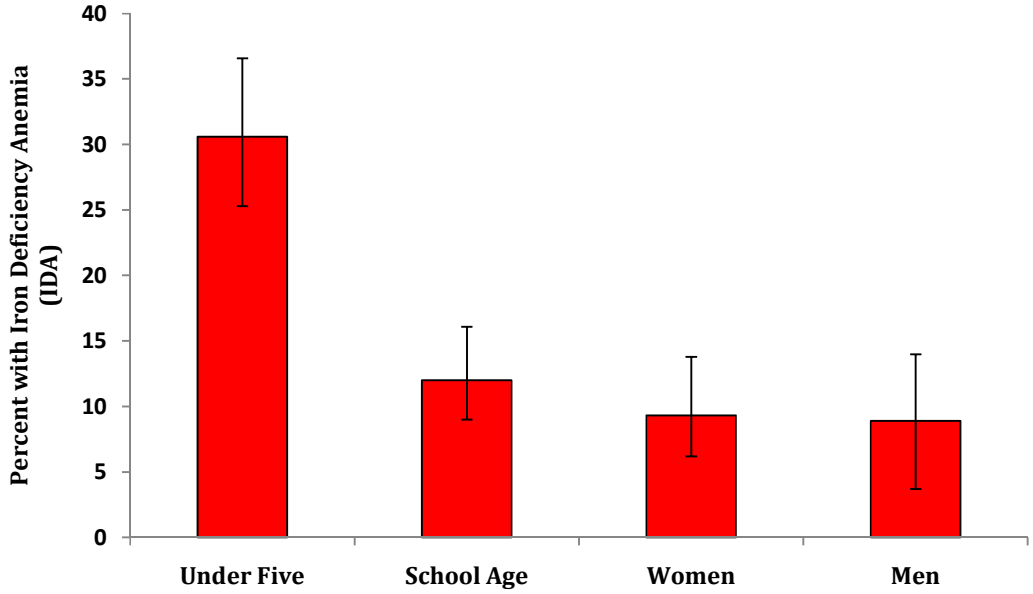
### 9.3.4 Iron Deficiency Anaemia in Men

The prevalence of IDA measured using a combination of TfR and hemoglobin was 8.9% (95%CI 6.2-12.5). Due to small number of men with IDA (n=7), the associations between IDA and demographic characteristics were not assessed.

### 9.3.5 Summary of Iron Deficiency Anaemia by target group

The highest prevalence of IDA when measured using a combination of TfR and hemoglobin was found in under five aged children (30.6%), followed by school-aged children (12.0%) and non-pregnant women (9.3%) and lastly men (8.9%), Figure 9.3.

**Figure 9-3 Prevalence of iron deficiency anaemia by target group**




*Data are weighted to account for survey design. IDA determined by low haemoglobin and elevated TfR.*

## 9.4 Anaemia, Iron Deficiency Anemia and Infection

Anaemia has many contributing factors. Infections that cause cellular lysis for example malaria or suppression of hematopoesis or blood loss increase the prevalence of anaemia.[35] Therefore, data on infection were combined with hemoglobin values to determine the percentage in each target group who were anemic.

### 9.4.1 Anaemia, Iron Deficiency Anaemia and Infection

There was a significant difference in the prevalence of anaemia in non-pregnant women with and without malaria and also in school-aged children. There were also significant differences in the prevalence of iron deficiency between under five children with and without malaria parasitemia, and a significant difference in IDA between under five children and school-aged children with and without malaria, Table 9-12. However, there were no significant differences in the other age groups.

[35] Assessing the iron status of populations: report of a Joint World Health Organization/Centers for Disease Control and Prevention Technical Consultation on the Assessment of Iron Status at the Population Level, Geneva, Switzerland, 6–8 April 2004. – 2nd ed.

**Table 9-12. Prevalence of anaemia and iron deficiency anaemia in those with and without malaria parasitemia**

| Target group | Malaria parasi-temia | N | Prevalence of Anaemia (%) | | Prevalence of Iron deficiency (%) (TfR) | N | Prevalence of Iron deficiency anaemia (%) (TfR) † |
|---|---|---|---|---|---|---|---|
| Under five children | Yes | 167 | 60.9 (52.6-68.6) | 180 | 67.9 (58.1-76.4)* | 167 | 43.6 (33.5-54.4)* |
| | No | 661 | 52.9 (47.5-58.2) | 715 | 46.9 (42.1-51.7) | 661 | 27.4 (23.0-32.3) |
| School-aged children | Yes | 91 | 35.4 (26.9-45.1)* | 95 | 42.0 (30.9-54.0) | 91 | 18.8 (12.1-27.9)* |
| | No | 458 | 25.9 (20.7-31.9) | 472 | 26.1 (20.8-32.2) | 458 | 10.8 (7.6-15.1) |
| Non-pregnant women | Yes | 16 | 57.1 (31.0-79.7)* | 19 | 25.2 (9.5-51.9) | 16 | 16.3 (4.0-47.6) |
| | No | 392 | 31.4 (25.8-37.8) | 424 | 27.1 (22.3-323) | 392 | 9.4 (6.3-13.8) |

*Data are weighted to account for survey design; * p<0.05 test signifies variable differs across groups*

### 9.4.2 Anaemia and Infection in School-aged children

The relationship between hookworm infection and anaemia and urinary schistosomiasis and anaemia were examined in school-aged children. There were no significant differences noted in the prevalence of anemia, iron deficiency and IDA between those with and without infection, except for prevalence of anaemia between those with and without bilhazia. Table 9-13.

**Table 9-13 Parasitic infection and prevalence of anaemia in school-aged children**

| Parasitic infection | | N | Prevalence of anaemia (%) | N | Prevalence of Iron deficiency (%) (TfR) | N | Prevalence of Iron deficiency anaemia (%) (TFR) |
|---|---|---|---|---|---|---|---|
| Hookworm | Yes | 10 | 18.0 (3.9-54.4) | 10 | 33.8 (12.3-65.1) | 10 | 18.0 (3.9-54.4) |
| | No | 515 | 26.7 (22.0-32.0) | 520 | 28.6 (22.9-35.2) | 505 | 11.0 (7.8-15.1) |
| Urinary schistosomiasis | Yes | 80 | 38.5 (30.5-47.2)* | 84 | 34.5 (22.8-48.6) | 80 | 13.7 (7.9-22.8) |
| | No | 464 | 25.0 (19.6-31.3) | 478 | 28.3 (22.3-35.1) | 464 | 11.9 (8.1-17.1 |

*Data are weighted to account for survey design*

## 9.5 Use of iron supplements

Women of childbearing age were asked about their current and previous use of iron supplements. Of the women who were interviewed, 36.6% of the pregnant women were taking iron and 5.3% of the non-pregnant were taking iron supplements at the time of the survey. Almost all of the women taking iron supplements (89.3%) did so daily, with 5.8% reporting not taking the iron regularly and 4.3% taking iron supplements weekly. Most women, 64.4%, obtained their iron supplements from a clinic, hospital or health center (Table 9-14).

**Table 9-14 Sources of iron supplements among women reporting iron supplement use**

| Place where iron supplements are obtained | Percent of women who obtained iron supplements |
|---|---|
| Village health volunteer | 8.6 (3.7-18.9) |
| Health surveillance assistant | 27.7 (15.3-44.7) |
| Purchased at a grocery/market | 2.2 (0.3-14.0) |
| Clinic/hospital/health centre | 59.3 (42.8-73.9) |
| Other | 2.3 (0.5-9.1) |

*Data are weighted to account for survey design*

Women (n=427) were also asked if they had received iron supplements during any of their pregnancies. A total of 93.1% received iron supplements during at least one of their previous pregnancies.

## 9.6 Knowledge of anaemia and its prevention

Both women of childbearing age and school-aged children were asked a number of knowledge questions about anaemia. Overall, 88.1% of women and 43.8% of the school-aged children interviewed had heard of anaemia/shortage of blood. Only those who said that they had heard of anaemia/shortage of blood were asked further questions.

### 9.6.1 Knowledge of Iron – School-aged children

Some of the children (43.8%) reported that they know about anaemia. There was a significant difference in the knowledge level by age and education; knowledge increased significantly with age and education level, Table 9-15.

**Table 9-15 Percentage of school-aged children (6-12 years) having ever heard of anaemia/shortage of blood**

| Characteristics of school-aged children | N | Percent reporting having ever heard of anaemia/shortage of blood |
|---|---|---|
| **Age group (years)** | | |
| 6-7 | 247 | 337 (27.1-41.1)* |
| 8-9 | 223 | 42.7 (34.0-51.9) |
| 10-11 | 192 | 50.8(42.4-59.2) |
| 12 | 91 | 58.8 (47.9-68.8) |
| **Education (years)_** | | |
| 0 | 63 | 25.1 (14.2-40.3)* |
| 1 | 258 | 36.2 (28.7-44.5) |
| 2 | 155 | 48.0 (37.9-58.3) |
| 3 | 151 | 49.7 (40.7-58.8) |
| 4 | 76 | 57.1 (43.4-69.7) |
| 5 | 22 | 54.0 (32.2-74.4) |
| 6-8 | 27 | 70.2 (47.0-86.2) |
| **Sex** | | |
| Male | 377 | 47.1(40.5-53.8) |
| Female | 366 | 40.5 (33.6-47.7) |
| **SES** | | |
| Low | 306 | 41.7 (34.4-49.4) |
| Moderate | 232 | 42.4 (32.2-53.4) |
| High | 213 | 47.8 (39.4-56.4) |
| **Residence** | | |
| Urban | 102 | 34.8 (23.0-48.9) |
| Rural | 651 | 45.2 (39.4-51.0) |
| **Region** | | |
| Northern | 240 | 45.0 (36.8-53.5) |
| Central | 257 | 38.1 (29.8-47.2) |
| Southern | 256 | 48.4 (40.0-57.0) |
| **National** | **753** | **43.8 (38.4-49.3)** |

*Data are weighted to account for survey design, * p<0.05 test signifies variable differs across groups, missing values: education (n=1), sex (n=10), SES (n=2)*.

School-aged children who had heard of anaemia or shortage of blood were asked two additional knowledge questions about anaemia. The most common causes of anemia reported by the school-aged children were lack of food (38.9%) and illness/disease (40.6%). The top foods mentioned that prevent anaemia were vegetables (48.1%), fruits (19.1%) and beans (15.1%), Table 9-16.

**Table 9-16 Among school-aged children (6-12 years) who had ever heard about anaemia/shortage of blood, responses to questions concerning anaemia n=330**

| | N | |
|---|---|---|
| **Causes of shortage of blood/anaemia** | | |
| Lack of food | 133 | 38.9 (31.2-47.1) |
| Illness/disease | 143 | 40.6 (33.9-47.6) |
| Bleeding | 20 | 6.1 (3.9-9,5) |
| Heavy work | 1 | 0.1 (0.0-0.9) |
| Genetics | 2 | 0.3 (0.0-1.0) |
| Other | 21 | 6.8(4.4-10.5) |
| Don't know | 91 | 29.5 (23.2-36.7) |
| **Foods to prevent shortage of blood/anaemia** | | |
| Eggs | 37 | 6.9 (4.6-10.3) |
| Milk | 18 | 4.6 (2.4-8.9) |
| Vegetables | 159 | 48.1 (40.1-56.1) |
| Beans | 51 | 15.1 (10.5-21.3) |
| Fruit | 68 | 19.1 (14.8-24.4) |
| Fish, Grasshopper, Birds, Meat (beef) | 2 | 0.7 (0.2-2.9) |

*Data are weighted to account for survey design*

### 9.6.2 Knowledge of Iron - Women

Most of the women (88.1%) reported to have heard about anaemia. There were significant differences in knowledge by education level (Table 9-17). Knowledge increased significantly with level of education. There was no significant difference in the level of knowledge in the other sociodemographic characteristics.

**Table 9-17 Percentage of women of childbearing age (15-49 years) having ever heard of anaemia/shortage of blood**

| Characteristics of women | N | Percent reporting having ever heard of anaemia/shortage of blood |
|---|---|---|
| **Age group (months)** | | |
| 15-19 | 130 | 84.6 (75.6-90.6) |
| 20-29 | 327 | 88.3 (83.7-91.7) |
| 30-39 | 185 | 88.1 (81.2-92.6) |
| 40-49 | 112 | 91.6 (83.6-95.9) |
| **Education (years)** | | |
| None | 88 | 82.1 (71.7-89.2)* |
| 1-5 | 245 | 83.6 (78.0-87.9) |
| 6-8 | 248 | 91.3 (86.8-94.3) |
| >8 | 152 | 96.9(88.1-99.2) |
| **SES** | | |
| Low | 273 | 87.1 (81.4-91.3) |
| Moderate | 225 | 88.7 (81.7-93.2) |
| High | 256 | 88.6 (82.9-92.6) |
| **Residence** | | |
| Urban | 151 | 91.4 (83.6-95.7) |
| Rural | 603 | 87.3 (83.4-90.4) |
| **Region** | | |
| Northern | 264 | 92.8 (88.9-95.4) |
| Central | 249 | 84.3 (78.0-89.1) |
| Southern | 241 | 90.0(84.7-90.9) |
| **National** | **754** | **88.1 (84.7-90.9)** |

*Data are weighted to account for survey design, * p<0.05 test signifies variable differs across groups, missing values: education (21)*

The most common causes of anaemia reported by women were lack of food (68.5%) and illness/disease (54.9%). Very few women mentioned bleeding (20.8%) as a cause of anaemia. When asked about foods that prevent anaemia, the most common answers were beans (70.2%), fruits (43.4%) and meat (27.0%), Table 9-18.

**Table 9-18 Among women of childbearing age (15-49 years) who had ever heard about anaemia/shortage of blood, responses to questions concerning anaemia n=672**

| | N | % |
|---|---|---|
| **Causes of shortage of blood/anaemia (n=673)** | | |
| Lack of food | 469 | 68.5 (63.8-72.9) |
| Illness/disease | 384 | 54.9 (50.0-60.0) |
| Bleeding | 141 | 20.8 (17.2-24.8) |
| Heavy work | 25 | 4.0 (2.6-6.2) |
| Genetics | 3 | 0.4 (0.1-1.4) |
| Other | 60 | 9.4 (7.3-12.0) |
| Don't know | 63 | 10.4 (7.6-14.1) |
| **Foods to prevent shortage of blood/anaemia (n= 673)** | | |
| Eggs | 132 | 15.4 (12.6-18.6) |
| Milk | 66 | 8.2 (6.3-10.7) |
| Vegetables | 197 | 22.6 (19.0-26.8) |
| Beans | 522 | 70.2 (64.7-75.1) |
| Fruit | 368 | 43.4 (39.2-48.5) |
| Rice | 17 | 2.2 (1.3-3.7) |
| Maize | 10 | 1.5 (0.8-2.9) |
| Nsima | 44 | 6.4 94.7-8.7) |
| Meat | 173 | 27.0 (22.6-31.9) |
| Vitamin C rich food | 2 | 2.6 (1.6-4.2) |
| Other | 140 | 20.5 (17.0-24.6) |
| Don't know | 28 | 3.7 (2.3-5.8) |

*Data are weighted to account for survey design*

# 10. Summary of findings

The survey has found that although there has been an improvement in the nutritional status, Malawi still has a problem with micronutrient deficiencies in under five children, school children, women of childbearing age and men. The data obtained from the survey provides information on the progress that has been made so far and provides a bench mark for future assessments. The data also establishes a basis for advocacy and resource mobilization for micronutrient interventions and to establish priorities for action.

In this section, we compare select findings to previous estimates obtained from the 2004 Malawi Demographic and Health Survey (MDHS) and the 2006 Malawi Multiple Indicator Cluster Survey (MICS). MDHS and MICS are nationally-representative household surveys that provide data for a wide range of monitoring and impact evaluation indicators in the areas of population, health, and nutrition. Similar to the 2009 Micronutrient Survey, both surveys use a two-stage sampling methodology. In the 2004 MDHS[36], the first stage selected 522 enumeration areas drawn from the 1998 Census sampling frame (485 rural and 64 urban areas). The National Statistical Office staff conducted an exhaustive listing of households in each of the MDHS clusters in August and September 2004. From these lists, a systematic sample of households was drawn for a total of 15,091 households. All women age 15-49 in the selected households were eligible for individual interview. All children under five years who stayed in the selected household the night before the interview were also assessed for nutritional status. In every third household, all men aged 15-54 were eligible for individual interview. The survey sample included 11,698 women, 3,261 men and 8,520 children under five. In the 2006 MICS[37], within each district, 40 census enumeration areas were selected with probability proportional to size. A household listing was carried out within the cluster and a systematic sample of 30 households was drawn to obtain 1,200 households per district. A total of 22,994 children under the age of five, 26,259 women aged 15–49, and 7,636 men aged 15–49 were interviewed in 26 districts of Malawi. With 30,553 households interviewed in the survey, MICS 2006 was one of the largest household surveys undertaken in the country.

## 10.1 Demographics

The study sample was very similar to results from the 2008 Population and Housing Census in Malawi in terms of location of the households and the age distribution. Most of the households were located in rural areas (84.5%), and most men (81.6%) and women (66.8%) were married. The age and sex distribution for the sample was also similar to the 2008 national census report. There were more men who were able to read and write (84.2%) compared with women (64.7%). There were few participants who were highly educated with only 19.5% women and 33.1% men having completed secondary school and beyond.

[36] Malawi Demographic Health Survey, 2004, http://www.measuredhs.com/pubs/pub_details.cfm?ID=575&srchTp=advanced
[37] Malawi Multiple Indicator Cluster Survey, 2006. http://www.childinfo.org/files/MICS3_Malawi_FinalReport_2006_eng.pdf

## 10.2 Anthropometry

### 10.2.1 Low height-for-age (shortness or stunting) in under five children

The prevalence of stunting was 48.8% indicating that stunting is still a big problem in Malawi according to WHO guidelines.[38] At community level, a high prevalence of stunting among young children implies long-term malnutrition and/or poor health of the population, and is a reliable indicator of overall socioeconomic conditions. In a generally healthy and well-nourished population, the statistically expected prevalence of stunting is about 2.3%. Although the HAZ standard deviation was larger than expected, the prevalence of stunting in this survey is comparable to the prevalence found in the 2004 MDHS (47.8%) and the MICS 2006 survey (47.0%) indicating minimal change in the prevalence of stunting in under five children. Similar to the 2004 MDHS, stunting was slightly more prevalent in boys (52.4%) than in girls (45.6%).

### 10.2.2 Low weight-for-age (underweight) in under five children

The proportion of children in this survey who were underweight was 12.1%, which is less than what was found in the 2004 MDHS (22.0%) and the 2006 MICS survey (20.0%), indicating that there has been a substantial decline in the prevalence of underweight in under five children. According to the WHO guidelines, the proportion of children who are underweight in Malawi represents a medium public health problem as compared to a high public health problem in previous surveys.

### 10.2.3 Weight and height (wasting) in under five children

The prevalence of wasting was low at 1.8% suggesting no acute nutritional problems at the time of the survey. The prevalence was lower than what was found in the 2004 MDHS (5.2%) and the 2006 MICS (4.0%) surveys. Based on WHO criteria, the prevalence of wasting would be considered "acceptable." There were very few children (4.9%) who were overweight and obese (0.5%), therefore obesity in under five children is also not a public health problem.

### 10.2.4 Anthropometry in school-aged children

The prevalence of obesity in school-aged children was low, only 0.8% of the children were obese. However, the proportion of school-aged children who are undernourished is higher. The prevalence of stunting in school-aged children was 31.0% and severe stunting was 8.8% indicating that chronic malnutrition is also a problem in school-aged children. The proportion of children who were underweight was 14.4% and severely underweight was 3.8%.

### 10.2.5 Weight and height in women of childbearing age

Body mass index (BMI) results indicate that the majority of women (79.8%) fall within the normal range of 18-25 kg/m$^2$. It is important to note that 5.2% of the women were

[38] World Health Organization. Physical status: The use and interpretation of anthropometry: Report of a WHO expert committee. WHO Technical Report Series 854, 1995.

underweight and 2.5% of the women were obese. The proportion of women who were underweight in this study was much less than the proportion reported in the 2004 MDHS study (9.2%). According the WHO guidelines the percentage of underweight women found in this study is within the expected normal ranges in a population. Obesity is also not a public health problem in women as the proportion on women who were obese is low (2.5%). However, it will be important to utilize BMI over time as a monitor of adult nutritional status particularly as more women become educated and possibly shift the socioeconomic status distribution.

## 10.3 Morbidity

### 10.3.1 Malaria and bed net use

Mosquito bed nets have been shown to decrease the prevalence of malaria in communities[39]. Most of the heads of households (97.3%) have heard of bed nets and of these, 75.3% own a mosquito bed net in their home. This is much higher than 41.0% of the households that reported having bed nets in the 2004 MDHS and 51% in the 2006 MICS survey. In houses that owned bed nets, 61.6% of the fathers, 77.4% of the mothers and 54.2% of the under five children sleep under a bed net. As expected, the highest prevalence of malaria was in under five children (21.9%) and school-aged children (17.5%). Children are at most at risk for malaria infection because they have not developed partial immunity against malaria. Additionally, the prevalence of malaria in pregnant women (5.1%) was higher than in non-pregnant women (4.5%). Pregnant women are also more at risk for malaria infection than non-pregnant adults. Men had a prevalence of malaria parasitemia of 5.1%. Although there has been a significant increase in awareness and ownership of bed nets, interventions to increase the number of under five children and pregnant women who sleep under bed nets are still needed as they are most at risk for infection and complications.

### 10.3.2 Intestinal parasites and urinary schistosomiasis

Although most school-aged children did not know how to prevent the transmission of intestinal parasites, the proportion of children who were infected with intestinal parasites was very low. None of the school-aged children had Tapeworm infection, only 1.5% had Hookworm infection and 1.3% had *Schistosoma mansoni* infection.

Although the prevalence of *Schistosoma haematobium* infection has declined since the 2001 survey, the prevalence is still high; 10.3% of the women and 18.9% of the school-aged children were infected at the time of the survey indicating that it is still a public health problem. Knowledge on transmission and prevention of urinary schistosomiasis in women and school-aged children was still very low indicating the need to continue community education interventions to reduce the prevalence of urinary schistosomiasis infection.

[39] Maxwell CA, Msuya E, Sudi M, Njunwa KJ, Carneiro IA, Curtis CF. Effect of community-wide use of insecticide-treated nets for 3-4 years on malarial morbidity in Tanzania. Trop Med Int Health. 2002 Dec;7(12):1003-8.

## 10.4 Health history

The prevalence of self reported illnesses (fever, diarrhoea, blood in stool and urine) was higher in under five children and school children compared with adults. Only in under five children was a history of fever associated with the presence of malaria parasitemia. This is important to note because presumptive treatment of malaria based on a history of fever alone might lead to unnecessary use of antimalarial drugs and increase the risk for developing antimalarial drug resistance.

Visible blood in the urine in school-aged children was associated with the presence of schistosomiasis eggs in urine and therefore can potentially be used as a screening test for *Schistosomiasis.*

## 10.5 Breastfeeding

There were 36.2% women who were breastfeeding at the time of the survey and most of the women (63.4%) exclusively breastfed for 6 months as recommended. This is higher than reported in the 2004 MDHS in (53.3%) and in the 2006 MICS (56.7%). This shows that there has been an improvement in the proportion of women who are exclusively breastfeeding their children.

## 10.6 Iodine status

Based on the urinary iodine test results, the urinary iodine levels in the survey population are within the WHO recommendations that less than 50% of the school-aged children and non-pregnant women should have urinary iodine levels of less than 50 µg/L. In this survey only 11.2% of the school-aged children and 12.0% of the non-pregnant women had iodine levels less than 50 µg/L. Most of the households (94.4%) had iodised salt of which 82.6% had the recommended content of iodine of at least 15ppm. However, efforts are still needed to increase the proportion of households that use salt containing the recommended quantities of iodine because the proportion of households that had the recommended content in this survey (82.7%) was below the WHO recommended level of 90%. Iodine content exceeded the Malawi standard of 100 ppm among 16.9% of households suggesting the need for improved quality control in the iodization of salt.

Only a few school-aged children (17.8%) had heard about iodised salt as compared to the proportion of women (68.5%) who had heard about iodised salt. Most of the women (90.6%) who indicated that they had heard about iodised salt reported that they purchase iodised salt. It is therefore important to ensure that the salt that is available on the market has enough iodine content to ensure that households get the required amount of iodine. Additionally, there is need for community education on the importance of having good storage conditions for salt as only 51.0% of the households indicated that they store salt in a container with a lid which might affect the content of iodine. Health education should also contain information on the health functions of iodine as only 45.0% of the women knew that iodine prevents the development of goiter.

## 10.7 Vitamin A status

Due to the need to further investigate RBP data, Vitamin A deficiency results will be provided in a separate report.

Almost all (91.8%) of the under five children received vitamin A supplementation, most of them (60.8%) in the previous 6 months. The most common source of Vitamin A supplementation was a routine visit to a health facility. Most of the women were also given postpartum supplementation. The Vitamin A supplementation programs in the country should be commended for the high supplementation coverage and should continue to use every opportunity when children have contact with health facilities for example during routine under five visits for Vitamin A supplementation and for women when they visit health facilities for postnatal check up.

## 10.8 Anaemia, iron deficiency and iron deficiency anaemia

The highest prevalence of anaemia was in under five children (54.8%) followed by non-pregnant women (32.0%), school children (25.4%) and men (12.2%). Anemia is therefore still a public health problem in under five children, women and school-aged children. Although some of the known causes of anaemia include malaria and intestinal parasites infection, anaemia was only associated with malaria parasitemia in under five children but not in the other age groups. There was also no association between anemia and hookworm infection or urinary schistosomiasis. Since the etiology of anaemia is multi-factorial, there could be other causes of anaemia found in the study participants.

In this survey, in addition to assessing the prevalence of anaemia, the prevalence of iron deficiency was also assessed. Iron deficiency was measured using TfR and ferritin for all target groups. Due to high prevalence of inflammation, iron deficiency results are based on TfR. The prevalence of iron deficiency was 50.9% among under five children, 29.6% among school-aged children, 26.1% among non-pregnant women and 7.1% among men. According to WHO guidelines, iron deficiency is a problem in under-five children, school-aged children and nonpregnant women. Iron deficiency has many adverse consequences.[40] Among under five children, iron deficiency can delay psychomotor development and impair cognitive performance. Among pregnant women, deficiency is associated with increased maternal mortality and poor birth outcomes including preterm delivery and prenatal and perinatal infant mortality. Among adolescents and adults, iron deficiency may contribute to fatigue and reduced work capacity. More efforts should therefore be put into iron supplementation programs to reduce the prevalence of iron deficiency to reduce its complications.

IDA was assessed by combining haemoglobin with TfR. The prevalence of IDA was highest in under five children (30.6%) followed by school-aged children (12.0%), then non-pregnant women (9.3%) and lastly men (8.9%). Iron deficiency anemia is still a

[40] Iron Deficiency Anaemia: Assessment, Prevention and Control, A guide for programme managers (2001). A report of a Joint World Health Organization (WHO), the United Nations Children's Fund (UNICEF), and the United Nations University (UNU) technical consultation on the Assessment of Iron Status at the Population Level, Geneva, Switzerland, 6-10 December 1993.

problem in under five children and school-aged children. Currently, iron supplementation is only given to pregnant women. Expanding the supplementation program to other target groups might reduce the prevalence of IDA.

# 11. Comparison of 2001 and 2009 Micronutrient Survey Results

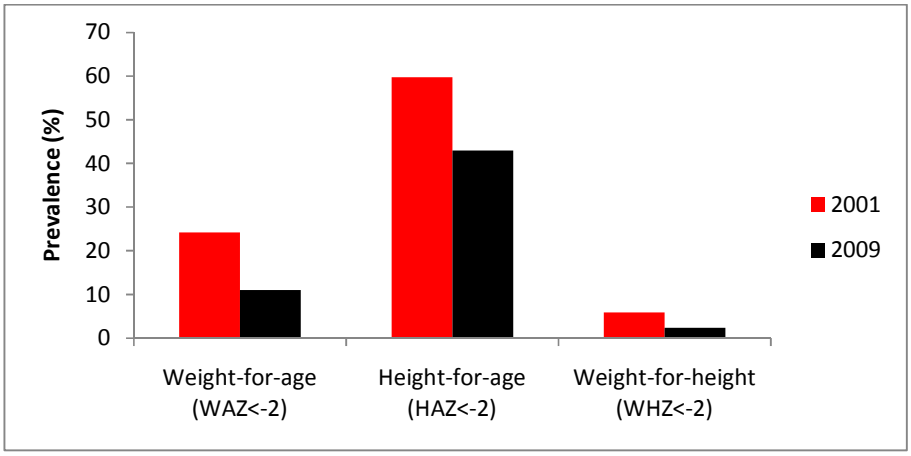
In this section, we compare select findings to previous estimates obtained from the 2001 Malawi Micronutrient Survey. Both surveys used two-stage sampling methodology with stratification by Northern, Central, and Southern regions. In 2001, probability proportional to size was used to select 30 clusters per region, making a national total of 90 clusters. Following household enumeration, 18 households were randomly selected per cluster. In each household, every preschool child 6-36 months and every other woman of childbearing age 15-45 years was selected for an interview and sample collection. Two adult men (20-55 years) were also sampled per cluster. A school survey was conducted at the school situated nearest to the first of the selected households. Eight children and two alternate children 6-12 years were selected from each school. Thus, school-aged children in 2001 include only those who were attending school. The 2001 survey sample included 1,619 households, 532 women, 161 men, 701 school-aged children and 548 children under three. For comparison purposes we have restricted the 2009 data in this section for under five children to the same 6-36 month age group.

## 11.1 Anthropometry

### 11.1.1 Anthropometry in under five children

Anthropometric indices for 2001 were reanalyzed using the 2006 WHO Child Growth Standards described in methods section 2.11.6. The prevalence of stunting, underweight and wasting decreased from 2001 to 2009 as indicated in Figure 11.1. The prevalence of stunting decreased from 58.8% (95%CI 53.8-63.7) to 43.0% (95%CI 37.6-48.6) (p<0.001) and the prevalence of severe stunting decreased from 31.6% (96%CI 27.3-36.1) to 14.4% (95%CI 11.5-18.1) (p<0.001). The prevalence of underweight children decreased from 24.2% (95%CI 19.1-30.1) to 11.0% (95%CI 8.3-14.3) (p<0.001) but there was no change in the prevalence of severely underweight children [7.5% (95%CI 4.7-11.8), 2001, versus 4.5% (95%CI 2.9-7.0), 2009] (p=0.15). The prevalence of wasting decreased from 6.2% (95%CI 1.1-4.6) to 2.3% (95%CI 1.1-4.6) (p=0.02) and severe wasting decreased from 1.5% (95%CI 1.1-4.6) to 0.5% (95%CI 0.1-1.8) (p=0.046).

**Figure 11-1 Prevalence of malnutrition in under five children**



### 11.1.2 Anthropometry in non-pregnant women

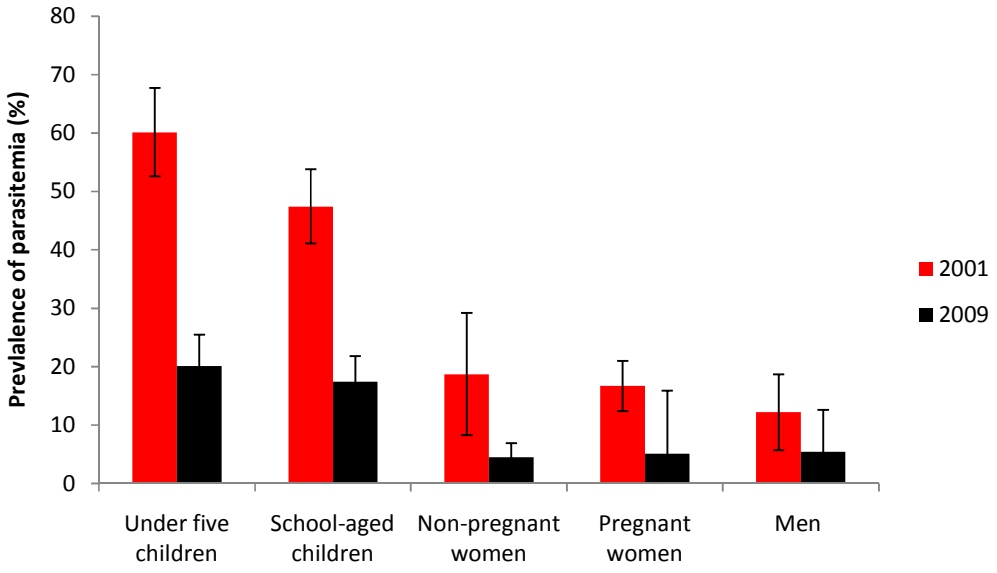
There was no change in the proportion of women who were thin [6.9% (95%CI 4.1-10.0), 2001, versus 5.2% (95%CI 3.5-7.6), 2009] (p=0.33). However, the proportion of overweight women increased from 8.0% (95%CI 5.5-10.5) in 2001 to 12.5% (95%CI 9.7-16.0) in 2009 (p=0.03). There was no change in the proportion of women who were obese [2.4% (95%CI 0.8-4.0) versus 2.5% (95%CI 1.4-4.6), p=0.91].

## 11.2 Morbidity

### 11.2.1 Prevalence of malaria, awareness and use of bed nets

The prevalence of malaria parasitemia has significantly decreased since 2001 in all age groups (p<0.01) as indicated in Figure 11.2. The differences in the prevalence of malaria could also be attributed to differences in the time when the surveys were conducted (September to October for the 2001 survey and July to August for the 2009 survey). A rainy season runs from November through April. There is little to no rainfall throughout most of the country from May to October. It is hot and humid from October to April along the lake and in the Lower Shire Valley. From June through August, the lake areas and far south are comfortably warm, but the rest of Malawi can be chilly at night, with temperatures ranging from 5o-14oC (41o-57oF).[41]

**Figure 11-2 Prevalence of malaria parasitemia by age group in 2001 and 2009**

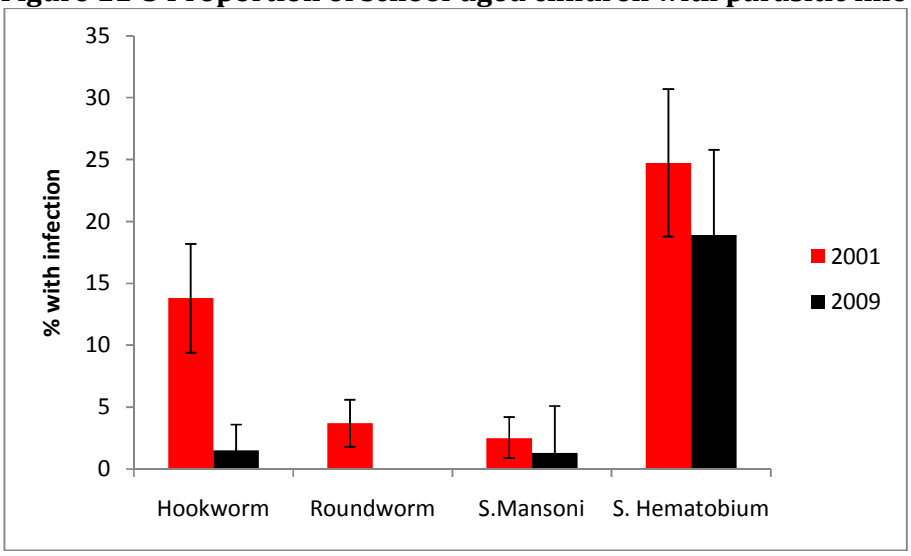



[41] http://www.state.gov/r/pa/ei/bgn/7231.htm

### 11.2.2 Parasite infection in school-aged children

The proportion of school-aged children who were infected with parasites also decreased from 2001 to 2009, Figure 11.3. The proportion of school-aged children who had hookworm infection in 2001 was 13.8% (95%CI 9.4-18.2) compared with 1.5% (95%CI 0.6-3.6) in 2009, p<0.01. The proportion of school-aged children infected with roundworms was 3.8% (95%CI 1.8-5.6) in 2001 compared with none in 2009. The proportion of school-aged children infected with *S. mansoni* decreased from 2.5% (95%CI 0.9-4.2) in 2001 to 1.3% (95%CI 0.3-5.1) in 2009; however this was not significantly different (p=0.31). The proportion of school-aged children infected with *S. hematobium* also decreased from 24.7% (95%CI 18.8-30.6) in 2001 to 18.9% (95%CI 13.5-25.8) in 2009; this again was not significantly different (p=0.18).

**Figure 11-3 Proportion of school-aged children with parasitic infection**




## 11.3 Iodine

There was no difference in the proportion of households that had salt at the time of survey (86.1%, 2001 versus 89.6%, 2009) or in the number of households that had iodine in their salt as detected by rapid test [91.7% (95%CI 89.4-94.0), 2001 versus 94.4% (95%CI 90.9-95.2), 2009, p=0.07). There was no difference in proportion of households that had the recommended level of 15-40 ppm iodine in salt [26.2% (95%CI 21.1-31.3), 2001 versus 23.5% (95%CI 20.2-27.2), 2009, p=0.39].

## 11.4 Vitamin A

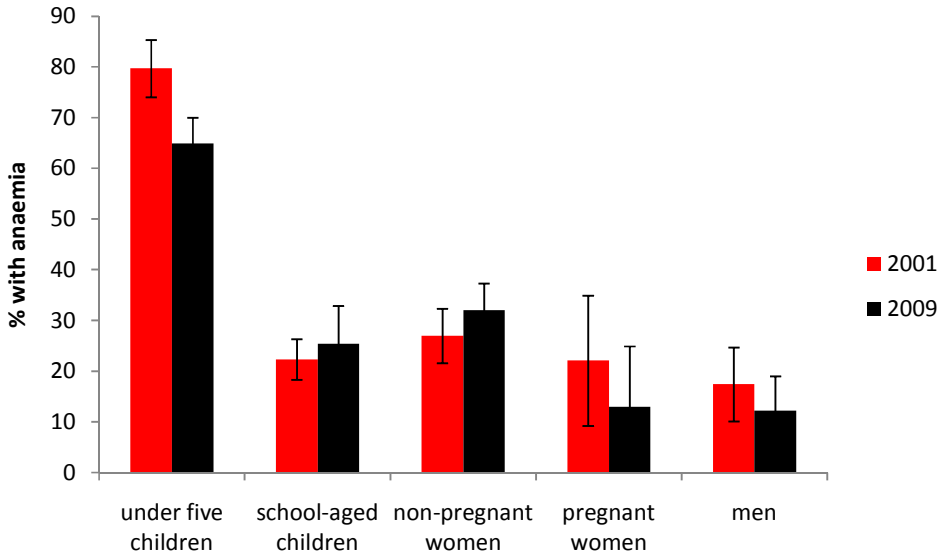
Due to the need to further investigate RBP data, Vitamin A deficiency results will be provided in a separate report.

## 11.5 Anaemia, Iron Deficiency and Iron Deficiency Anaemia

### 11.5.1 Anaemia

From 2001 to 2009, the prevalence of anaemia significantly decreased in children 6-36 months of age [79.7% (95%CI 74.0-85.3) versus 64.8% (95%CI 59.4-70.0), p<0.01]. There were no significant changes among pregnant women (22.1% (95%CI 9.2-34.9) versus 13.0% (95%CI 6.3-24.9), p=0.25), non-pregnant women [27.0% (95%CI 21.6-32.3) versus 32.0% (95%CI 27.1-37.3), p=0.18], school-aged children [22.3% (95%CI 18.3-26.3) versus 24.5% (95%CI 19.5-30.3), p=0.32] or men [17.4% (95%CI 10.1-24.7) versus 12.2% (95%CI 7.6-19.0), p=0.27], as indicated in Figure 11-4.

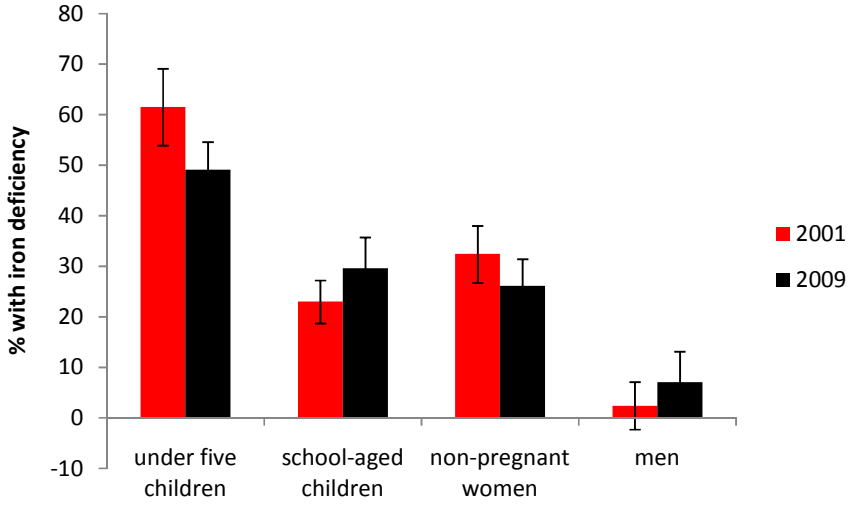
**Figure 11-4 Prevalence of anaemia by age group in 2001 and 2009**




### 11.5.2 Iron deficiency

From 2001 to 2009, the prevalence of iron deficiency (using TfR) decreased significantly in under five children 6-36 months of age [61.5% (95%CI 53.9-69.1) versus 49.1% (95%CI 45.5-54.6), p<0.01]. There were no significant changes among school-aged children [23.0% (95%CI 18.7-27.2) versus 29.6% (24.3-35.7), p=0.06], non-pregnant women [32.4% (95%CI 26.7-38.0) versus 26.1% (95%CI 21.5-31.4), p=0.10], or men [2.4% (95%CI 0.0-7.1) versus 7.1% (95%CI 3.7-13.1), p=0.16], as indicated in Figure 11.5.

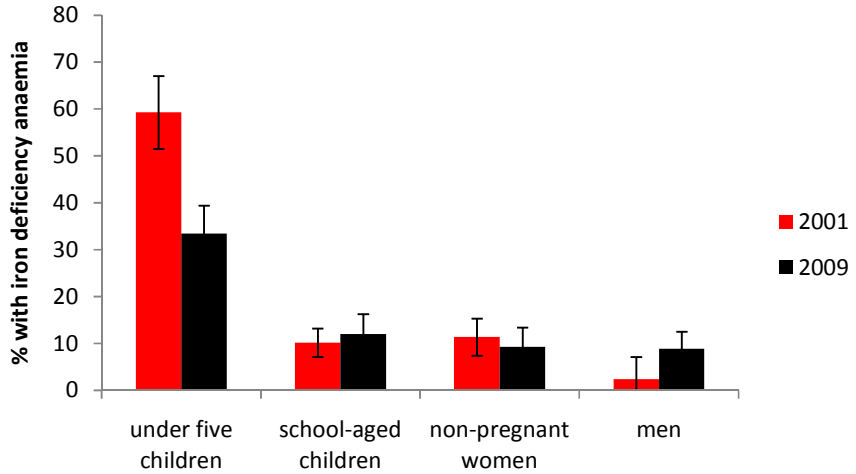
**Figure 11-5 Prevalence of iron deficiency in 2001 and 2009**




### 11.5.3 Iron deficiency anemia

From 2001 to 2009, the prevalence of iron deficiency anaemia decreased among under five children [59.3% (95%CI 51.5-67.0) versus 33.5% (95%CI 28.2-39.4), p <0.01] and increased among men [2.4% (95%CI 0.0-7.1) versus 8.9% (95%CI 6.2-12.5), p<0.01]. There was no significant change among school-aged children [10.2% (95%CI 7.1-13.2) versus 12.0% (95%CI 8.7-16.3), p=0.45] or non-pregnant women [11.4% (95%CI 7.5-15.3) versus 9.3% (95%CI 6.3-13.4), p=0.42], as indicated in Figure 11-6.

**Figure 11-6 Prevalence of iron deficiency anaemia (TfR and Hemoglobin) in 2001 and 2009**



## Appendix 1 Map of Malawi

## APPENDIX 2 SAMPLE SIZE CALCULATION

### SAMPLE SIZE CALCULATIONS FOR A SINGLE SURVEY WITH MULTIPLE OUTCOMES[1]

NUMBER OF STRATA OR DOMAINS: 3 HOUSEHOLD RESPONSE RATE: 90%

| INSTRUCTIONS | | To calculate number of PERSONS to select | | | | | | To calculate number of HOUSEHOLDS to select | | | | | | Actual number of PERSONS obtained | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Target group | Indicator | Estimated prevalence | Precision in 1 stratum (± X%) | Design effect[2] | Individual response rate | Number persons to select in 1 stratum | Number persons to select in ALL strata | Average number of individuals per HH | | Average HH size | Target group as % of population | Number HHs to select in 1 stratum | Number HHs to select in ALL strata | Number with data in 1 stratum | Number with data in ALL strata | Estimated prevalence | Precision in 1 stratum | Precision in ALL strata |
| Household | Iodized salt | | 10.0% | 2.3 | | | | | | | | | | 540 | 1620 | | | |
| Children 6-59 months | *Complete column J OR columns L and M for children:* | | | | | | | | OR | 4.3 | 17.7% | | | | | | | |
| | Anemia | 70% | 10.0% | 3.8 | 90% | 339 | 1,017 | | | | | 495 | 1,485 | 370 | 1110 | 70% | ± 9.1% | 5.2% |
| | Iron def | 57% | 10.0% | 4.5 | 90% | 469 | 1,407 | | | | | 685 | 2,055 | 370 | 1110 | 57% | ± 10.7% | 6.2% |
| | Vit A def | 50% | 10.0% | 2.9 | 90% | 310 | 930 | | | | | 453 | 1,359 | 370 | 1110 | 50% | ± 8.7% | 5.0% |
| | Wasting | 5% | 10.0% | 2.0 | 90% | 41 | 123 | | | | | 60 | 180 | 370 | 1110 | 5% | ± 3.1% | 1.8% |
| | Stunting | 46% | 10.0% | 2.0 | 90% | 213 | 639 | | | | | 311 | 933 | 370 | 1110 | 46% | ± 7.2% | 4.1% |
| Non-pregnant women 15-49 years | *Complete column J OR columns L and M for non-pregnant women:* | | | | | | | | OR | 4.3 | 10.4% | | | | | | | |
| | Anemia | 20% | 10.0% | 1.6 | 90% | 111 | 333 | | | | | 276 | 828 | 218 | 654 | 20% | ± 6.8% | 3.9% |
| | Iron def | 25% | 10.0% | 1.4 | 90% | 114 | 342 | | | | | 284 | 852 | 218 | 654 | 25% | ± 6.8% | 4.0% |
| | Vit A def | 50% | 10.0% | 2.2 | 90% | 235 | 705 | | | | | 584 | 1,752 | 218 | 654 | 50% | ± 9.8% | 5.7% |
| | BMI <18.5 | 7% | 10.0% | 2.0 | 90% | 54 | 162 | | | | | 135 | 405 | 218 | 654 | 7% | ± 4.7% | 2.7% |
| | BMI >25 | 8% | 10.0% | 2.0 | 90% | 64 | 192 | | | | | 160 | 480 | 218 | 654 | 8% | ± 5.1% | 3.0% |
| | Iodine def | 50% | 10.0% | 2.0 | 90% | 214 | 642 | | | | | 532 | 1,596 | 218 | 654 | 50% | ± 9.4% | 5.4% |
| All pregnant women 15-49 years | *Complete column J OR columns L and M for pregnant women:* | | | | | | | | OR | 4.3 | 1.5% | | | | | | | |
| | Anemia | 20% | 10.0% | 2.0 | 90% | 137 | 411 | | | | | 2,361 | 7,083 | 32 | 96 | 20% | ± 19.6% | 11.3% |
| | Iron def | | | | | | | | | | | | | | | | | |
| | Vit A def | | | | | | | | | | | | | | | | | |
| | BMI <18.5 | | | | | | | | | | | | | | | | | |
| | BMI >25 | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Iodine def | 50% | 10.0% | 2.0 | 90% | 214 | 642 | | | | | 3,687 | 11,061 | | 32 | 96 | 50% | ± | 24.5% | 14.1% |
| All women 15-49 years[3] | *Complete column J OR columns L and M for all women:* | | | | | | | | OR | 4.3 | 11.9% | | | | | | | | | |
| | Anemia | 20% | 10.0% | 1.6 | 90% | 111 | 333 | | | | | 243 | 729 | | 248 | 744 | 20% | ± | 6.3% | 3.7% |
| | Iron def | 25% | 10.0% | 1.4 | 90% | 114 | 342 | | | | | 249 | 747 | | 248 | 744 | 25% | ± | 6.4% | 3.7% |
| | Vit A def | 50% | 10.0% | 2.2 | 90% | 235 | 705 | | | | | 513 | 1,539 | | 248 | 744 | 50% | ± | 9.2% | 5.3% |
| | BMI <18.5 | 7% | 10.0% | 2.0 | 90% | 54 | 162 | | | | | 118 | 354 | | 248 | 744 | 7% | ± | 4.4% | 2.5% |
| | BMI >25 | 8% | 10.0% | 2.0 | 90% | 64 | 192 | | | | | 140 | 420 | | 248 | 744 | 8% | ± | 4.8% | 2.8% |
| | Iodine def | 50% | 10.0% | 2.0 | 90% | 214 | 642 | | | | | 467 | 1,401 | | 248 | 744 | 50% | ± | 8.8% | 5.1% |
| Men 20-55 years[4] | *Complete column J OR columns L and M for men:* | | | | | | | 1 | OR | | | | | | | | | | | |
| | Anemia | 17% | 10.0% | 2.0 | 90% | 123 | 369 | | | | | 137 | 411 | | 98 | 294 | 17% | ± | 10.6% | 6.1% |
| | Vit A def | 37% | 10.0% | 2.0 | 90% | 199 | 597 | | | | | 222 | 666 | | 98 | 294 | 37% | ± | 13.5% | 7.8% |
| Children 6-12 y[5] | *Complete column J OR columns L and M for this target group:* | | | | | | | | OR | 4.3 | 10.0% | | | | | | | | | |
| | Anemia | 54% | 10.0% | 1.4 | 90% | 151 | 453 | | | | | 391 | 1,173 | | 209 | 627 | 54% | ± | 8.1% | 4.6% |
| | Iodine def | 0.5 | 0.1 | 2.0 | 0.9 | 214 | 642 | | | | | 553 | 1,659 | | 209 | 627 | 50% | ± | 9.6% | 5.5% |
| | Vit A def | 38% | 10.0% | 2.1 | 90% | 212 | 636 | | | | | 548 | 1,644 | | 209 | 627 | 38% | ± | 9.5% | 5.5% |

| FINAL NUMBER OF HOUSEHOLDS TO SELECT: | 600 | 1,800 | |
|---|---|---|---|
| | 120 | 360 | <--MEN ONLY |

[1] This table provided the regional and national precision for target groups with 120 clusters sampled.

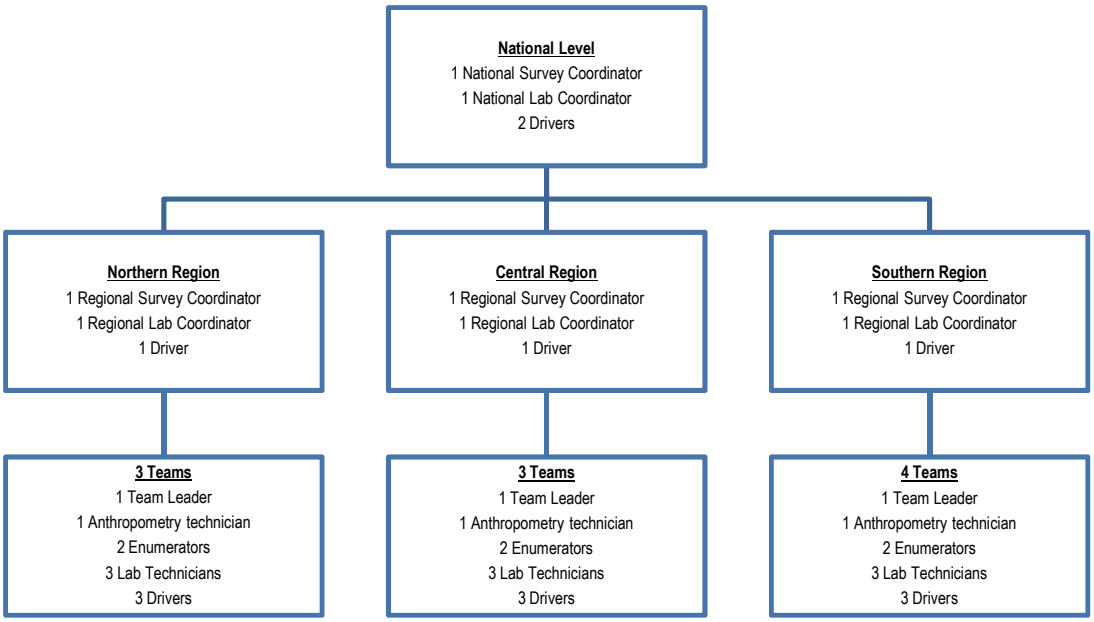
[2] DEFF have been adjusted for the sampling in each target group based on the intracluster correlations observed in 2001.

[3] WOMEN: 23.8% of population is women 15-49 y (of which 13% expected to be pregnant, i.e., 3.0% of population pregnant, 20.3% non-pregnant). Women from every other household will be sampled so "Target group as % of the population" have been halved above (i.e., 10.4%, 1.5% and 11.9%).

[4] MEN: Men will be sampled from only 3 households in each cluster, resulting in approximately 3 men per cluster.

[5] SCHOOL-AGED CHILDREN: 20% of population is school-aged children. School-age children from every other household will be sampled so "Target group as % of the population" has been halved above (i.e., 10.0%)

**APPENDIX 3 JOB DESCRITIONS FOR THE SURVEY TEAM**




**National Survey Coordinator responsible for:**

- The day-to-day planning and implementation of the survey and assist the Survey Task Force.
- General survey oversight and specifically for developing the survey proposal and work plan.
- Control work of the Regional supervisors.

**National Laboratory Coordinator**, an integral member of the coordination team responsible for:

- Coordinating the training and pilot study (including the invitation of women, men and children to medical clinics.
- Develop and train the fieldworkers on universal precautions for biological specimen and the protocol for reporting severe anemia and/or wasting.
- Hiring the fieldworkers and securing their necessary for their involvement for the duration of the survey.
- Contacting the District Hospitals in all clusters to introduce the survey and obtain any permission needed for the fieldwork.
- Control work of the Regional supervisors.

**Regional Supervisors (Laboratory and Survey)** responsible for:

- direct oversight of the 3-4 teams in his/her region assisting with training the staff including team supervisors and field workers,
- organizing field logistics,
- trouble-shooting in the field,
- organization of required supplies for field work before it starts, preparation of supplies for field work before leaving Lilongwe,
- securing locations for the community laboratory to work in each region of the country,
- working with local communities to provide respondents attendance,
- communicating with the village medical workers to prepare them for the field-work,
- following up with the day to day activities of data collection
- Transportation of supplies from CHSU to his/her region
- Distribution of supplies to the teams in his/her region
- Distribution of the labels to the Team Supervisors of each team in his/her region
- Transportation of the samples from the regions to CHSU weekly or biweekly
- In collaboration with the Team Supervisors, ensured the cold chain is properly maintained during transportation of samples from the field to district hospitals. The Regional Supervisor will be responsible for securing the MOH Letter of In-troduction and badges for all field staff, assigning cars and drivers to teams; moving field teams; and securing overnight lodging (when applicable).
- Overseeing field logistics for blood sampling. The Regional Supervisor will work with the Team Supervisors to ensure that samples are sent to the correct district hospital for processing and storage.
- Ensured that the district and rural hospitals are aware that their facilities will be used and that the District Health Officer is informed.
- Ensured that laboratory space at the District Hospital (freezer and a generator in case the electricity is lost) is adequate for blood processing, urine and plasma storage and that teams in his/her region have sufficient supplies and equipment including centrifuges, generators, microscopes and HemoCues.

**Team Supervisor**

There will be one Team Supervisor for each field team responsible for:

- Notifying the local authorities in advance of the field team,
- ensuring that field supplies are available to the field teams
- distributing labels and questionnaires to the field teams

- Collecting and reviewing completed questionnaires, completing interview tracking forms and returning questionnaires to the Data Management Coordinator for data entry.
- Support the Laboratory Technicians to ensure maintenance of the cold chain.
- Integral part of the field team and will support the field workers by applying the questionnaire and helping with anthropometry.
- Overseeing all aspects of the survey related to the biological measurements to be taken.
- Supervise the laboratory technicians and provide support whenever needed.
- ensure that hemoglobin values are determined in the field using the hemoCue and that all Laboratory Technicians are correctly reporting values both on the questionnaire and to the mothers.
- for transporting specimens (including maintenance of cold chain) to the district hospitals and from the district hospital to The Community Health Sciences Unit (CHSU) Public Health Laboratory.
- troubleshooting in the field if samples are too frequently haemolysing, arriving to the district hospital laboratory too warm or too cold, etc.
- Ensure all laboratory equipment is ordered, arrives in proper condition, and is prepared for the field.
- Work with the Regional Supervisor to pack and ship all samples for laboratory analysis.
- work with the Regional Supervisor to ensure all supplies; labels are available and are prepared for each field team.
- supplying each team with two cold boxes and sufficient numbers of gel packs.
- ensure that a community laboratory is setup or if a rural health center is used that the health center is setup for field work.

**Laboratory Technicians responsible for**:

- taking the blood samples from children, women and men, processing the blood samples upon arrival at the district hospital.
- keep record of samples on the laboratory log, label cryovials properly, centrifuge microtainers, separate the plasma into cryovials, and storing cryovials properly in boxes in the freezer and recording on the sample tracking forms.
- maintaining the cold chain in the field by replacing cooling elements when necessary to maintain the cold box at a temperature between 4 and 10oC.
- reporting to the Team Supervisor unusual results (such as multiple hemolyzed samples from the same Laboratory Technician.
- ***Role of Lab Technicians in the community lab***

Lab Technician #1(Finger stick, HemoCue & Malaria Tech) will*:*

1. Participate in the setup of the community lab.

2. Perform finger stick blood collection from an estimated 24 subjects per day. Measure the hemoglobin. levels of the subject using the hemoCue Hb 201
3. Prepare and read the malarial smear.
4. Coordinate with other lab team members and supervisors for the transportation of blood and urine samples to the district hospitals for processing and storage.

Lab Technician #2(Urine and Stool Tech) will:

1. Participate in the setup of the community lab.
2. Receive and process the stool samples for parasitic assessment.
3. Receive and process the urine samples for Schistosomiasis and aliquot urine into 2 crovials for urinary iodine measurement.
4. Coordinate with other lab team members and supervisors for the transportation of blood and urine samples to the district hospitals for processing and storage.

Lab Technician #3 (Float Tech)

1. Participate in the setup of the community lab.
2. Assist Lab Technicians #1 and #2 until midday or when at least half of the number of subjects (estimated n = 12) have been completed for finger stick collection. The Lab Technician should then leave for the district hospital with the microtainer blood tubes, urine samples (cups and cryovials) and labels for processing and storage. The rest of the blood samples in areas that are 1-2 hrs from the district hospital will be transported either to CHSU or the district hospital to reach there by 4 pm.
3. Store the urine samples in the district hospital refrigerator/freezer.
4. Centrifuge the microtainer blood tubes and aliquot the plasma into cryovials and store in the freezer at -5C.
5. Work with the Regional Supervisor to transport urine samples and plasma to CHSU for storage.

**Anthropometry measurer/interviewer**:

Each team will have two anthropometry measurer/ interviewers responsible for:

- Completing the questionnaires and taking anthropometric measurements of the children and women.
- Give all completed questionnaires to the Team Supervisor. The Team Supervisor will review the questionnaires and if there is a problem or missing data,
- The anthropometry measurer/interviewers will be responsible for correcting the error and completing the data collection when possible.

## Appendix 4 Training Schedule for the 2009 Malawi Micronutrient Survey

| Date | Time | Lab techs (45) | Interviewers (30) & Supervisors (15) | Anthropometrist (20) |
|---|---|---|---|---|
| **Monday, 22 June 09** | | Pre-training preparation: | | |
| | | All members of the Technical Working Group to review and revise training materials. | | |
| | | Also go over responsibilities as regional supervisors | | |
| | 08:30 – 9:00 | Registration **–NSO** | | |
| **Day 1: Tuesday 23/06** | 09:00 - 09:15 | Welcoming Remarks by **: Principal of Bunda college,** | | |
| | 09:15 - 09:25 | Address by **CDC** | | |
| | 09:25 - 09:35 | Address by **UNICEF Representative** | | |
| | 09:35 - 09:45 | Address by **Commissioner of Statistics** | | |
| | 09:45 - 10:00 | Opening remarks by **PS (OPC)** | | |
| | 10:00 - 10:30 | **Break & Group Photo** | | |
| | 11:00 - 12:00 | Background of Survey - **Dr Mtimuni** | | |
| | 12:00 - 12:30 | Logistics (Overview of field supplies (availability and distribution) - **CHSU/NSO** | | |
| | 12:30 - 13:30 | **Lunch Break** | | |
| | 13:30 - 14:30 | Field procedures (Proceedings of the team from the district to household-Sampling and selection of households; Household listing; Identification of Enumeration Areas & Households) & logistics - **Mr Zanera/ Ms Mahowe** | | |
| | 14:30 - 15:00 | Sample Collection and Processing (overview of samples that will be collected) - **Mr Mwalwimba** | | |
| | 15:00 - 15:30 | Labels (what needs to be labeled, distribution) –**Dr Drammeh** | | |
| | **15:30 - 16:00** | **Afternoon Break** | | |

| | | | | |
|---|---|---|---|---|
| | 16:00 - 16:30 | Introduction and Importance of Informed Consent- **Mr Numeri** | | |
| | | Informed consent forms and procedures - **Mr Numeri** | | |
| | 16:30 - 17:00 | Questionnaire Overview and review - **Mr Mdyetseni** | | |
| **Day 2: Wednesday 24/06** | 08:30 - 09:00 | Participants Introduction - **Chairperson**<br>Review of schedule - **Chiwaula** | Household questionnaire - **Ms Mahowe**<br>Salt testing & Action Cards- **Mr Kathumba** | Anthropometry Presentation - **Mr Geresomo** |
| | 09:00 - 10:00 | Survey and Laboratory Overview – **Dr. Chilima/R. Mwenda** | | |
| | 10:00 - 10:30 | **Break** | | |
| | 10:30 - 12:30 | Team composition and laboratory technicians, laboratory regional supervisors and laboratory team leaders – **Dr. Chilima** | Women's questionnaire-**Mr Kachaka/ Ms Mahowe**<br>Role plays | Anthropometry Presentation - **Mr Geresomo** |
| | 12:30 - 13:30 | **Lunch Break** | | |
| | 13:30 - 14:30<br>14:30 - 15:30 | Sample Collection and Processing: -Blood ( malaria smears, hemoglobin & plasma) **Yassin/Jellita** | Infant questionnaire - **Mr Geresomo**<br>Role plays | Demonstration and standardization (Need anthropometric equipment - 15 Height Boards & 15 scales) -**Mr Geresomo/ Dr Sharma** |
| | 15:30 - 16:00 | **Afternoon Break** | | |
| | 16:00 - 17:00 | Urine & Stool -**Mr Kandulu**<br>Salt- **Mr Chiwaula** | Role plays | Role plays |
| **Day 3: Thursday** | 08:30 - 09:30 | Cold Chain-stability study - **Dr Drammeh** | School-aged child questionnaire - **Mr** | Review of the standardization process **Mr Geresomo/ Dr** |

| | | | | |
|---|---|---|---|---|
| **25/06** | | | **Kathumba** | **Sharma** |
| | 09:30 - 10:00 | Labeling (Types of labels, labeling instructions for the laboratory technicians, inventory of the samples, instructions for shipping the serum samples) - **Dr Drammeh** | Role plays | Standardization exercise (Have children available for practice) **Mr Geresomo/ Dr Sharma** |
| | 10:00 - 10:30 | **Break** | | |
| **Day 4: Friday 26/06** | 10:30 - 11:30 | Labeling (Types of labels, labeling instructions for the laboratory technicians, inventory of the samples, instructions for shipping the serum samples) - **Dr Drammeh** | FRAT training- **Dr Kalimbira** | Standardization exercise (Have children available for practice) **Mr Geresomo/ Dr Sharma** |
| | 11:30 - 12:30 | Sample logistics and tracking (time in cold box, transport to district hospital and CHSU) - **Dr Drammeh** | Pre-school | |
| | 12:30 - 13:30 | **Lunch Break** | | |
| | 13:30 - 14:30 | Universal Precautions<br>Blood volume vs. Plasma<br>Hemolysis **Chiwaula** | FRAT training- **Dr Kalimbira/Dr Mtimuni** | Review of the standardization process **Mr Geresomo/ Dr Sharma** |
| | 14:30 - 15:30 | Blood collection (Finger/toe/heel-stick collection presentation) **Chiwaula** | Woman | |
| | 15:30 - 16:00 | **Afternoon Break** | | |

| | | | |
|---|---|---|---|
| 16:00 - 17:00 | Hemocue Theory (Hemocue instrument use, instrument self check, daily quality control procedures, filling the cuvettes with blood by tilting the microtainer, checking hemoglobin values, Hemocue cleaning instructions-**Yassin** | Man | Role plays |
| 8:30 am – 10:00 am | Practice finger sticks – **All facilitators**<br>Filling of microtainers - **All facilitators**<br>Spinning and transferring of samples – **All facilitators**<br>Storage of plasma - **All facilitators**<br>Measure hemoglobin using Hemocue – **All facilitators**<br>Malaria thick smears – **All facilitators**<br>Referral forms – **All facilitators**<br>Malaria staining - **All facilitators**<br>Urine and stool training – **All facilitators** | Anthropometry Pres-entation - **Mr Geresomo** | Household questionnaire - **Ms Mahowe**<br>Women's questionnaire-**Mr Kachaka/ Ms Mahowe** |
| 10:30 - 11:00 | **Break** | | |
| 11:00 - 12:30 | ***Practical continued*** | Demonstration and standardization (Need anthropometric equipment -15 Height Boards & 15 scales) - **Dr Mtimuni** | Infant questionnaire - **Mr Geresomo** |

| | | | | |
|---|---|---|---|---|
| | | | | School-aged child questionnaire - **Mr Kathumba** |
| | 12:30 - 13:30 | **Lunch Break** | | |
| | 13:30 – 15:30 | ***Practical continued*** | Supervisors Training | |
| | 15:30 - 16:00 | **Afternoon Break** | | |
| | 16:00 17:00 | Meeting with Laboratory Regional Supervisors (Selection of possible Laboratory Teams) | Selection of teams and meeting with Team leaders & regional supervisors | |
| **Day 5: Saturday 27/06** | 08:30 - 10:30 | Pairing with Laboratory and Enumerators teams | | |
| | 10:30 - 11:00 | **Break** | | |
| | 11:00 - 12:30 | Supervisors Training and Responsibilities (Overall flow of work, laboratory technicians role and supplies) – **Dr. Chilima**<br>Documentation: Sample inventory and logistics – **Chiwaula/Yassin** | | |
| | 12:30 - 13:30 | **Lunch Break** | | |
| | 13:30 - 17:00 | Prepare reagents for field tests – **All facilitators and selected 20 laboratory technicians**<br>Packing of supplies for pilot and survey – **All facilitators and selected 20 laboratory technicians** | | |
| **Day 6: Sunday 28/06** | All day | Resting & Worship | | |
| **Day 7:** | All day | **Field testing -** | | |

| | | |
|---|---|---|
| **Monday 29/06** | | **teams to clusters that have been enumerated near Lilongwe, vehicles and drivers needed** |
| **Day 8: Tuesday 30/06** | All day | **1st Pilot Study -** |
| | | **teams to clusters that have been enumerated near Lilongwe, vehicles and drivers needed** |
| | Evening | Process samples collected |
| **Day 9: Wednesday 01/07** | Morning | Review of First Day of Pilot Study (report from all teams) |
| | | - Blood, urine and stool collection |
| | | - Blood, urine and stool processing |
| | | - Labeling |
| | | - Hemocue use |
| | | - Sample storage |
| | | - Sample inventory |
| | | - Documentation-sample logistics |
| | | - Anthropometric measurement |
| | | - Questionnaire administration-informed consent |
| | 10:30 - 11:00 | **Break** |
| | | - Identification of households |
| | | Making changes to questionnaires |
| | | Final Team selection |
| | | Final questions & Logistics |
| | 12:30 - 13:30 | **Lunch Break** |
| | 13:30 - 17:00 | Continue reviewing the protocols |

| | | |
|---|---|---|
| | | |
| **Day 10: Thursday 02/07** | All day | **2nd Pilot Study -** |
| | | **teams to clusters that have been enumerated near Lilongwe, vehicles and drivers needed** |
| | Evening | Process samples collected |
| **Day 11: Friday 03/07** | Morning | Review of Second Day of Pilot Study (report from all teams) |
| | 10:30 - 11:00 | **Break** |
| | | - Identification of households |
| | | Making changes to questionnaires |
| | | Final Team selection |
| | | Final questions & Logistics |
| | 12:30 - 13:30 | **Lunch Break** |
| | 13:30 - 17:00 | Gather Supplies for Survey |
| | | Teams Travel to assigned cluster |
| | | Prepare for next day when survey begins |

PUT BAR CODE

unicef

## 2008 NATIONAL MICRONUTRIENT SURVEY

## HOUSEHOLD QUESTIONNAIRE

| **HOUSEHOLD INFORMATION PANEL** | | |
|---|---|---|
| HH1. District Number<br>__ __ | HH2. Cluster Number<br>__ __ __ | HH3. Household Number<br>__ __ |
| HH4. Interviewer's Name and Number | | __ __ |
| HH5. Supervisor's Name and Number | | __ __ |
| HH6. Name of the Head of Household | | |
| Interview visits (dd/mm/yyyy):<br>1st attempt: __ __/__ __/__ __ __ __<br>2nd attempt: __ __/__ __/__ __ __ __<br>3rd attempt: __ __/__ __/__ __ __ __<br><br>HH7. Date of Interview (dd/mm/yyyy):<br>__ __ / __ __ / __ __ __ __ | HH8. Result of the Head of Household Interview: (circle)<br>Completed .....1<br>Not home/no competent person .....2<br>Refused.....3<br>Partly completed.....4<br>Postponed.....5<br>Incapacitated .....6<br>Other (specify) .....88<br>_____ | |
| HH9. Region: (circle)<br>Northern..... 1<br>Central ..... 2<br>Southern ..... 3 | HH10. Residence (circle)<br>Rural .....1<br>Urban .....2 | |

| SURVEY information panel (to be filled in AFTER all interviews are completed and interviewer has left the ***HOUSEHOLD FOR THE LAST TIME.)*** | | | |
|---|---|---|---|
| HH11. Language of interview: (circle)<br>Chichewa.....1<br>Tumbuka.....2<br>English.....3 | | | |
| HH12. No. of women 15-49 years in household | | HH16. No. of women questionnaires completed | |
| HH13. No. of children 6–59 months in household | | HH17. No. of child (6-59 mo) quest. completed | |
| HH14. No. of children 6-12 years in household | | HH18. No. of child (6-12 y) quest. completed | |
| HH15. No. of men 20-55 years in household | | HH19. No. of male questionnaires completed | |

| | |
|---|---|
| **NOTES** (Interviewer/supervisor notes: *use this space to record notes about the interview with the household, such as call back times, incomplete individual interviews forms, number of attempts to re-visit and your general assessment of the interview)* | |
| HH20. Data Entry Clerk's name and number | __ __ |

## HOUSEHOLD CONSENT

**READ TO THE HOUSEHOLD:**

"We are from the Ministry of Health and the National Statistical Office (NSO). We are conducting a survey on nutrition and health to collect information which will help the government to improve the health of the people of Malawi. We would like to ask you some questions about your household and we have some questions for infant, caregivers, children, women and men living in your household. All the information we collect will remain strictly confidential. You are free to choose not to answer any questions and you can also stop the interview process at any time. If you do not want to participate, this will not affect your access to health services.

During this survey, we may weigh and measure some people in the household and collect a small amount of blood (about 1 ml) from a finger prick to check for anaemia and malaria. For some subjects (sub-sample), two microtainers (2 mls) of blood from 2 finger pricks will be collected to help us further evaluate vitamin A status. Testing the blood will also help us to determine if people in Malawi are receiving sufficient amounts of Vitamin A which is important to maintain good health.

We may need to collect a sample of stool from the school-age children, and collect a urine sample from the school-age children and women in the household. We would also like to test the salt you use in your household for iodine. We will replace the salt that we use.

The results of the survey will be used by the Government of Malawi to help create and improve nutrition and health programs in Malawi. Do you have any question? Do you agree that your household should participate in this survey?"

**CONSENT OBTAINED FROM ADULT HOUSEHOLD MEMBER? Yes No**

Respondent's Name:_____Signature or thump-print _____ Date: _____

Interviewer's Name: _____ Signature: _____ _____ Date: _____

<u>If consent is not obtained then stop here and move on to the next household</u>. If there are no adult household members present, schedule another visit when an adult household member will be present.

***"Now that you have accepted to participate I will ask a number of questions. Please ask me to explain if you do not understand any of the questions.***
***May we begin?"***

**HOUSEHOLD LISTING FORM** **HL**

***"We would like to talk to you about your household, that is, all of the people who normally live and eat here. First, please tell me the name of each person who usually lives here, starting with the head of the household."*** List the head of the household in line 01. List all household members starting on line 02. Record the name (HL2), relationship (HL 3), sex (HL4) and age (HL5) for each household member. Then ask: ***"Are there any others who live here, even if they are not at home now? (These may include children in school or at work)."*** If yes, complete listing.

□ Is this an ODD numbered household (#1, 3, 5, 7, 9, 11, 13, 15)?

□ Is this an EVEN numbered household? (Add a continuation sheet if there are more than 15 members. Tick here if continuation sheet used □. )

| HL1. Line No. | HL2. Name | HL3 What is the relation-ship of (Name ) to the head of the HH? | HL4. Sex Circle 1=Male 2=Female | | HL5. Age Record age in months for children 6-59 months and age in completed years for all who are 5 years and older. Use seasonal/event calendar to help determine age. DK = 999 | | HL6. Woman's eligibility. Is this an ODD numbered household? If yes, circle line no if this is a woman aged 15-49 years | HL7. Woman's FRAT eligibility. Is this household numbered 3, 5 or 7? If yes, from the women 15-49 years, circle the line no of the main cook | HL8. Child's eligibility. Circle line no if this is a child aged 6-59 months | HL9. Child's FRAT eligibility. Is this household numbered 2, 4 or 6? If yes, circle line no of the first child aged 12-59 months | HL10. School-aged child's eligibility. Is this an ODD numbered household? If yes, circle line no if this is a child aged 6-12 years | HL11. Man's eligibility (includes FRAT). Is this household numbered 9, 11 or 13? If yes, circle the line no of the first man aged 20-55 years | HL12. Question-naire Complete? 1 = Yes 2 = No 9 = Not Applicable | HL13. FRAT Complete? 1 = Yes 2 = No 9 = Not Applicable | HL14. Anthro-pometry Complete? 1 = Yes 2 = No 9 = Not Applicable | HL15. Sample Collection Complete? 1 = Yes 2 = No 9 = Not Applicable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Name | Rela-tionship | M | F | Years | Months | | | | | | | | | | |
| 01 | | | 1 | 2 | | | 01 | 01 | 01 | 01 | 01 | 01 | | | | |
| 02 | | | 1 | 2 | | | 02 | 02 | 02 | 02 | 02 | 02 | | | | |
| 03 | | | 1 | 2 | | | 03 | 03 | 03 | 03 | 03 | 03 | | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 04 | | | 1 | 2 | | | 04 | 04 | 04 | 04 | 04 | 04 | | | | |
| 05 | | | 1 | 2 | | | 05 | 05 | 05 | 05 | 05 | 05 | | | | |
| 06 | | | 1 | 2 | | | 06 | 06 | 06 | 06 | 06 | 06 | | | | |
| 07 | | | 1 | 2 | | | 07 | 07 | 07 | 07 | 07 | 07 | | | | |
| 08 | | | 1 | 2 | | | 08 | 08 | 08 | 08 | 08 | 08 | | | | |
| 09 | | | 1 | 2 | | | 09 | 09 | 09 | 09 | 09 | 09 | | | | |
| 10 | | | 1 | 2 | | | 10 | 10 | 10 | 10 | 10 | 10 | | | | |
| 11 | | | 1 | 2 | | | 11 | 11 | 11 | 11 | 11 | 11 | | | | |
| 12 | | | 1 | 2 | | | 12 | 12 | 12 | 12 | 12 | 12 | | | | |
| 13 | | | 1 | 2 | | | 13 | 13 | 13 | 13 | 13 | 13 | | | | |
| 14 | | | 1 | 2 | | | 14 | 14 | 14 | 14 | 14 | 14 | | | | |
| 15 | | | 1 | 2 | | | 15 | 15 | 15 | 15 | 15 | 15 | | | | |

**CONTINUATION OF HOUSEHOLD LISTING FORM** **HL**

*List all household members starting on line 16. Record the name (HL2), sex (HL3) and age (HL4) for each household member. Then ask:* **ARE THERE ANY OTHERS WHO LIVE HERE, EVEN IF THEY ARE NOT AT HOME NOW? (THESE MAY INCLUDE CHILDREN IN SCHOOL OR AT WORK)**. *If yes, complete listing.*

☐ ***IS THIS AN ODD NUMBERED HOUSEHOLD*** *(#1, 3, 5, 7, 9, 11, 13, 15)?*

☐ Is this an **EVEN** numbered household?

| HL1. Line No. | HL2. Name | HL3 What is the relation-ship of (Name ) to the head of the HH? | HL4. Sex<br>Circle 1=Male 2=Female | HL5. Age<br>Record age in months for children 6-59 months and age in completed years for all who are 5 years and older. Use seasonal/event calendar to help determine age. DK = 999 | HL6. Woman's eligibility.<br>Is this an ODD numbered household?<br>If yes, circle line no if this is a woman aged | HL7. Woman's FRAT eligibility.<br>Is this household numbered 3, 5 or 7?<br>If yes, from the women 15-49 years, circle the line no of | HL8. Child's eligibility.<br>Circle line no if this is a child aged 6-59 months | HL9. Child's FRAT eligibility.<br>Is this household numbered 2, 4 or 6?<br>If yes, circle line no of the first child aged 12-59 | HL10. School-aged child's eligibility.<br>Is this an ODD numbered household?<br>If yes, circle line no if this is a child aged | HL11. Man's eligibility (includes FRAT).<br>Is this household numbered 9, 11 or 13?<br>If yes, circle the line no of the first man aged 20-55 | HL12. Question-naire Complete?<br>1 = Yes 2 = No 9 = Not Applicable | HL13. FRAT Complete?<br>1 = Yes 2 = No 9 = Not Applicable | HL14. Anthro-pometry Complete?<br>1 = Yes 2 = No 9 = Not Applicable | HL15. Sample Collection Complete?<br>1 = Yes 2 = No 9 = Not Applicable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | 15-49 years | the main cook | | months | 6-12 years | years | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Name | Rela-tionship | M | F | Years | Months | | | | | | | | | | |
| 16 | | | 1 | 2 | | | 01 | 01 | 01 | 01 | 01 | 01 | | | | |
| 17 | | | 1 | 2 | | | 02 | 02 | 02 | 02 | 02 | 02 | | | | |
| 18 | | | 1 | 2 | | | 03 | 03 | 03 | 03 | 03 | 03 | | | | |
| 19 | | | 1 | 2 | | | 04 | 04 | 04 | 04 | 04 | 04 | | | | |
| 20 | | | 1 | 2 | | | 05 | 05 | 05 | 05 | 05 | 05 | | | | |
| 21 | | | 1 | 2 | | | 06 | 06 | 06 | 06 | 06 | 06 | | | | |
| 22 | | | 1 | 2 | | | 07 | 07 | 07 | 07 | 07 | 07 | | | | |
| 23 | | | 1 | 2 | | | 08 | 08 | 08 | 08 | 08 | 08 | | | | |
| 24 | | | 1 | 2 | | | 09 | 09 | 09 | 09 | 09 | 09 | | | | |
| 25 | | | 1 | 2 | | | 10 | 10 | 10 | 10 | 10 | 10 | | | | |
| 26 | | | 1 | 2 | | | 11 | 11 | 11 | 11 | 11 | 11 | | | | |
| 27 | | | 1 | 2 | | | 12 | 12 | 12 | 12 | 12 | 12 | | | | |
| 28 | | | 1 | 2 | | | 13 | 13 | 13 | 13 | 13 | 13 | | | | |
| 29 | | | 1 | 2 | | | 14 | 14 | 14 | 14 | 14 | 14 | | | | |
| 30 | | | 1 | 2 | | | 15 | 15 | 15 | 15 | 15 | 15 | | | | |

**INTERVIEWER:** **NOW FOR EACH ELIGIBLE WOMAN, CHILD, SCHOOL-AGED CHILD, AND MAN, WRITE THE NAME, LINE NUMBER AND OTHER IDENTIFYING INFORMATION ON THE INFORMATION PANEL OF THE APPROPRIATE QUESTIONNAIRE. YOU SHOULD NOW HAVE A SEPARATE QUESTIONNAIRE FOR EACH ELIGIBLE PERSON IN THIS HOUSEHOLD.**

| HOUSEHOLD CHARACTERISTICS | |
|---|---|
| Q1 | What is your tribe or ethnicity?<br>Chewa ..... 1<br>Tumbuka ..... 2<br>Yao ..... 3<br>Sena ..... 4<br>Lomwe ..... 5<br>Senga ..... 6<br>Ngoni ..... 7<br>Tonga ..... 8<br>Nkhonde ..... 9<br>Lambya ..... 10<br>Other [Specify]_____ ..... 88 |
| Q2 | What is your religion?<br>Christian ..... 1<br>Islam ..... 2<br>Hindu ..... 3<br>Traditional ..... 4<br>No Religion ..... 5<br>Other [Specify]_____ ..... 88 |
| Q3 | What type of fuel does your household mainly use for cooking?<br>Firewood ..... 1<br>Cow dung ..... 2<br>Paraffin ..... 3<br>Charcoal ..... 4<br>Electricity ..... 5<br>Gas/propane ..... 6<br>Other [Specify]_____ ..... 88<br>Don't know ..... 99 |
| Q4 | What is your current main source of drinking water?<br>Piped water in dwelling ..... 1<br>Communal/Public tap ..... 2 |

| | |
|---|---|
| | Borehole ..... 3<br>Well/spring (protected) ..... 4<br>Well/spring (unprotected) ..... 5<br>Lake/river/small pond ..... 6<br>Other [Specify]_____ ..... 88 |
| Q5 | What kind of toilet facility does your household use?<br>Flush toilet ..... 1<br>Pit latrine ..... 2<br>Ventilated improved pit (VIP) latrine/Sanplat ..... 3<br>Bush/river/lake ..... 4<br>Other [Specify]_____ ..... 88 |
| Q6 | What is the material of the roof?<br>Reeds/grass ..... 1<br>Corrugated iron/tin/metal ..... 2<br>Tile ..... 3<br>Wood planks ..... 4<br>Other [Specify]_____ ..... 88 |
| Q7 | What is the material of the floor?<br>Earth smeared ..... 1<br>Earth natural, not smeared ..... 2<br>Bricks ..... 3<br>Cement ..... 4<br>Wood ..... 5<br>Ceramic titles ..... 6<br>Carpet ..... 7<br>Other [Specify]_____ ..... 88 |
| Q8 | Number of rooms in the main house ___ ___ |
| ***"I am now going to ask you some questions about assets that your household may have. Could you please tell me whether your household has any of these?"*** | |
| Q9a | Radio<br>Yes ..... 1<br>No ..... 2 |

| | |
|---|---|
| | Don't know ..... 99 |
| Q9b | Television<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 |
| Q9c | Bicycle<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 |
| Q9d | Motorcycle<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 |
| Q9e | Ox cart<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 |
| Q9f | Car or truck<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 |
| Q9g | Mobile phone<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 |
| Q9h | Canoe/boat<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 |

| **MALARIA MODULE** | |
|---|---|
| Q10 | Have you ever heard of a mosquito net? |

| | |
|---|---|
| | Yes.....1<br>No .....2<br>Don't know.....99 |
| Q11 | Does your household have any mosquito nets that are used while sleeping?<br>Yes.....1<br>No .....2<br>Don't know..... 99 |
| Q12 | If yes, who sleeps under the mosquito nets in your household?<br>*(Multiple answers possible)*<br>Father……1<br>Mother……...2<br>Child under-five……3<br>Other (specify)……..8 |
| Q13 | How many mosquito nets does your household have? ____ ___ |

| **SALT IODIZATION MODULE** | |
|---|---|
| ***"Now, I would like to check whether the salt used in your household is iodised. I will need to take a little salt for testing but I will give you a packet of iodised salt as replacement. May I see the salt used to cook the main meal eaten by members of your household last night?"*** | |
| Q14 | Do you have salt in your household?<br>Yes……1<br>No……2 |
| Q15 | *If Yes, examine the salt, circle number that corresponds to test outcome.*<br>Iodised with Potassium Iodate (any color change)..... 1<br>Not iodised (no color change) 2 |
| Q16 | What brand of salt does the household use? (circle all that apply) (See the original package for the salt)<br>Yes No<br>a. Tambala..... 1 2<br>b. Cerebos ..... 1 2<br>c. Astor ..... 1 2<br>d. Family Pride ..... 1 2 |

| | | | |
|---|---|---|---|
| | e. Rab Processors | 1 | 2 |
| | f. Anapuna | 1 | 2 |
| | g. Loose from open sack (Oyeza) | 1 | 2 |
| | h. Repackaged/No brand name | 1 | 2 |
| | i. Other [Specify]_____ | 1 | 2 |
| Q17 | How do you store your household salt that you use for cooking? | | |
| | Container with lid | 1 | |
| | Container without lid | 2 | |
| | Same packet in which salt was bought | 3 | |
| | Other [Specify]_____ | 88 | |

| **Is this an ODD numbered household?** | |
|---|---|
| *NO → End the interview.* | |
| *YES →* | *Take a sample of salt from the ODD numbered households. You will need 1.5 tablespoons of salt. Make sure to place the sample of salt in a plastic bag and seal it. Put the household label on the outside of the bag.* |
| Q18 | Was a salt sample taken from this household? |
| | Yes 1 |
| | No 2 |

**Give a packet of replacement salt to the respondent.**

***This marks the end of the household survey.***

**THANK** *the participant for their cooperation.*
**CHECK** *that the data collection form has been completed correctly.*
**CHECK** *that the identification numbers are at the top of each page.*

**Data Entry Information Panel**

(To be completed by the data entry clerks)

| | | | |
|---|---|---|---|
| First data entry clerk ID number | | Second data entry clerk ID number | |

Put bar code label here

**2008 NATIONAL MICRONUTRIENT SURVEY**

## Man's (20-55 years) Questionnaire and FRAT

The man's survey is to be done on one man in households #9, #11, #13 by one identified interviewer. The first eligible man identified on the household listing should be asked the following questions.

| **INFORMATION PANEL** | | |
|---|---|---|
| MIP1. District Number<br>__ __ | MIP2. Cluster Number<br>__ __ __ | MIP3. Household Number<br>__ __ __ __ |
| MIP4. Interviewer's Name and Number | | __ __ |
| MIP5. Supervisor's Name and Number | | __ __ |
| MIP6. Name of the Man | | |
| MIP7. Man's Line Number from Household Listing Form | | __ __ |
| MIP8. Date of Interview: (dd/mm/yyyy)<br>__ __ / __ __ / __ __ __ __ | MIP9. Result of Interview: (circle)<br>Completed ..... 1<br>Not home/no competent person ..... 2<br>Refused ..... 3<br>Partly completed ..... 4<br>Postponed ..... 5<br>Incapacitated ..... 6<br>Other (specify) ..... 88<br>_____ | |

| ***NOTES*** *(Interviewer/supervisor notes: use this space to record notes about the interview with the woman, such as call back times, incomplete individual interview, number of attempts to re-visit and your general assessment of the interview)* | |
|---|---|
| MIP10. Data Entry Clerk's name and number | __ __ |

**READ TO THE MAN:**

"We are from the Ministry of Health and the National Statistical Office (NSO). We are conducting a survey on nutrition and health which will help us to improve the health of the people of Malawi. We would like to ask you some questions. All the information we obtain will remain strictly confidential. You can choose to not answer any questions and you can stop the interview process at any time. If you do not want to participate, this will not affect your access to health services.

During this survey, we like to collect a small amount of blood from your finger (about 1 ml) to check for Malaria parasites, haemoglobin, Iron status and Vitamin A status. The test uses new, sterile, disposable instruments that are completely clean and safe. Testing the blood will help us to determine if males in Malawi are receiving sufficient amounts of iron and vitamin A which is important to maintain good health. During the survey, we will let you know your anaemia status. As a respondent to the survey, you will be able to know the results of Malaria parasites and haemoglobin levels after the test has been conducted but will not be able to give you results on vitamin A status because this test will be analyzed after the survey is over.

The results of the survey will be used by the Government of Malawi to help create and improve nutrition and health programs in Malawi.

Do you have any questions? Do you agree to participate in this survey on behalf of the child?"

CONSENT OBTAINED FROM THE MAN? Yes ☐ No ☐

Respondent's Name: _____ Signature (thump print) _____ Date: _____

Interviewer's Name: _____ Signature: _____ Date: _____

If consent is not obtained then stop here and move on to the next household. If there are no adult household members present, schedule another visit when an adult household member will be present.

***"Now that you have accepted to participate I will ask a number of questions. Please ask me to explain if you do not understand any of the questions. May we begin?"***

| DEMOGRAPHIC INFORMATION | | |
|---|---|---|
| ***"First I will ask you some questions about your age, marital status, education, religion and ethnicity/tribe."*** | | |
| Q400 | In what year and month were you born?<br>Birthdate (dd/mm/yyyy) __ __ /__ __ / __ __ __ __<br><br>*(Interviewer: Use event calendar for age. Enter 01 for the day if not known. Enter 01 for the month if not known. Must enter a year.)* | |
| Q401 | What is your age?<br>Age in completed years .....\|__\|__\| | |
| Q402 | What is your marital status?<br>Currently married, monogamous ..... 1<br>Currently married, polygamous ..... 2<br>Widowed ..... 3<br>Divorced ..... 4<br>Separated ..... 5<br>Never Married ..... 6<br>Not married, living with partner ..... 7 | |
| Q403 | Are you able to read?<br>Yes ..... 1<br>No ..... 2 | |
| Q404 | What is the highest level of education you completed?<br>Primary School<br>Standard 1 ..... 1<br>Standard 2 ..... 2<br>Standard 3 ..... 3<br>Standard 4 ..... 4<br>Standard 5 ..... 5<br>Standard 6 ..... 6<br>Standard 7 ..... 7<br>Standard 8 ..... 8<br>Secondary School<br>Form 1 ..... 9 | |

| | | |
|---|---|---|
| | Form 2 ..... 10<br>Form 3 ..... 11<br>Form 4 ..... 12<br>Tertiary……13<br>Literacy/religious education..... 14<br>Never attended……..15 | |

| **HEALTH HISTORY** | | |
|---|---|---|
| ***"I will now ask you questions about your health"*** | | |
| Q405 | Do you currently smoke cigarettes?<br>Yes ..... 1<br>No ..... 2 | |
| Q406 | Did you have a fever in the past 2 weeks?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | |
| Q407 | Did you have a cough or runny nose in the past 2 weeks?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | |
| Q408 | Did you have diarrhea in the past 2 weeks?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | |
| Q409 | In the past 2 weeks have you noticed any blood in your stool?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | |
| Q410 | In the past 2 weeks have you noticed any blood in your urine?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | |
| Q411 | In the past two weeks, have you had any other condition/illnesses? | |

| | | |
|---|---|---|
| | Yes [Specify]_____ ..... 1<br>No ..... 2<br>Don't know ..... 99 | |

| FRAT - 24 HOUR RECALL ON FOODS TO FORTIFY | | |
|---|---|---|
| Q412 | We would like to know what foods you ate yesterday. Was your intake unusual in any way yesterday?<br>Yes ..... 1<br>No ..... 2 | |

***Interviewer**: If yes, then ask the following questions about a usual day. If no, then ask the following questions about yesterday. Begin by asking what <u>foods or beverages</u> were eaten the previous day or on a usual day. List them in the table below:*

| LISTED FOODS | | | |
|---|---|---|---|
| **Breakfast** | **Lunch** | **Supper/dinner** | **Snacks** |
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***Interviewer:*** *Use this list of foods in the table above as a reference for the section of each of the centrally processed foods listed below*

| **SUGAR** | | |
|---|---|---|
| ***"I will now ask you questions about foods or beverages with sugar that your household might have consumed yesterday [on a usual day]"***<br><br>***Interviewer:*** Refer to listed foods .in the table above | | |
| Q413 | Did you consume any <u>foods or beverages</u> with sugar yesterday/usual day?<br>Yes ..... 1<br>No ..... 2<br>Don't know..... 99 | 2→go to Q417<br>99→go to Q417 |
| Q414 | What <u>foods or beverages</u> contained sugar?<br><br>***Interviewer****: List the foods and amounts consumed in the table below* | |

| **Foods and beverages consumed yesterday containing <u>SUGAR</u>** | **Amount of sugar consumed (specify Teaspoon or Tablespoon)** |
|---|---|
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| | | | |
| ***"Now think about the foods you've eaten in the last 7 days."*** | | | |
| Q415 | How many days, in the last 7 days, did you eat <u>foods or beverages</u> prepared with **<u>sugar</u>**?<br>***Interviewer**: Response must be between 0 and 7*<br>Number of days ..... \|__\| | | |
| Q416 | In which season(s) do you eat **<u>sugar</u>**?<br>All seasons ..... 1<br>Rainy season only ..... 2<br>Harvest seasons ..... 3<br>Other [Specify]_____ ..... 88 | | |

| **CENTRALLY PROCESSED OIL** | | | | |
|---|---|---|---|---|
| ***"I will now ask you questions about food with centrally processed oil that your household might have eaten yesterday [on a usual day]"***<br><br>***Interviewer:** Refer to listed foods above.* | | | | |
| Q417 | Did you consume any foods with **<u>centrally processed oil</u>** yesterday/usual day?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | | | 2→go to Q421<br>99→go to Q421 |
| Q418 | What foods or beverages contained **<u>centrally processed oil</u>**?<br><br>***Interviewer**: List the foods and amounts consumed or used in a recipe in the table below.* | | | |
| | **Foods consumed yesterday containing <u>CENTRALLY PROCESSED OIL</u>** | **Amount used in recipe (Tablespoon)** | **Number of people served** | |
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***"Now think about the foods you've eaten in the last 7 days."***

| | | |
|---|---|---|
| Q419 | How many days, in the last 7 days, did you eat foods prepared with **centrally processed oil**?<br>***Interviewer**: Response must be between 0 and 7*<br>Number of days ..... \|__\| | |
| Q420 | In which season(s) do you eat **centrally processed oil**?<br>All seasons ..... 1<br>Rainy season only ..... 2<br>Harvest seasons ..... 3<br>Other [Specify]_____ ..... 88 | |

| **CENTRALLY PROCESSED MAIZE FLOUR** | | |
|---|---|---|
| ***"I will now ask you questions about food that contains maize flour that your household might have eaten yesterday [on a usual day]."***<br><br>***Interviewer:** Refer to listed foods.* | | |
| Q421 | Did you consume any foods with **centrally processed maize flour** yesterday/ usual day?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | 2→go to Q425<br>99→go to Q425 |
| Q422 | What foods or beverages contained **centrally processed maize flour**?<br><br>***Interviewer**: List the foods and amounts consumed in the table below.* | |
| | **Foods consumed yesterday containing** | **Amount consumed** |

| | **CENTRALLY PROCESSED MAIZE FLOUR** | **(Bowl; S, M, or L Chipande)** |
|---|---|---|
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***"Now think about the foods you've eaten in the last 7 days."***

| | | |
|---|---|---|
| Q423 | How many days, in the last 7 days, did you eat foods prepared with **centrally processed maize flour**?<br>***Interviewer**: Response must be between 0 and 7*<br>Number of days ..... \|__\| | |
| Q424 | In which season(s) do you eat **centrally processed maize flour**?<br>All seasons ..... 1<br>Rainy season only ..... 2<br>Harvest seasons ..... 3<br>Other [Specify]_____ ..... 88 | |

| **CENTRALLY PROCESSED WHEAT FLOUR** | | |
|---|---|---|
| ***"I will now ask you questions about food that contains wheat flour that your household might have eaten yesterday [on a usual day]"***<br><br>***Interviewer:** Refer to listed foods.* | | |
| Q425 | Did you consume any foods with **centrally processed wheat flour** yesterday/ usual day?<br>***(Interviewer:** These might include bread, mandazi/donuts, mabanzi, cakes made in the home**)***<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | 2→go to Q429<br>99→go to Q429 |

| | | |
|---|---|---|
| Q426 | What foods contained **centrally processed wheat flour**?<br><br>***Interviewer**: List the foods and amounts consumed in the table below.* | |
| | 2 Foods consumed yesterday containing **centrally processed wheat flour** | **Amount consumed (UNITS)** |
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| ***"Now think about the foods you've eaten in the last 7 days."*** | | |
| Q427 | How many days, in the last 7 days, did you eat foods prepared with **centrally processed wheat flour**?<br>***Interviewer**: Response must be between 0 and 7*<br>Number of days ..... \|__\| | |
| Q428 | In which season(s) do you eat **centrally processed wheat flour**?<br>All seasons ..... 1<br>Rainy season only ..... 2<br>Harvest seasons ..... 3<br>Other [Specify]_____ ..... 88 | |

Complete an **ACTION CARD** and give to man.

*Once you have completed all the interviews for the household, take the eligible household members to the central lab for anthropometry and lab measurements.*

**SPECIMEN COLLECTION**

| | | |
|---|---|---|
| Q429 | ***READ TO MAN: "NOW, I WOULD LIKE TO TAKE A LITTLE BLOOD FROM YOUR FINGER FOR TESTING. IS THIS OK?"***<br>YES ..... 1<br>NO ..... 2<br>REFUSED ..... 7<br>OTHER [SPECIFY]_____ ..... 88 | |
| Q430 | HEMOGLOBIN (G/DL) LEVEL FROM HEMOCUE | __ __ .__ |
| Q431 | IF HEMOGLOBIN VALUE WAS 7.0 OR LESS, WAS A HB REFERRAL FORM GIVEN TO MAN?<br>YES ..... 1<br>NO ..... 2 | |
| Q432 | WAS A MICROTAINER OF BLOOD COLLECTED FROM THIS MAN?<br>YES ..... 1<br>NO ..... 2<br>REFUSED ..... 7<br>OTHER [SPECIFY]_____ ..... 88 | |

***This marks the end of interview.***

***"I thank you very much for sparing your time to talk to me."***

**THANK** *the participant for their cooperation.*

**CHECK** *that the data collection form has been completed correctly.*

**CHECK** *that the identification numbers are at the top of each page.*

---

**Data Entry Information Panel**

(To be completed by the data entry clerks)

| | | | | |
|---|---|---|---|---|
| First data entry clerk ID number | | Second data entry clerk ID number | | **PUT BAR CODE** |

unicef

## 2008 NATIONAL MICRONUTRIENT SURVEY

## WOMAN'S (15-49 years) QUESTIONNAIRE

| **INFORMATION PANEL** | | |
|---|---|---|
| WIP1. District Number<br>__ __ | WIP2. Cluster Number<br>__ __ __ | WIP3. Household Number<br>__ __ |
| WIP4. Interviewer's Name and Number | | __ __ |
| WIP5. Supervisor's Name and Number | | __ __ |
| WIP6. Name of the Woman | | |
| WIP7. Woman's Line Number from Household Listing Form | | __ __ |
| WIP8. Date of Interview: (dd/mm/yyyy)<br>__ __ / __ __ / __ __ __ __ | WIP9. Result of the Interview:<br>Completed .....1<br>Not home/no competent person.....2<br>Refused.....3<br>Partly completed.....4<br>Postponed.....5<br>Incapacitated .....6<br>Other (specify) .....88<br>_____ | |

| | |
|---|---|
| **NOTES** *(*Interviewer/supervisor notes: *use this space to record notes about the interview with the woman, such as call back times, incomplete individual interview, number of attempts to re-visit and your general assessment of the interview)* | |
| WIP10. Data Entry Clerk's name and number | __ __ |

**READ TO THE WOMAN:**

"We are from the Ministry of Health and the National Statistical Office (NSO). We are conducting a survey on nutrition and health which will help us to improve the health of the people of Malawi. We would like to ask you some questions. All the information we obtain will remain strictly confidential. You can choose to not answer any questions and you can stop the interview process at any time. If you do not want to participate, this will not affect your access to health services.

During this survey, we would like to weigh and measure you and collect a sample of urine so that we can test your iodine status. We would also like to collect a small amount of blood from your finger (about 1 ml) to check for Malaria parasites, haemoglobin, Iron status and Vitamin A status. For some subjects (sub-sample), two microtainers (2 mls) of blood from 2 finger pricks will be collected to help us further evaluate vitamin A status.

Testing the blood will help us to determine if women in Malawi are receiving sufficient amounts of iron and Vitamin A which is important to maintain good health. During the survey, we will let you know your anaemia status and malaria results, but will not be able to give you results on your iodine or vitamin A status because these tests will be analyzed after the survey is over. The test uses new, sterile, disposable instruments that are completely clean and safe.

The results of the survey will be used by the Government of Malawi to help create and improve nutrition and health programs in Malawi. Do you have any questions? Do you agree to participate in this survey on behalf of the child?"

**CONSENT OBTAINED FROM WOMAN?** **Yes** **No**

Respondent's Name: _____Signature (thump print) _____ Date: _____

Interviewer's Name: _____ Signature: _____ Date: _____

[If consent is not obtained then stop here]

***"Now that you have accepted to participate I will ask a number of questions. Please ask me to explain if you do not understand any of the questions. May we begin?"***

| DEMOGRAPHIC INFORMATION | | |
|---|---|---|
| ***"First I will ask you some questions about your age, marital status, education, religion and ethnicity/tribe."*** | | |
| Q300 | In what year and month were you born?<br>Birthdate (dd/mm/yyyy) __ __ /__ __ / __ __ __ __<br><br>*(Interviewer: Use event calendar for age. Enter 01 for the day if not known. Enter 01 for the month if not known. Must enter a year.)* | |
| Q301 | How old were you at your last birthday?<br>Age in completed years.....\|__\|__\| | |
| Q302 | What is your marital status?<br>Married.....1<br>Widowed.....2<br>Divorced.....3<br>Separated.....4<br>Never married.....5<br>Not married, living with partner.....6 | |
| Q303 | Are you able to read?<br>Yes.....1<br>No.....2 | |
| Q304 | What is the highest grade level you have completed?<br>Has not attended school.....0<br>Primary School<br>Standard 1.....1<br>Standard 2.....2<br>Standard 3.....3<br>Standard 4.....4<br>Standard 5.....5<br>Standard 6.....6<br>Standard 7.....7<br>Standard 8.....8<br>Secondary School<br>Form 1.....9 | |

| | | |
|---|---|---|
| | Form 2.....10<br>Form 3.....11<br>Form 4.....12<br>Tertiary .....13<br>University .....14<br>Literacy/religious education .....15 | |
| Q305 | Now I would like you to read this sentence to me.<br><br>Show sentences the following to respondent.<br>Cannot read at all ... 1<br>Able to read only parts of sentence 2<br>Able to read whole sentence ..... 3<br>No sentence in required language 4<br>(specify language) _____<br>Blind/mute, visually/speech impaired 5 | |
| | **CHICHEWA**<br>1. Mwana akuwerenga bukhu.<br>2. Chaka chino mvula inabwera mochedwa.<br>3. Makolo ayenera kusamalira ana awo.<br>**TUMBUKA**<br>1. Mwana wakuberenga buku<br>2. Chaka chino vula yangwiza mwakuchedwa<br>3. Bapapi bakwenera kupwelera bana bawo<br>**ENGLISH**<br>1. The child is reading a book.<br>2. The rains came late this year.<br>3. Parents must take care of their children | |
| **Maternal Health Module** | | |
| Q306 | Are you currently breastfeeding?<br>Yes.....1<br>No .....2 | |

| | | | |
|---|---|---|---|
| Q307 | How long after birth did you first put (Name) to the breast?<br>***If less than 1 hour, record '00' hours.***<br>*If less than 24 hours, record hours. Otherwise, record days.* | Immediately ..... 00<br>Hours □□<br>or<br>Days ..... □□<br>Don't know/remember 99 | |
| Q308 | Do you currently have your menstrual period?<br>Yes ..... 1<br>No ..... 2 | | |
| Q309 | Are you currently pregnant?<br>Yes ..... 1<br>No ..... 2<br>Don't Know ..... 99 | | 2 →go to Q311<br>9 →go to Q311 |
| Q310 | How many months have you been pregnant? \|__\|__\|<br>Don't Know ..... 99 | | |
| Q311 | How many times have you been pregnant? \|__\|__\| | | 0→go to Q314 |
| Q312 | How many children have you ever given birth ? \|__\|__\| | | 0-go to Q314 |
| Q313 | How many of your children are currently living? \|__\|__\| | | |

| **IODISED SALT USE** | | |
|---|---|---|
| ***"Now, I will ask you some questions about the salt you use for cooking."*** | | |
| Q314A | Have you ever heard of iodised salt?<br>Yes ..... 1<br>No ..... 2 | 2 →go to Q317 |
| Q314B | Where did you heard about iodised salt?<br>Health workers ..... 1<br>Child Health Days ..... 2<br>Agriculture worker ..... 3<br>Radio ..... 4<br>Print media ..... 5<br>Television ..... 6<br>Church/market ..... 7<br>Other [Specify]_____ 88 | |

| | | |
|---|---|---|
| Q315 | When you shop, do you buy iodised salt?<br>Yes ..... 1<br>No ..... 2<br>Don't shop ..... 8<br>Don't know 99 | |
| Q316 | Why should people use iodised salt? ***(Multiple answers possible)***<br>Prevent goiter development ..... 1<br>Prevent still births, spontaneous abortions and infant deaths ..... 2<br>Prevent growth failure ..... 3<br>Other [Specify]_____ 88<br>Don't know 99 | |

| **ANAEMIA** | | |
|---|---|---|
| ***"Now I will ask you about anaemia."*** | | |
| Q317 | Have you ever heard of anaemia/shortage of blood?<br>Yes ..... 1<br>No ..... 2 | 2 → go to Q321 |
| Q318 | Can you tell me how you get a shortage of blood? ***(Multiple answers possible)***<br>Lack of food ..... 1<br>Illness/disease ..... 2<br>Bleeding ..... 3<br>Heavy work ..... 4<br>Genetics ..... 5<br>Other [Specify]_____ ..... 88<br>Don't know ..... 99 | |
| Q319A | Can you tell me the foods that can prevent a shortage of blood/ anaemia? ***(Multiple answers possible)***<br>Eggs ..... 1<br>Milk ..... 2<br>Beans ..... 3<br>Vegetables ..... 4 | |

| | | |
|---|---|---|
| | Fruit..... 5<br>Rice..... 6<br>Maize ..... 7<br>Nsima..... 8<br>Meat..... 9<br>Chicken..... 10<br>Dark green leafy vegetables ..... 11<br>Vitamin C rich food ..... 12<br>Other [Specify]_____..... 88<br>Don't know 99 | |
| Q319B | What is the source of your information on prevention of anaemia?<br>Health workers.....1<br>Child Health Days.....2<br>Agriculture worker.....3<br>Radio.....4<br>Print media.....5<br>Television…… 6<br>Church/market……7<br>Other [Specify]_____ 88 | |
| Q320 | Are you currently taking iron tablets (**show common iron tablet in Malawi**)?<br>Yes.....1<br>No ……..2 | 2 → go to Q325 |
| Q321 | How often do you take these tablets?<br>Daily.....1<br>Weekly.....2<br>Not Often .....3<br>Other [Specify]_____ 88 | |
| Q322 | Who provides these tablets?<br>Village health volunteer/NGO.....1<br>Health Surveillance Assistants (HSAs) .....2<br>Traditional birth attendants (TBAs) .....3 | |

| | | |
|---|---|---|
| | Purchase in grocery/market .....4<br>Clinic/Hospital/Health Center .....5<br>Other [Specify]_____ 88<br>Don't know 99 | |
| Q323 | If No, why not? ***(Multiple answers possible)***<br>Nauseated .....1<br>Made my stool black.....2<br>Constipation.....3<br>Made me feel bad.....4<br>Other [Specify]_____ 88<br>Don't Know 99 | |
| Q324 | Did you receive these tablets during any of your pregnancies?<br>Yes.....1<br>No .....2<br>Not applicable, never been pregnant 99 | |

| **VITAMIN A** | | |
|---|---|---|
| ***"I will now ask you questions about vitamin A."*** | | |
| Q325 | Have you ever heard about vitamin A?<br>Yes.....1<br>No.....2 | 2 →go to Q330 |
| Q326 | What does vitamin A do for the body? ***(Multiple answers possible)***<br>Good growth ..... 1<br>Makes your skin nice..... 2<br>Makes a person strong..... 3<br>Helps a person see..... 4<br>Prevents oedema ..... 5<br>Protects from disease..... 6<br>Other [Specify]_____..... 88<br>Don't Know ..... 99 | |
| Q327 | What problems does a person with vitamin A deficiency have? ***(Multiple answers possible)***<br>Night blindness ..... 1 | |

| | | |
|---|---|---|
| | Bad skin ..... 2<br>Weakness ..... 3<br>Always sick ..... 4<br>Loss of appetite ..... 5<br>Anaemia..... 6<br>Other [Specify]_____..... 88<br>Don't Know ..... 99 | |
| Q328 | What can a person do to prevent vitamin A deficiency? ***(Multiple answers possible)***<br>Vitamins from hospital ..... 1<br>Eat diversified meal ..... 2<br>Eat enough food ..... 3<br>Eat fruit rich in vitamin A..... 4<br>Sunbathe ..... 5<br>Avoid contaminated food..... 6<br>Nothing..... 7<br>Other [Specify]_____..... 88<br>Don't know ..... 99 | |
| Q329A | What are the main sources of vitamin A? ***(Multiple answers possible)***<br>Dark green leafy vegetables..... 1<br>Yellow fruits/vegetables..... 2<br>Ground nuts ..... 3<br>Meat ..... 4<br>Eggs..... 5<br>Pills/syrup/capsule/medicine ..... 6<br>Cooking oil ..... 7<br>Sugar ..... 8<br>Margarine..... 9<br>Other [Specify]_____..... 88<br>Don't know ..... 99 | |
| Q329B | What is the source of your information on vitamin A sources?<br>Health workers.....1<br>Child Health Days.....2<br>Agriculture worker.....3 | |

| | | |
|---|---|---|
| | Radio.....4<br>Print media.....5<br>Television…… 6<br>Church/market……7<br>Other [Specify]_____ 88 | |
| Q330 | **Interviewer:** If the woman has never been pregnant →**go to Q331**<br><br>During your last pregnancy did you have difficulty with your vision?<br>Yes..... 1<br>No..... 2<br>Don't remember..... 99 | 2 →go to Q332<br>99 →go to Q332 |
| Q331 | During your last pregnancy at what time of the day did you have difficulty with your vision?<br>Day time only..... 1<br>Night time only..... 2<br>Both day and night..... 3<br>Don't remember..... 99 | |
| Q332 | After your last pregnancy, in the first two months after delivery, did you receive a vitamin A capsule/supplement like this one **(show vitamin A capsule)?**<br>Yes..... 1<br>No..... 2<br>Don't remember..... 99 | |

| **BILHARZIA/URINARY SCHISTOSOMIASIS** | | |
|---|---|---|
| ***"I will now ask you questions about Bilharzia or urinary schistosomiasis"*** | | |
| Q333 | Have you ever heard of Bilharzia?<br>Yes.....1<br>No .....2 | 2 →go to Q335 |
| Q334 | What are the symptoms of Bilharzia? ***(Multiple answers possible.)***<br>Blood in urine .....1<br>Pain when urinating.....2 | |

| | | |
|---|---|---|
| | Abdominal pain.....3<br>Fever .....4<br>Itching skin .....5<br>Other [Specify]_____ .....88<br>Don't know.....99 | |
| Q335 | How do people get Bilharzia? ***(Multiple answers possible.)***<br>Contact with contaminated water (e.g. swimming in lake) .....1<br>Witchcraft.....2<br>Snails.....3<br>Other [Specify]_____ .....88<br>Don't know.....99 | |
| Q336 | How can Bilharzia be prevented in the community? ***(Multiple answers possible.)***<br>Increase access to protected water sources .....1<br>Stop bathing in a lake/river .....2<br>Prevent defecating and urinating outside of latrine .....3<br>Clear vegetation .....4<br>Other [Specify]_____ .....88<br>Don't know.....99 | |

| **HEALTH HISTORY** | | |
|---|---|---|
| ***"I will now ask you questions about your health."*** | | |
| Q337 | Do you smoke ?<br>Yes..... 1<br>No ..... 2 | |
| Q338 | Did you have fever in the past 2 weeks?<br>Yes..... 1<br>No ..... 2<br>Don't know..... 99 | |
| Q339 | Did you have diarrhea in the past 2 weeks?<br>Yes..... 1<br>No ..... 2<br>Don't know..... 99 | |

| | | |
|---|---|---|
| Q340 | In the past 2 weeks did you notice blood in your stool?<br>Yes..... 1<br>No ..... 2<br>Don't know..... 99 | |
| Q341 | In the past 2 weeks did you notice blood, other than menstrual blood, in your urine?<br>Yes..... 1<br>No ..... 2<br>Don't know..... 99 | |
| Q342 | In the past two weeks, have you had any other condition/illnesses?<br>Yes [Specify]_____ ..... 1<br>No ..... 2<br>Don't know..... 99 | |

***This marks the end of interview.***

***"I thank you very much for sparing your time to talk to me."***

Complete an **ACTION CARD** and give to woman.

*Once you have completed all the interviews for the household, take the eligible household members to the central lab for anthropometry and lab measurements.*

**Make sure the urine (to be collected from 10-2 pm) and stools samples are collected**

| ANTHROPOMETRY | | | |
|---|---|---|---|
| 69. *If the woman is pregnant do not weigh or measure height.* | | | |
| | | FIRST MEASUREMENT | SECOND MEASUREMENT |
| Q343 | HEIGHT (CM)<br>(MEASURE TO NEAREST 0.1 CM) | Q347A<br>__ __ __ .__<br>(ENTER 999.9 IF PREGNANT) | Q347B<br>__ __ __ .__<br>(ENTER 999.9 IF PREGNANT) |

| | | | |
|---|---|---|---|
| Q344 | WEIGHT (KG)<br>(MEASURE TO NEAREST 0.1 KG) | Q348A<br>__ __ .__<br>(ENTER 999.9 IF PREGNANT) | Q348B<br>__ __ .__<br>(ENTER 999.9 IF PREGNANT) |
| **SPECIMEN COLLECTION** | | | |
| Q345 | *Read to woman: "we would like to take a little blood from your finger for testing. Is this ok?"*<br>YES ..... 1<br>NO ..... 2<br>REFUSED ..... 7<br>OTHER [SPECIFY]_____ ..... 88 | | |
| Q346 | Hemoglobin (g/dl) level from hemocue | __ __ .__ | |
| Q347 | If hemoglobin value was 7.0 or less, was a hb referral form given to woman?<br>Yes ..... 1<br>No ..... 2 | | |
| Q348 | Was a microtainer of blood collected from this woman?<br>Yes ..... 1<br>No ..... 2<br>Refused ..... 7<br>Other [specify]_____ ..... 88 | | |
| Q349 | Was a urine sample collected from this woman?<br>Yes ..... 1<br>No ..... 2<br>Refused ..... 7<br>Other [specify]_____ ..... 88 | | |

**FOR CLUSTERS # 5, 13, 21, 29, AND 37 ONLY**

| | |
|---|---|
| Q350 | ***READ TO WOMAN: Now, I would like to take a second container of blood from your finger for testing. This will help us further evaluation of vitamin A status in Malawi. Is this ok?"***<br>*Yes..... 1*<br>*No ..... 2*<br>*Refused..... 7*<br>*Other [Specify]_____..... 88* |
| Q351 | Was a second microtainer of blood collected from this woman?<br>Yes ..... 1<br>No ..... 2<br>Refused ..... 7<br>Other [specify] ..... 88 |

***This marks the end of the interview.***

**THANK** *the participant for their cooperation.*

**CHECK** *that the data collection form has been completed correctly.*

**CHECK** *that the identification numbers are at the top of each page.*

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**Data Entry Information Panel**

(To be completed by the data entry clerks)

| | | | |
|---|---|---|---|
| First data entry clerk ID number | | Second data entry clerk ID number | |

**PUT BAR CODE**

**2008 NATIONAL MICRONUTRIENT SURVEY**

**School-Aged Child (6-12 years) Questionnaire**

| SCHOOL-AGED CHILD INFORMATION PANEL ..... | | |
|---|---|---|
| SIP1. District Number<br>__ __ | SIP2. Cluster Number<br>__ __ __ | SIP3. Household Number<br>__ __ __ __ |
| SIP4. Interviewer's Name and Number | __ __ | |
| SIP5. Supervisor's Name and Number | __ __ | |
| SIP6. Mother/Caregiver's Name | | |
| SIP7. Name of the Child | | |
| SIP8. Child's Line Number from Household Listing Form | __ __ | |
| SIP9. Date of Interview: (dd/mm/yyyy)<br>__ __ / __ __ / __ __ __ __ | SIP10. Result of the Interview: (circle)<br>Completed .....1<br>Not home/no competent person .....2<br>Refused.....3<br>Partly completed .....4<br>Postponed.....5<br>Incapacitated .....6<br>Other (specify) .....88<br>_____ | |

| **NOTES** (Interviewer/supervisor notes: *use this space to record notes about the interview with the child, such as call back times, incomplete individual interview, number of attempts to re-visit and your general assessment of the interview)* | |
|---|---|
| SIP11. Data Entry Clerk's name and number | __ __ |

**READ TO THE GUARDIAN OF CHILD:**

"We are from the Ministry of Health and the National Statistical Office (NSO). We are conducting a survey on nutrition and health which will help the government to improve the health of the people of Malawi. We would like to ask you some questions about the child that you care for. All the information we obtain will remain strictly confidential. You or the child can choose to not answer any questions and you can stop the interview process at any time. If you or the child does not want to participate, this will not affect your access to health services.

During this survey, we would like to weigh and measure the child and collect a urine and stool sample to determine iodine status and check for parasites that can affect nutritional status. We would also like to collect a small amount of blood from the child's finger about 1ml to test for Malaria parasites, haemoglobin, Iron status and Vitamin A status. The test uses new, sterile, disposable instruments that are completely clean and safe. Testing the blood will help us to determine if children in Malawi are receiving sufficient amounts of Vitamin A which is important to maintain good health. As a respondent to the survey, you will be able to know the results of Malaria parasites, haemoglobin and schistosoma soon after the test has been conducted but will not be able to give you results on vitamin A status and iodine status because these tests will be analyzed after the survey is over.

The results of the survey will be used by the Government of Malawi to help create and improve nutrition and health programs in Malawi."

Do you have any questions? Do you agree to participate in this survey on behalf of the child?"

CONSENT OBTAINED FROM ADULT HOUSEHOLD MEMBER? Yes No ☐ ☐

Respondent's Name: _____Signature (thump print) _____ Date: _____

Interviewer's Name: _____ Signature: _____ Date: _____

[If consent is not obtained then stop here]

**"Now that you have accepted to participate I will ask a number of questions. Please ask me to explain if you do not understand any of the questions. May we begin?"**

| DEMOGRAPHIC INFORMATION | | |
|---|---|---|
| ***"First I will ask you questions about your [child's] age and schooling."*** | | |
| Q200 | Sex of the child<br>Male..... 1<br>Female ..... 2 | |
| Q201 | In what month and year were you born?<br>Birthdate (dd/mm/yyyy) __ __ /__ __ / __ __ __ __<br><br>***Interviewer****: Look on child health card (preferable) or use event calendar for age. Enter 15 for the day if not known. Enter 01 for the month if not known. Must enter a year.*<br><br>*Only children 6-12 years of age are eligible for the survey. Eligible children were born on/after 01 July 1997 and before 01 July 2003.* | |
| Q202 | What was the child's age at his/her last birthday?<br>Age in completed years.....\|__\|__\|<br>(Enter 00 if less than one year old) | |

| SCHOOL ATTENDANCE | | |
|---|---|---|
| Q203 | Is the child currently enrolled in school?<br>Yes.....1<br>No 2 | |
| Q204a | If yes in what grade level is the child?<br>Primary School<br>Standard 1.....1<br>Standard 2.....2<br>Standard 3.....3<br>Standard 4.....4<br>Standard 5.....5<br>Standard 6.....6<br>Standard 7.....7<br>Standard 8.....8<br>Secondary School<br>Form 1.....9<br>Form 2.....10<br>Form 3.....11 | |

| | | |
|---|---|---|
| | Form 4 12 | |
| Q204b | If no, what is the highest grade level the child has completed?<br>Has not attended school ..... 0<br>Primary School<br>Standard 1 ..... 1<br>Standard 2 ..... 2<br>Standard 3 ..... 3<br>Standard 4 ..... 4<br>Standard 5 ..... 5<br>Standard 6 ..... 6<br>Standard 7 ..... 7<br>Standard 8 ..... 8<br>Secondary School<br>Form 1 ..... 9<br>Form 2 ..... 10<br>Form 3 ..... 11<br>Form 4 ..... 12 | |

| **IODINE** | | |
|---|---|---|
| ***"Now, I will ask you [your child] questions about iodine"*** | | |
| Q205 | Have you heard of iodised salt?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 3 | <br><br>2 →go to Q207<br>3 → go to Q207 |
| Q206A | Why should people use iodised salt?<br>***(Multiple answers possible)***<br>Prevent goiter development ..... 1<br>Prevent still births, spontaneous abortions and infant deaths ..... 2<br>Prevent growth failure ..... 3<br>Other [Specify]_____ ..... 88<br>Don't know 99 | |
| Q206B | Where did you heard about iodised salt?<br>Health workers ..... 1<br>Child Health Days ..... 2<br>Agriculture worker ..... 3<br>Radio ..... 4 | |

| | | |
|---|---|---|
| | Print media ..... 5<br>Television…… 6<br>Church/market……7<br>Other [Specify]_____ 88 | |

| **ANAEMIA** | | |
|---|---|---|
| ***"Now I will ask you [your child] about anaemia/ shortage of blood."*** | | |
| Q207 | Have you ever heard of anaemia/shortage of blood?<br>Yes ..... 1<br>No ..... 2 | <br><br>2 →go to Q210 |
| Q208 | Can you tell me how you get a shortage of blood?<br>***(Multiple answers possible)***<br>Lack of food ..... 1<br>Illness/disease ..... 2<br>Bleeding ..... 3<br>Heavy work ..... 4<br>Genetics ..... 5<br>Other [Specify]_____ ..... 88<br>Don't know ..... 99 | |
| Q209A | Can you tell me any foods that are good to eat to prevent a shortage of blood/anaemia?<br>***(Multiple answers possible)***<br>Eggs ..... 1<br>Milk ..... 2<br>Beans ..... 3<br>Vegetables ..... 4<br>Fruit ..... 5<br>Fish, Grasshopper, Birds, Meat (beef) ..... 9<br>Chicken ..... 10<br>Dark green leafy vegetables ..... 11<br>Vitamin C rich food ..... 12<br>Other [Specify]_____ ..... 88<br>Don't know ..... 99 | |
| Q209B | What is the source of your information on prevention of anaemia?<br>Health workers ..... 1<br>Child Health Days ..... 2 | |

| | | |
|---|---|---|
| | Agriculture worker ..... 3<br>Radio ..... 4<br>Print media ..... 5<br>Television…… 6<br>Church/market……7<br>Other [Specify]_____ 88 | |
| Q210 | Have you ever taken iron tablet like this one?<br>**Interviewer: Show the iron tablet to the child**<br>Yes.....1<br>No .....2 | <br><br><br>2→go to Q213 |
| Q211 | When did you last take this tablet?<br>Number of months..... \|__\|__\|<br>(Enter 00 for current month, Enter 99 for don't know) | |
| Q212 | Where did you get the tablet from?<br>On routine visit to the health facility.....1<br>Sick child visit to the health facility .....2<br>School Health and Nutrition Programme……. 3<br>Other [Specify]_____.....88<br>Don't know .....99 | |

| **VITAMIN A** | | |
|---|---|---|
| ***"I will now ask you questions about vitamin A."*** | | |
| Q213 | Have you ever heard about vitamin A?<br>Yes ..... 1<br>No..... 2 | <br><br>2 →go to Q218 |
| Q214 | What does vitamin A do for the body?<br>***(Multiple answers possible)***<br>Good growth ..... 1<br>Makes your skin nice ..... 2<br>Makes a person strong ..... 3<br>Helps a person see ..... 4<br>Prevents oedema ..... 5<br>Protects from disease ..... 6<br>Other [Specify]_____..... 88<br>Don't know ..... 99 | |
| Q215 | What problems does a person with vitamin A deficiency have? | |

| | | |
|---|---|---|
| | ***(Multiple answers possible)***<br>Night blindness ..... 1<br>Bad skin ..... 2<br>Weakness ..... 3<br>Always sick ..... 4<br>Loss of appetite ..... 5<br>Anaemia ..... 6<br>Other [Specify]_____ ..... 88<br>Don't Know ..... 99 | |
| Q216 | What can a person do to prevent vitamin A deficiency?<br>***(Multiple answers possible)***<br>Get Vitamin A capsules from hospital ..... 1<br>Eat balanced diet ..... 2<br>Eat enough food ..... 3<br>Eat fruit rich in vitamin A ..... 4<br>Sunbathe ..... 5<br>Avoid contaminated food ..... 6<br>Nothing ..... 7<br>Other [Specify]_____ ..... 88<br>Don't know ..... 99 | |
| Q217A | What are the main sources of vitamin A? ***(Multiple answers possible)***<br>Dark green leafy vegetables ..... 1<br>Yellow fruits/vegetables ..... 2<br>Groundnuts ..... 3<br>Meat ..... 4<br>Eggs ..... 5<br>Pills/capsule/medicine ..... 6<br>Cooking oil ..... 7<br>Sugar ..... 8<br>Margarine ..... 9<br>Other [Specify]_____ ..... 88<br>Don't know 99 | |
| Q217B | What is the source of your information on vitamin A sources?<br>Health workers ..... 1<br>Child Health Days ..... 2<br>Agriculture worker ..... 3 | |

| | | |
|---|---|---|
| | Radio .....4<br>Print media .....5<br>Television…… 6<br>Church/market……7<br>Other [Specify]_____ 88 | |

| **BILHARZIA/URINARY SCHISTOSOMIASIS** | | |
|---|---|---|
| **"I will now ask you questions about Bilharzia."** | | |
| Q218 | Have you ever heard of Bilharzia?<br>Yes .....1<br>No .....2 | <br><br>2→go to Q225 |
| Q219 | What are the symptoms of Bilharzia? ***(Circle answers. Multiple answers possible)***<br>Blood in urine .....1<br>Pain when urinating.....2<br>Abdominal pain.....3<br>Fever .....4<br>Itching skin .....5<br>Other [Specify]_____ .....88<br>Don't know.....99 | |
| Q220 | Do you have Bilharzia now?<br>Yes .....1<br>No .....2<br>Don't know.....99 | |
| Q221 | Have you ever had Bilharzia?<br>Yes .....1<br>No .....2<br>Don't know.....99 | |
| Q222 | Have you ever been treated for Bilharzia?<br>Yes .....1<br>No .....2<br>Don't know.....99 | |
| Q223 | How do people get Bilharzia? ***(Multiple answers possible)***<br>Contact with contaminated water (i.e. swimming in lake) .....1<br>Witchcraft .....2<br>Snails.....3 | |

| | | |
|---|---|---|
| | Other [Specify]_____ ..... 88<br>Don't know ..... 99 | |
| Q224 | How can Bilharzia be prevented in the community? ***(Multiple answers possible)***<br>Increase access to protected water sources ..... 1<br>Stop bathing in a lake/river ..... 2<br>Prevent defecating and urinating outside of latrine ..... 3<br>Clear vegetation ..... 4<br>Other [Specify]_____ ..... 88<br>Don't know ..... 99 | |

| **INTESTINAL WORMS** | | |
|---|---|---|
| **"I will now ask you questions about intestinal worms."** | | |
| Q225 | Have you ever heard of intestinal worms?<br>Yes ..... 1<br>No ..... 2 | <br><br>2→go to Q235 |
| Q226 | What are the symptoms and signs of intestinal worms?<br>***(Multiple answers possible)***<br>Stomach pains ..... 1<br>Fever ..... 2<br>Pass worms in stools ..... 3<br>Weakness ..... 4<br>Diarrhoea ..... 5<br>Other [Specify]_____ ..... 88<br>Don't know ..... 99 | |
| Q227 | Do you have intestinal worms now?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | |
| Q228 | Have you ever had intestinal worms?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | |
| Q229 | Have you ever been treated for intestinal worms?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | |

| | | |
|---|---|---|
| Q230 | How did you/do people get intestinal worms? ***(Multiple answers possible)***<br>Unwashed food ..... 1<br>Untreated water ..... 2<br>Walking barefoot ..... 3<br>Witchcraft ..... 4<br>Other [Specify]_____ ..... 88<br>Don't know ..... 99 | |
| Q231 | How can you avoid getting intestinal worms? ***(Multiple answers possible)***<br>Eating balanced diet ..... 1<br>Wearing shoes ..... 2<br>Using latrines ..... 3<br>Washing hands before eating ..... 4<br>Washing food before eating ..... 5<br>Other [Specify]_____ ..... 88<br>Don't know ..... 99 | |
| Q232 | Have you ever received drugs for intestinal worms?<br>**Interviewer: Show albendazole tablet to the child**<br>Yes ..... 1<br>No ..... 2 | <br><br><br>2→go to Q235 |
| Q233 | How many months ago?<br>Number of months ..... \|__\|__\|<br>(Enter 00 for current month, Enter 99 for don't know) | |
| Q234 | Where did you get it from?<br>On routine visit to health facility ..... 1<br>Sick child visit to the health facility ..... 2<br>National immunization campaign ..... 3<br>Child health days ..... 4<br>Other [Specify]_____ ..... 88<br>Don't know ..... 99 | |

| **HEALTH HISTORY** | | |
|---|---|---|
| ***"I will now ask you questions about your health."*** | | _____ |
| Q235 | Did you have fever in the past 2 weeks?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | |
| Q236 | Did you have diarrhea in the past 2 weeks? | |

| | | |
|---|---|---|
| | Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | |
| Q237 | In the past 2 weeks have you noticed any blood in your stool?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | |
| Q238 | In the past 2 weeks have you noticed any blood in your urine?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | |
| Q239 | In the past two weeks, have you had any other condition/illnesses?<br>Yes [Specify]_____ ..... 1<br>No ..... 2<br>Don't know ..... 99 | |

Complete an **ACTION CARD** and give to child or to mother/caretaker of child.

**Once you have completed all the interviews for the household, take the child to the central lab in the cluster for anthropometry and lab measurements.**

**Make sure the urine (to be collected from 10-2 pm) and stools samples are collected**

| **ANTHROPOMETRY** | | | |
|---|---|---|---|
| | | FIRST MEASUREMENT | SECOND MEASUREMENT |
| Q240 | Height (cm)<br>(measure to nearest 0.1 cm) | Q240A<br>__ __ __ .__ | Q240B<br>__ __ __ .__ |
| Q241 | Weight (kg)<br>(measure to nearest 0.1 kg) | Q241A<br>__ __ .__ | Q241B<br>__ __ .__ |
| **SPECIMEN COLLECTION** | | | |
| Q242 | ***READ TO CHILD OR MOTHER/CARETAKER: "NOW, I WOULD LIKE TO TAKE BOUT 1ML OF BLOOD FROM YOUR [YOUR CHILD'S] FINGER FOR TESTING. IS THIS OK?"***<br>YES ..... 1<br>NO ..... 2<br>REFUSED ..... 7<br>OTHER [SPECIFY]_____ ..... 88 | | |
| Q243 | HEMOGLOBIN (G/DL) LEVEL FROM HEMOCUE | __ __ .__ | |

| | |
|---|---|
| Q244 | IF HEMOGLOBIN VALUE WAS 7.0 OR LESS, WAS A HB REFERRAL FORM GIVEN TO CHILD/MOTHER OR CARETAKER?<br>YES ..... 1<br>NO ..... 2 |
| Q245 | WAS A MICROTAINER OF BLOOD COLLECTED FROM THIS CHILD?<br>YES ..... 1<br>NO ..... 2<br>REFUSED ..... 7<br>OTHER [SPECIFY]_____ ..... 88 |
| Q246 | WAS A URINE SAMPLE COLLECTED FROM THIS CHILD?<br>YES ..... 1<br>NO ..... 2<br>REFUSED ..... 7<br>OTHER [SPECIFY]_____ ..... 88 |
| Q247 | WAS A STOOL SAMPLE COLLECTED FROM THIS CHILD?<br>YES ..... 1<br>NO ..... 2<br>REFUSED ..... 7<br>OTHER [SPECIFY]_____ ..... 88 |

***This marks the end of interview.***

***"I thank you very much for sparing your time to talk to me."***

**THANK** *the participant for their cooperation.*
**CHECK** *that the data collection form has been completed correctly.*
**CHECK** *that the identification numbers are at the top of each page.*

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**Data Entry Information Panel**

(To be completed by the data entry clerks)

| | | | |
|---|---|---|---|
| First data entry clerk ID number | | Second data entry clerk ID number | |

**PUT BAR CODE**

unicef

## 2008 NATIONAL MICRONUTRIENT SURVEY

## Pre-School Child (6-59 months) Questionnaire

Interview mother or primary caretaker of the child

| **INFANT/CHILD INFORMATION PANEL** | | |
|---|---|---|
| CIP1. District Number<br>__ __ | CIP2. Cluster Number<br>__ __ __ | CIP3. Household Number<br>__ __ |
| CIP4. Interviewer's Name and Number | | __ __ |
| CIP5. Supervisor's Name and Number | | __ __ |
| CIP6. Mother/Caregiver's Name | | |
| CIP7. Name of the Infant/Child | | |
| CIP8. Infant/Child's Line Number from Household Listing Form | | __ __ |
| CIP9. Date of Interview: (dd/mm/yyyy)<br>__ __ / __ __ / __ __ __ __ | CIP10. Result of the Interview: (circle)<br>Completed .....1<br>Not home/no competent person.....2<br>Refused.....3<br>Partly completed.....4<br>Postponed.....5<br>Incapacitated .....6<br>Other (specify) .....88<br>_____ | |

| | |
|---|---|
| **NOTES** (Interviewer/supervisor notes: *use this space to record notes about the interview with the infant/child's caregiver, such as call back times, incomplete individual interview, number of attempts to re-visit and your general assessment of the interview)* | |
| CIP11. Data Entry Clerk's name and number | __ __ |

**READ TO THE GUARDIAN OF CHILD**

"We are from the Ministry of Health and the National Statistical Office (NSO). We are conducting a survey on nutrition and health which will help the government to improve the health of the people of Malawi. We would like to ask you some questions about the child that you care for. All the information we obtain will remain strictly confidential. You can choose not to answer any questions and you can stop the interview process at any time. If you do not want to participate, this will not affect your access to health services.

During this survey, we would like to weigh and measure the child and collect a small amount of blood from the child's finger of about 1ml to test for Malaria parasites, schistosoma, haemoglobin, Iron status and Vitamin A status. For some subjects (sub-sample), two microtainers (2 mls) of blood from 2 finger pricks will be collected to help us further evaluate vitamin A status. The test uses new, sterile, disposable instruments that are completely clean and safe. Testing the blood will help us to determine if children in Malawi are receiving sufficient amounts of Vitamin A which is important to maintain good health. As a respondent to the survey, you will be able to know the results of Malaria parasites, haemoglobin and schistosoma soon after the test has been conducted but will not be able to give you results on vitamin A status because this test will be analyzed after the survey is over..

The results of the survey will be used by the Government of Malawi to help create and improve nutrition and health programs in Malawi.

Do you have any questions? Do you agree to participate in this survey on behalf of the child?"

CONSENT OBTAINED FROM GUARDIAN OF CHILD? Yes ☐ No ☐

Respondent's Name: _____Signature (thump print) _____ Date: _____

Interviewer's Name: ___ _____ Signature: _____ _____ Date: _____

[If consent is not obtained then stop here]

***"Now that you have accepted to participate I will ask a number of questions. Please ask me to explain if you do not understand any of the questions. May we begin?"***

| DEMOGRAPHIC INFORMATION | | |
|---|---|---|
| ***"First I will ask you questions about the child's gender and age"*** | | |
| Q100 | Sex of the child<br>Male..... 1<br>Female ..... 2 | |
| Q101 | In what month and year was the child born?<br>Birthdate (dd/mm/yyyy) __ __ /__ __ / __ __ __ __<br><br>***Interviewer**: Look on child health card (preferable) or use event calendar for age. Enter 15 for the day if not known. Enter 01 for the month if not known. <u>Must enter a year.</u>*<br><br>*Only children 6-59 months of age are eligible for the survey. Eligible children were born on/after <u>01 July 2004</u> and before <u>01 January 2009</u>.* | *(These dates will depend on the time that the survey is implemented)* |
| Q102 | What was the child's age at her/his last birthday?<br>Age in completed years..... \|__\|__\|<br>(If less than one year of age, enter 00) | |

| FEEDING INFORMATION | | |
|---|---|---|
| ***"Now I will ask you questions about feeding your child"*** | | |
| Q103 | Is the child breast feeding?<br><br>Yes……..1<br>No……2 | 1⇨ go to Q105 |
| Q104a | How old was this child when you stopped breastfeeding?<br>Never breast fed……1<br>0-6 months……...2<br>6-12 months……3<br>12-24 months……...4 | **If 1 or 2⇨ go to Q105** |

| | | |
|---|---|---|
| | Other *(specify)*……...88<br>Don't know…… …99 | |
| Q104b | Why?<br><br>Medical advice……1<br>Mother passed away……..2<br>Mother's illness……..3<br>Pregnancy…… ……..4<br>Others *(specify)*…… ……..88 | |
| Q105 | How old was this child when s/he was first fed something <u>other</u> than breast milk? (including water, formula, juice, solid foods, mzuwa, tea, soft drinks)<br>In months.....\|__\|__\|<br>(Enter 99 if don't know) | |
| Q106 | Is this child enrolled in a feeding program?<br>Yes.....1<br>No .....2<br>Don't know 99 | 2→go to Q107<br>99→go to Q107 |
| Q107 | Which feeding program?<br>Nutrition Rehabilitation Unit.....1<br>Community Therapeutic Care (CTC)/Outpatient Therapeutic Programme (OTP) .....2<br>Supplementary feeding .....3<br>General food distribution .....4<br>Other [Specify]_____ 88<br>Don't know 99 | |

| **VITAMIN A** | | |
|---|---|---|
| ***"I will now ask you questions about vitamin A."*** | | |
| Q108 | Has this child **(NAME)** ever received vitamin A capsule like this one?<br><br>**Interviewer: Show Vitamin A capsule to the caregiver (Check** | |

| | | |
|---|---|---|
| | **Child Health Card/booklet)**<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | 2→go to Q111<br>99→go to Q110 |
| Q109 | When did the child take the last dose?<br>Number of months ..... \|__\|__\|<br>(Enter 00 for current month, Enter 99 for don't know) | |
| Q110 | Where did the child get this last dose?<br>Routine visit to health facility..... 1<br>Sick child visit to the health facility..... 2<br>Child Health Day/Campaign..... 3<br>School..... 4<br>Other [Specify]_____ ..... 88<br>Don't know..... 99 | |

| **HEALTH HISTORY** | | |
|---|---|---|
| ***"I will now ask you questions about your child's health."*** | | |
| Q111 | Did the child have fever in the past 2 weeks?<br>Yes 1<br>No 2<br>Don't know.....99 | |
| Q112 | Did the child have diarrhea in the past 2 weeks?<br>Yes 1<br>No 2<br>Don't know 99<br><br>***Diarrhoea is determined as perceived by mother or caregiver, or as three or more loose or watery stools per day, or blood in stool.*** | |
| Q113 | In the past 2 weeks have you noticed any blood in the child's stool?<br>Yes 1<br>No .....2<br>Don't know 99 | |

| | | |
|---|---|---|
| Q114 | In the past 2 weeks have you noticed any blood in the child's urine?<br>Yes 1<br>No 2<br>Don't know 99 | |
| Q115 | In the past two weeks, have your child had any other condition/illnesses?<br>Yes [Specify]_____ 1<br>No 2<br>Don't know 99 | |

***This marks the end of interview.***

***"I thank you very much for sparing your time to talk to me."***

Complete an **ACTION CARD** and give to mother or caretaker of child.

Once you have completed all the interviews for the household, take the infant/child with their mother or caretaker to the central lab in the cluster for anthropometry and lab measurements.

**ANTHROPOMETRY**

Check child's age again:

If child less than 24 months or less than 85 cm: measure <u>length</u> (lying down) and their weight with their mother/caretaker.

1. **If child 24 months or more or over 85 cm: measure <u>height</u> (standing up) and their weight, either with their mother/caretaker or by themselves.**

| | | FIRST MEASUREMENT | SECOND MEASUREMENT |
|---|---|---|---|
| Q116 | Length / Height (cm)<br>(circle type of measurement taken)<br>(measure to nearest 0.1 cm) | Q122a<br>___ ___ ___ .___ | Q122b<br>___ ___ ___ .___ |
| Q117 | Weight of infant/child (kg)<br>(measure to nearest 0.1 kg) | Q123a<br>___ ___ .___ | Q123b<br>___ ___ .___ |

| | | | |
|---|---|---|---|
| Q118 | Bilateral oedema<br>Yes.....1<br>No.....2 | | |
| **SPECIMEN COLLECTION** | | | |
| Q119 | **READ TO MOTHER/CARETAKER:** ***"Now, I would like to take a few drops of blood (1 ml) from your child's finger for testing. Is this ok?"***<br>Yes.....1<br>No.....2<br>Refused..... 7<br>Other [Specify]_____.....88 | | |
| Q120 | Hemoglobin (g/dL) level from HemoCue | ___ ___ ▪___ | |
| Q121 | If hemoglobin value was 7.0 or less, was Hb REFERRAL form given to the mother/caretaker of child?<br>Yes.....1<br>No .....2 | | |
| Q122 | Was a microtainer of blood collected from this child?<br>Yes.....1<br>No.....2<br>Refused.....7<br>Other [Specify]_____..... 88 | | |

## FOR CLUSTERS # 5, 13, 21, 29, AND 37 ONLY

| | |
|---|---|
| Q123 | **READ TO MOTHER/CARETAKER*: "Now, I would like to take a second microtainer (1ml) of blood from your child's finger for testing. This will help us further evaluation vitamin A status in Malawi. Is this ok?"***<br>Yes ..... 1<br>No..... 2<br>Refused..... 7 |

| | |
|---|---|
| | Other [Specify]_____ ..... 88 |
| Q124 | Was a second microtainer of blood collected from this child?<br>Yes ..... 1<br>No ..... 2<br>Refused ..... 7<br>Other [specify] ..... 88 |

***This marks the end of the interview.***

**THANK** *the participant for their cooperation.*

**CHECK** *that the data collection form has been completed correctly.*

**CHECK** *that the identification numbers are at the top of each page.*

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**Data Entry Information Panel**

(To be completed by the data entry clerks)

| | | | |
|---|---|---|---|
| First data entry clerk ID number | | Second data entry clerk ID number | |

**PUT BAR CODE**

**2008 NATIONAL MICRONUTRIENT SURVEY**

**WOMAN FORTIFICATION RAPID ASSESSMENT TOOL (FRAT) QUESTIONNAIRE**

This FRAT is to be completed on households #3, #5, #7 in each cluster by one identified interviewer. From the women aged 15-49 years, identify the MAIN COOK in the household and ask the following questions.

| **INFORMATION PANEL** | | |
|---|---|---|
| WFIP1. District Number<br>__ __ | WFIP2. Cluster Number<br>__ __ __ | WFIP3. Household Number<br>__ __ |
| WFIP4. Interviewer's Name and Number | | __ __ |
| WFIP5. Supervisor's Name and Number | | __ __ |
| WFIP6. Name of the Woman | | |
| WFIP7. Woman's Line Number from Household Listing Form | | __ __ |
| WFIP8. Date of Interview: (day/month/year)<br>__ __ / __ __ / __ __ __ __ | WFIP9. Result of the Interview: (circle)<br>Completed ..... 1<br>Not home/no competent person ..... 2<br>Refused ..... 3<br>Partly completed ..... 4<br>Postponed ..... 5<br>Incapacitated ..... 6<br>Other (specify) ..... 88<br>_____ | |

| |
|---|
| ***NOTES*** *(Interviewer/supervisor notes: use this space to record notes about the interview with the woman, such as call back times, incomplete individual interview, number of attempts to re-visit and your general assessment of the interview)* |

| | |
|---|---|
| WFIP10. Data Entry Clerk's name and number | __ __ |

| COOKING OIL | | |
|---|---|---|
| ***"Now, I will ask you about cooking oil that you may use in this household for consumption."*** | | |
| Q500 | Do you usually use cooking oil?<br>Yes ..... 1<br>No ..... 2 | 2→go to Q505 |
| Q501 | How often do you buy cooking oil?<br>Every day ..... 1<br>Every other day ..... 2<br>Once a week ..... 3<br>Every two weeks ..... 4<br>Once a month ..... 5<br>Other [Specify]_____ ..... 88<br>Don't know ..... 99 | |

***Interviewer**: Ask to see the household cooking oil (complete table below)*

| | Type of oil | Tick if found in household | Q503. **How many days a week do you use this oil?** *(Must be number between 0 and 7)* |
|---|---|---|---|
| | a. Kazinga (fortified) | | |
| | b. Kukoma | | |
| | c. Superstar | | |
| | d. Sunfoil | | |
| | e. Olivine | | |
| | f. Mulawe | | |
| | g. Homemade | | |
| | h. Rina | | |
| | i. Golden K | | |
| | j. Tafika | | |
| | k. D'lite | | |
| | l. Sunflower | | |
| | m. From container (Oyeza) | | |
| | n. Repackaged/No brand | | |

| | | | |
|---|---|---|---|
| Q502 | name /Sausage | | |
| | o. Other (specify) | | |

| | | |
|---|---|---|
| Q504 | How do you store the cooking oil that you use in this household?<br>Same bottle in which cooking oil was bought..... 1<br>Same sachet in which the cooking oil was bought…… …..2<br>In improvised bottles ..... 3<br>In tin with lid ..... 4<br>Other [Specify]_____ ..... 88 | |
| Q505 | Why don't you use cooking oil?<br>No money..... 1<br>Don't know where to buy it..... 2<br>We don't like food cooked with oil ..... 3<br>Other [Specify]_____ ..... 88 | |

| ***MAIZE FLOUR*** | | |
|---|---|---|
| ***"Now, I will ask you some questions about maize flour that you use for cooking nsima or porridge in this household."*** | | |
| Q506 | Is most of your household maize flour bought pre-processed or do you process it yourself?<br>Centrally processed .....1<br>Locally processed .....2<br>Don't know .....99 | 2 →go to Q509<br>99 →go to Q509 |
| Q507 | How often do you buy **centrally processed maize flour**?<br>Every day .....1<br>Every other day.....2<br>Once a week .....3<br>Every two weeks .....4<br>Once a month .....5<br>Never.....6<br>Other [Specify]_____ .....88<br>Don't know .....99 | |

| | | | |
|---|---|---|---|
| ***Interviewer**: Ask to see the package for the maize flour* | | | |
| Q508 | **Type of maize flour** | **Tick if found in household** | |
| | a. Bakhresa Whole Grain | | |
| | b. Bakhresa Super cream | | |
| | c. Bakhresa Cream of Maize | | |
| | d. Rab processors' Ufa Woyera | | |
| | e. Rab's Sunshine Cream of Maize | | |
| | f. Snow White | | |
| | g. Kwality | | |
| | h. Loose from open sack (Oyeza) | | |
| | i. Repackaged/No brand name | | |
| | j. Other (specify) | | |
| | k. None available | | |
| Q509 | Do you use a maize mill (Hammer mill)?<br>Yes .....1<br>No.....2 | | |

| | | |
|---|---|---|
| **SUGAR** | | |
| ***"Now, I will ask you questions about sugar that you use in this household."*** | | |
| Q510 | Do you usually use sugar in this household?<br>Yes .....1<br>No.....2 | 2 →go to Q516 |
| Q511 | How often do you buy sugar?<br>Every day .....1<br>Every other day.....2<br>Once a week .....3<br>Every two weeks.....4<br>Once a month .....5<br>Other [Specify]_____.....88<br>Don't know .....99 | |
| Q512 | When do you usually have sugar available in your house?<br>All seasons.....1 | |

| | | |
|---|---|---|
| | Rainy seasons only.....2<br>Harvest seasons .....3<br>Other [Specify]_____.....88 | |

***Interviewer**: Ask to see the household sugar (complete table below)*

| Q513 A | **Type of sugar** | **Tick if found in household** | Q513B. **How many days in a week do you use sugar in your household?** *(Must be number between 0 and 7)* |
|---|---|---|---|
| | a. Illovo | | |
| | b. Prestige | | |
| | c. Astor | | |
| | d. Loose from open sack (Oyeza) | | |
| | e. Repackaged/No brand name | | |
| | f. Other (specify) | | |

| | | |
|---|---|---|
| Q514 | How do you store your sugar?<br>In factory plastic bags.....1<br>In a container with a lid.....2<br>In a container without a lid…….3<br>Other [Specify]_____.....88 | |
| Q515 | Why don't you usually use sugar in this household?<br>No money.....1<br>Not available in shops.....2<br>We don't like sugar .....3<br>Other [Specify]_____.....88 | |

| **WHEAT FLOUR** | | |
|---|---|---|
| ***"Now, I will ask you questions about wheat flour that you may use in this household."*** | | |
| Q516 | Do you have centrally processed wheat flour in your home?<br>Yes .....1<br>No.....2 | |

***Interviewer:*** *Ask to see the package of the wheat flour*

| Q517 | **Type of wheat flour** | **Tick if found in household** |
|---|---|---|
| | a. Snowflake | |
| | b. Azam | |
| | c. Cake Flour | |
| | d. Ufa wa mandasi | |
| | e. Repackaged/No brand name | |
| | f. Loose from open sack (Oyeza) | |
| | g. None available | |
| | h. Other (specify) | |

| Q518 | **Type of food made with wheat flour** *(circle type of food mentioned) Multiple responses allowed* | Q520**. How many days a week do members of your household eat foods made with wheat flour?** *(Must be number between 0 and 7)* |
|---|---|---|
| | a. Mandazi | |
| | b. Cakes | |
| | c. Bread | |
| | d. Samosas | |
| | e. Chipati | |
| | f. Mabanzi | |
| | g. Pizza | |
| | h. Other (Specify) | |

| Q519 | What kind of pot do you use to cook the food for your household? |
|---|---|
| | Iron .....1 |
| | Aluminum .....2 |
| | Stainless Steel .....3 |
| | Clay Pot.....4 |
| | Enamel .....5 |

| | | |
|---|---|---|
| | Other [Specify]_____ .....88<br>Don't know .....99 | |

| FRAT - 24 HOUR RECALL ON FOODS TO FORTIFY | | |
|---|---|---|
| Q520 | We would like to know what foods you ate yesterday. Was your intake unusual in any way yesterday?<br>Yes..... 1<br>No ..... 2 | |

***Interviewer**: If yes, then ask the following questions about a usual day. If no, then ask the following questions about yesterday. Begin by asking what <u>foods or beverages</u> were eaten the previous day or on a usual day. List them in the table below:*

| LISTED FOODS | | | |
|---|---|---|---|
| **Breakfast** | **Lunch** | **Supper/dinner** | **Snacks** |
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***Interviewer:*** *Use this list of foods in the table above as a reference for the section of each of the centrally processed foods listed below*

**SUGAR**

***"I will now ask you questions about foods or beverages with sugar that your household might have consumed yesterday [on a usual day]"***

***Interviewer:*** Refer to listed foods in the table above

| | | |
|---|---|---|
| Q521 | Did you consume any <u>foods or beverages</u> with sugar yesterday/usual day? *These include fizzy drinks, tea, cakes*<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | 2→go to Q525<br>99→go to Q525 |

Q522 What <u>foods or beverages</u> contained **sugar**?

***Interviewer****: List the foods and amounts consumed in the table below*

| **Foods and beverages consumed yesterday containing <u>SUGAR</u>** | **Amount of sugar consumed (specify Teaspoon or Tablespoon)** |
|---|---|
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|---|---|---|
| ***"Now think about the foods you've eaten in the last 7 days."*** | | |
| Q523 | How many days, in the last 7 days, did you eat <u>foods or beverages</u> prepared with **<u>sugar</u>**?<br>***Interviewer**: Response must be between 0 and 7*<br>Number of days .....\|__\| | |
| Q524 | In which season(s) do you eat **<u>sugar</u>**?<br>All seasons ..... 1<br>Rainy season only ..... 2<br>Harvest seasons..... 3<br>Other [Specify]_____..... 88 | |

| **CENTRALLY PROCESSED OIL** | | |
|---|---|---|
| ***"I will now ask you questions about food with centrally processed oil that your household might have eaten yesterday [on a usual day]"***<br><br>***Interviewer:** Refer to listed foods above.* | | |
| Q525 | Did you consume any foods with **<u>centrally processed oil</u>** yesterday/usual day?<br>Yes ..... 1<br>No..... 2<br>Don't know ..... 99 | 2→go to Q529<br>99→go to Q529 |

Q526 What foods or beverages contained **<u>centrally processed oil</u>**?

***Interviewer**: List the foods and amounts consumed or used in a recipe in the table below.*

| **Foods consumed yesterday containing <u>CENTRALLY PROCESSED OIL</u>** | **Amount used in recipe (Tablespoon)** | **Number of people served** |
|---|---|---|
| | | |
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|---|---|---|---|
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***"Now think about the foods you've eaten in the last 7 days."***

| | | |
|---|---|---|
| Q527 | How many days, in the last 7 days, did you eat foods prepared with **centrally processed oil**?<br>***Interviewer**: Response must be between 0 and 7*<br>Number of days.....\|__\| | |
| Q528 | In which season(s) do you eat **centrally processed oil**?<br>All seasons..... 1<br>Rainy season only..... 2<br>Harvest seasons ..... 3<br>Other [Specify]_____ ..... 88 | |

**CENTRALLY PROCESSED MAIZE FLOUR**

***"I will now ask you questions about food that contains maize flour that your household might have eaten yesterday [on a usual day]."***

***Interviewer:** Refer to listed foods.*

| | | |
|---|---|---|
| Q529 | Did you consume any foods with **centrally processed maize flour** yesterday/ usual day?<br>Yes..... 1<br>No ..... 2<br>Don't know..... 99 | 2→go to Q532<br>99→go to Q532 |

Q530 What foods or beverages contained **centrally processed maize flour**?

***Interviewer**: List the foods and amounts consumed in the table below.*

| **Foods consumed yesterday containing CENTRALLY PROCESSED MAIZE FLOUR** | **Amount consumed (Bowl; S, M, or L Chipande)** |
|---|---|
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***"Now think about the foods you've eaten in the last 7 days."***

| | | |
|---|---|---|
| Q531 | How many days, in the last 7 days, did you eat foods prepared with **centrally processed maize flour**?<br>***Interviewer**: Response must be between 0 and 7*<br>Number of days ..... \|__\| | |
| Q532 | In which season(s) do you eat **centrally processed maize flour**?<br>All seasons ..... 1<br>Rainy season only ..... 2<br>Harvest seasons ..... 3<br>Other [Specify]_____ ..... 88 | |

| **CENTRALLY PROCESSED WHEAT FLOUR** | | |
|---|---|---|
| ***"I will now ask you questions about food that contains wheat flour that your household might have eaten yesterday [on a usual day]"***<br><br>***Interviewer:** Refer to listed foods.* | | |
| Q533 | Did you consume any foods with **centrally processed wheat flour** yesterday/ usual day?<br>***(Interviewer:** These might include bread, mandazi/donuts, mabanzi, cakes made in the home**)***<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | 2→go to Q537<br>99→go to Q537 |
| Q534 | What foods contained **centrally processed wheat flour**?<br><br>***Interviewer**: List the foods and amounts consumed in the table below.* | |

| | 70. **Foods consumed yesterday containing <u>centrally processed wheat flour</u>** | **Amount consumed (UNITS)** |
|---|---|---|
| | Obama | |
| | Bin Laden/Chintuwisa | |
| | Mandazi | |
| | Village scones (sangweji) | |
| | | |
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| | | |

***"Now think about the foods you've eaten in the last 7 days."***

| | | |
|---|---|---|
| Q535 | How many days, in the last 7 days, did you eat foods prepared with **<u>centrally processed wheat flour</u>**?<br>***Interviewer**: Response must be between 0 and 7*<br>Number of days .....\|__\| | |
| Q536 | In which season(s) do you eat **<u>centrally processed wheat flour</u>**?<br>All seasons .....1<br>Rainy season only .....2<br>Harvest seasons.....3<br>Other [Specify]_____.....88 | |

***This marks the end of the FRAT interview.***

**THANK** *the participant for their cooperation.*

**CHECK** *that the data collection form has been completed correctly.*

**CHECK** *that the identification numbers are at the top of each page.*

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**Data Entry Information Panel**

(To be completed by the data entry clerks)

| | | | |
|---|---|---|---|
| First data entry clerk ID number | | Second data entry clerk ID number | |

**PUT BAR CODE**

**2008 NATIONAL MICRONUTRIENT SURVEY**

**INFANT FORTIFICATION RAPID ASSESSMENT TOOL (FRAT) QUESTIONNAIRE**

This FRAT is to be completed on households #2, #4, #6 in each cluster by one identified interviewer. Select the first child aged 12-59 months from the household list and ask the child's mother or primary caretaker the following questions. Eligible children suffering from any condition preventing them from eating or drinking normally should be excluded.

| **INFANT/CHILD INFORMATION PANEL** | | |
|---|---|---|
| CFIP1. District Number<br>__ __ | CFIP2. Cluster Number<br>__ __ __ | CFIP3. Household Number<br>__ __ |
| CFIP4. Interviewer's Name and Number | | __ __ |
| CFIP5. Supervisor's Name and Number | | __ __ |
| CFIP6. Mother/Caregiver's Name | | |
| CFIP7. Name of the Infant/Child | | |
| CFIP8. Infant/Child's Line Number from Household Listing Form | | __ __ |
| CFIP9. Date of Interview: (dd/mm/yyyy)<br>__ __ / __ __ / __ __ __ __ | CFIP10. Result of the Interview: (circle)<br>Completed.....1<br>Not home/no competent person.....2<br>Refused.....3<br>Partly completed.....4<br>Postponed.....5<br>Incapacitated.....6<br>Other (specify).....88<br>_____ | |

| |
|---|
| ***NOTES*** *(Interviewer/supervisor notes: use this space to record notes about the interview with the woman, such as call back times, incomplete individual interview, number of attempts to re-visit and your general assessment of the interview)* |

| | |
|---|---|
| CFIP11. Data Entry Clerk's name and number | __ __ |

| 24 HOUR RECALL ON FOODS TO FORTIFY | | |
|---|---|---|
| Q600 | We would like to know what foods the child ate yesterday. Was the intake unusual in any way yesterday?<br>Yes..... 1<br>No ..... 2 | |

***Interviewer**: If yes, then ask the following questions about a usual day. If no, then ask the following questions about yesterday. Begin by asking what foods were eaten the previous day or on a usual day. List them in the table below:*

| LISTED FOODS | | | |
|---|---|---|---|
| **Breakfast** | **Lunch** | **Supper/dinner** | **Snacks** |
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***Interviewer:** Use this list of foods in the table above as a reference to the questions in the next section.*

| SUGAR | | |
|---|---|---|
| ***"Now I will ask you questions about food or beverages that you might have given to the child yesterday [on a usual day]"***<br><br>***Interviewer:*** *Refer to listed foods above.* | | |
| Q601 | Did he/she consume any foods or beverages with sugar yesterday/usual day?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | 2→go to Q603<br>99→go to Q603 |
| Q602 | If yes, what <u>foods or beverages</u> contain **sugar**?<br><br>***Interviewer****: List the foods and amounts consumed in the table below* | |

| **Foods and beverages consumed yesterday containing <u>SUGAR</u>** | **Amount of sugar consumed (specify Teaspoon or Tablespoon)** |
|---|---|
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| **"Now think about the foods that the child ate in the last 7 days".** | | |
|---|---|---|
| Q603 | How many days, in the last 7 days, did the child eat <u>foods or beverages</u> prepared with **<u>sugar</u>**?<br>***Interviewer****: Response must be between 0 and 7*<br>Number of days ..... \|__\| | |
| Q604 | In which season(s) does he/she eat **<u>sugar</u>**?<br>All seasons ..... 1<br>Rainy season only ..... 2 | |

| | | |
|---|---|---|
| | Harvest seasons ..... 3<br>Other [Specify]_____ ..... 88 | |

| **CENTRALLY PROCESSED OIL** | | |
|---|---|---|
| ***"I will now ask you questions about food which contains centrally processed oil that the child might have consumed yesterday [on a usual day]"***<br><br>***Interviewer:*** *Refer to listed foods above.* | | |
| Q605 | Did he/she consume any foods with **centrally processed oil** yesterday/usual day?<br>Yes ..... 1<br>No ..... 2<br>Don't' know..... 99 | 2→go to Q607<br>99→go to Q607 |
| Q606 | What foods or beverages contain **centrally processed oil**?<br><br>***Interviewer****: List the foods and amounts consumed or used in a recipe in the table below.* | |

| **Foods consumed yesterday containing CENTRALLY PROCESSED OIL** | **Amount used in recipe (Tablespoon)** | **Number of people served** |
|---|---|---|
| | | |
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|---|---|---|
| ***"Now think about the foods your child has eaten in the last 7 days."*** | | |
| Q607 | How many days, in the last 7 days, did the child eat foods prepared with **centrally processed oil**?<br>*Interviewer: Response must be between 0 and 7*<br>Number of days.....\|__\| | |
| Q608 | In which season(s) does this child eat **centrally processed oil**? | |

| | | |
|---|---|---|
| | All seasons ..... 1<br>Rainy season only ..... 2<br>Harvest seasons ..... 3<br>Other [Specify]_____ ..... 88 | |

| **CENTRALLY PROCESSED MAIZE FLOUR** | | |
|---|---|---|
| ***"I will now ask you questions about food that contains centrally processed maize flour that the child might have consumed yesterday [on a usual day]"***<br><br>***Interviewer:*** *Refer to listed foods.* | | |
| Q609 | Did this child consume any foods with **<u>centrally processed maize flour</u>** yesterday/ usual day?<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | 2→go to Q611<br>99→go to Q611 |
| Q610 | What foods or beverages contain **<u>centrally processed maize flour</u>**?<br><br>***Interviewer****: List the foods and amounts consumed in the table below.* | |

| **Foods consumed yesterday containing <u>CENTRALLY PROCESSED MAIZE FLOUR</u>** | **Amount consumed (Bowl; S, M, or L Chipande)** |
|---|---|
| | |
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***"Now think about the foods this child ate in the last 7 days".***

| | | |
|---|---|---|
| Q611 | How many days, in the last 7 days, did this child eat foods prepared with **centrally processed maize flour**?<br>*Interviewer: Response must be between 0 and 7*<br>Number of days.....\|__\| | |
| Q612 | In which season(s) does this child eat **centrally processed maize flour**?<br>All seasons..... 1<br>Rainy season only..... 2<br>Harvest seasons ..... 3<br>Other [Specify]_____ ..... 88 | |

| **CENTRALLY PROCESSED WHEAT FLOUR** | | |
|---|---|---|
| ***"Now I will ask you questions about any food that contains centrally processed wheat flour that the child might have consumed yesterday [on a usual day]"***<br><br>***Interviewer:*** *Refer to listed foods.* | | |
| Q613 | Did this child consume any foods with **centrally processed wheat flour** yesterday or on a usual day?<br>***(Interviewer: These might include bread, mandazi/donuts, mabanzi, cakes made in the home)***<br>Yes ..... 1<br>No..... 2<br>Don't know..... 99 | 2→go to Q615<br>99→go to Q615 |
| Q614 | What foods or beverages contain **centrally processed wheat flour**?<br><br>***Interviewer****: List the foods and amounts consumed in the table below.* | |

| **2.Foods consumed yesterday containing centrally processed wheat flour** | **Amount consumed (UNITS)** |
|---|---|
| | |
| | |
| | |
| | |

| | | |
|---|---|---|
| | | |
| | | |

***"Now think about the foods this child ate in the last 7 days".***

| | | |
|---|---|---|
| Q615 | How many days, in the last 7 days, did this child eat foods/beverages prepared with **centrally processed wheat flour**?<br>*(Interviewer: Response must be between 0 and 7)*<br>Number of days.....\|__\| | |
| Q616 | In which season(s) does this child eat **centrally processed wheat flour**?<br>All seasons..... 1<br>Rainy season only..... 2<br>Harvest seasons ..... 3<br>Other [Specify]_____ ..... 88 | |

**CENTRALLY PROCESSED COMPLEMENTARY FOODS**

***"I will now ask you some questions on any food that contains centrally processed food that the child might have consumed yesterday [on a usual day]"***

*Interviewer**: Refer to listed foods.***

| | | |
|---|---|---|
| Q617 | Did this child consume any foods with **centrally processed complementary foods** yesterday or on a usual day?<br>*(Interviewer: These might include Likuni Phala, Purity, Cerelac, Baby best)*<br>Yes.....1<br>No.....2<br>Don't know.....99 | 2→go to Q619<br>99→go to Q619 |
| Q618 | What foods or beverages contain **centrally processed wheat flour**?<br>***Interviewer**: List the foods and amounts consumed in the table below* | |

| **3.Foods consumed yesterday containing centrally processed complementary foods** | **Amount consumed** |
|---|---|

| | | |
|---|---|---|
| | | **(Bowl)** |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

***"Now think about the foods this child ate in the last 7 days".***

| | | |
|---|---|---|
| Q619 | How many days, in the last 7 days, did this child eat foods prepared with **centrally processed complementary foods**?<br>***Interviewer**: Response must be between 0 and 7*<br>Number of days .....\|__\| | |
| Q620 | In which season(s) does this child eat **centrally processed complementary foods**?<br>All seasons .....1<br>Rainy season only .....2<br>Harvest seasons.....3<br>Other [Specify]_____.....88 | |

| COMPLEMENTARY FOODS | | |
|---|---|---|
| ***"Now I will ask you about complementary food that you might use in this household"*** | | |
| Q621 | Did you usually use **centrally processed complementary foods?**<br>Yes ..... 1<br>No ..... 2<br>Don't know ..... 99 | 2→go to Q602<br>99→go to Q602 |
| Q622 | How often do you buy centrally processed complementary foods?<br>Every day ..... 1<br>Every other day ..... 2<br>Once a week ..... 3<br>Every two weeks ..... 4<br>Once a month ..... 5<br>Other [Specify]_____ ..... 88<br>Don't know ..... 99 | |
| ***Interviewer:*** *Ask to see the complementary foods in the house (complete table below)* | | |

| Q623 | **Type of food** | **Tick if found in household** |
|---|---|---|
| | a. Rabs Likuni Phala | |
| | b. Baby Best Likuni Phala | |
| | c. Breakfast Cereal | |
| | d. Cerelac | |
| | e. Infant formula | |
| | f. Purity | |
| | g. Nestum | |
| | h. Safari | |
| | i. Other (specify) | |

***This marks the end of the FRAT survey.***

**THANK** *the participant for their cooperation.*

**CHECK** *that the data collection form has been completed correctly.*

**CHECK** *that the identification numbers are at the top of each page.*

**Data Entry Information Panel**

(To be completed by the data entry clerks)

| | | | |
|---|---|---|---|
| First data entry clerk ID number | | Second data entry clerk ID number | |

t bar code
ıbel here

**ACTION CARD**

**2009 NATIONAL MICRONUTRIENT SURVEY**

Cluster number: |___|___|___|  Household number: |___|___|

Name: _____

Circle one: Infant/child School-aged child Woman Man

_____ of total _____ from household

| | TO DO | DONE |
|---|---|---|
| ACTIVITY AND SAMPLES | Mark X | Name |
| Questionnaire | | |
| Anthropometry | | |
| Blood taken for malaria, Hb and microtainer | | |
| Urine sample | | |
| Stool sample | | |
| Salt sample | | |

**APPENDIX 6 LABELING PROCEDURES**

## Roles and responsibilities

- The interviewer is responsible for sticking labels on questionnaires and samples
- The lab technician is responsible for handling the labels

## Objectives

- Every questionnaire, salt sample and biological sample needs a label. The label ID number is used to match the household information and an individual's information with the results of the laboratory testing of the specimens.

## Procedure

- Each label contained information on the subject type, specimen type, subject ID number and region.
- After completing all the required questionnaires, the interviewer is responsible for taking the subjects to the central lab and sticking a "Questionnaire" label on the appropriate questionnaires completed for each person from the household. The interviewer is also responsible for sticking a salt label on the collection bag containing salt collected from each household and any other samples obtained from the participants
- Each household will have different types of subjects eligible for the study. Each survey participant in a household has a unique ID but the same household ID. Each of the survey participants has multiple specimens collected as indicated below and in the table below:
    - Household-2 samples
    - Under-five children-6 samples
    - School-aged children-9 samples
    - Women- 9 samples
    - Men – 6 samples

| This chart describes the samples which should be collected for each eligible person in a household | | | | | | | | | | | | | | | | Does this need a label? | What label should I use? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Household** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | | |
| **Infant/child (6-59 mo)** | | | | | | | | | | | | | | | | | |
| Questionnaire | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | YES | Questionnaire |
| Anthropometry | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | NO-record on the questionnaire | |
| Hemoglobin | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | NO-record on the questionnaire | |
| RBP/CRP/AGP/Ferritin | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | YES | Microtainer and Plasma Cryovial |
| Malaria smear | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | YES | Malaria slide |
| Infant FRAT | | X | | X | | X | | | | | | | | | | NO- Cluster and household ID must be written on these forms. | |
| **School-aged child (6-12 y)** | | | | | | | | | | | | | | | | | |
| Questionnaire | X | | X | | X | | X | | X | | X | | X | | X | YES | Questionnaire |
| Anthropometry | X | | X | | X | | X | | X | | X | | X | | X | NO-record on the questionnaire | |
| Hemoglobin | X | | X | | X | | X | | X | | X | | X | | X | NO-record on the questionnaire YES | |
| RBP/CRP/AGP/Ferritin | X | | X | | X | | X | | X | | X | | X | | X | YES | Microtainer and Plasma Cryovial |
| Urine | X | | X | | X | | X | | X | | X | | X | | X | YES | Urine cup, Urine Cryovial1, Urine Cryovial 2, and Urine Schisto |
| Stool | X | | X | | X | | X | | X | | X | | X | | X | YES | Stool |
| Malaria Smear | X | | X | | X | | X | | X | | X | | X | | X | YES | Malaria slide |
| **Woman (15-49y)** | | | | | | | | | | | | | | | | | |
| Questionnaire | X | | X | | X | | X | | X | | X | | X | | X | YES | Questionnaire |
| Anthropometry | X | | X | | X | | X | | X | | X | | X | | X | NO-record on the questionnaire | |
| Hemoglobin | X | | X | | X | | X | | X | | X | | X | | X | NO-record on the | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | questionnaire | |
| RBP/CRP/AGP/Ferritin | X | | X | | X | | X | | X | | X | | X | | X | YES | Microtainer and Plasma Cryovial |
| Urine | X | | X | | X | | X | | X | | X | | X | | X | YES | Urine cup, Urine Cryovial1, Urine Cryovial 2, and Urine Schisto |
| Malaria smear | X | | X | | X | | X | | X | | X | | X | | X | YES | Malaria Slide |
| Woman FRAT | | | X | | X | | X | | | | | | | | | NO- Cluster and household ID must be written on these forms. | |
| **Man (20-55Y)** | | | | | | | | | | | | | | | | | |
| Questionnaire/FRAT | | | | | | | | | X | | X | | X | | | YES | Questionnaire |
| Hemoglobin | | | | | | | | | X | | X | | X | | | NO-record on the questionnaire | |
| RBP/CRP/AGP/Ferritin | | | | | | | | | X | | X | | X | | | YES | Microtainer and Plasma Cryovial |
| Malaria smear | | | | | | | | | X | | X | | X | | | YES | Malaria slide |

## Measuring the length of children 0-24 months

1. Measure infant without shoes and wearing light underclothing or clean diaper.
2. Remove hair accessories that interfere with measurement
3. Lay child on his back in the center of the measuring surface.
4. Assistant cups the ears to hold the infant's head so the infant is looking upward and the crown of the head is against the headpiece.
5. Bring knees together, extend both legs and bring movable foot piece to rest against heels.
6. Read measurement to the nearest 0.1 cm.

## Measuring height for individuals 2 years or older

1. Measure child without shoes and wearing light clothing.
2. Remove hair accessories that interfere with measurement.
3. Position child with feet flat and together on the base of the board.
4. Heels, back of knees, buttocks, shoulder blades and back of head should touch back of board while child is maintaining a normal stance. For some children this is not possible and only the heels and buttocks will touch the board.
5. The shoulders should be level and eyes should look straight ahead.
6. The headpiece should be placed firmly against top of the child's head and firmly against the board.
7. Read measurement to the nearest 0.1 cm.

## Measuring weight of children and adults who can stand on their own

1. Turn on the scale.
2. Move your foot across switch window.
3. Ask the person to step on the scale. Wait until the display shows weight.
4. Record the weight to the nearest 0.1kg
5. Ask the person to get off the scale.
6. Wait until the display shows 0.0 before weighing the next person.

## Measuring weight of children who cannot stand on their own

1. Turn on the scale.
2. Move your foot across switch window.
3. Ask the mother to step on the scale by herself. She can give her child to you or another mother to hold. Make sure her feet or clothes do not cover the switch window.
4. You will see the mother's weight in the display, record it to the nearest 0.1kg
5. With the mother on the scale pass your foot slowly across the switch window.
6. Then wait a couple seconds.
7. Ask the mother to step off the scale.
8. Ask the mother to step back on the scale with her child.
9. Record the wait and subtract the weight of the mother to the nearest 0.1kg.

Ask the mother to step off the scale. Pass your foot across the switch window to reset the scale before weighing the next mother.

**Revision Date: March**, 2009

- **Staff able to collect sample:** Enumerators

## Purpose

To collect salt sample for qualitative and quantitative iodine examination

## Requirements

Pre-printed labels
Sealable plastic bags

## Procedure

1. Register household ID on the data capture form
2. Label the sealable plastic bag with a pre-printed label
3. Collect two full table spoons of household salt and place in the sealable plastic bag
4. Tightly seal the plastic bag

**APPENDIX 9 FINGER PRICK PROCEDURES**

## Laboratory Standard Operational Procedures for 2009 Malawi Micronutrient Survey-

Collection of capillary blood samples by the finger prick method

Revision Date: March, 2009
Staff able to collect sample: Laboratory Technician /Technologist

### Purpose
This SOP is to guide the user on how to safely collect capillary blood from a subject.

### Principle
Capillary blood is collected in cases when you need to collect small volumes of whole blood for testing. Blood is collected by pricking the finger with a safety lancet and filling a microtainer.

### Requirements
Gloves
Lab coats or aprons
Sharps containers
Cotton wool
70% Methylated spirit or alcohol wipes
Safety Lancet
Microtainer (anti-coagulated with EDTA)
Gauze
Biohazard waste container
Goggles or face shields
Bench mats

### Safety precautions
In order to prevent injury and infection from occurring to subjects and health workers collecting blood, all personnel have a responsibility to adhere to and enforce this SOP at all times and avoid complacency. In addition, universal precautions for handling infectious and/or potentially infectious material must be adhered to.

- Use a new lancet for each subject
- Use a new microtainer for each subject
- Use a new pair of gloves for each subject

Determine if subject has any bleeding disorders before performing finger prick procedure. If the subject has any bleeding disorder, do not proceed with the procedure.

Procedure

1. Gather required supplies.
2. Identify the subject by name and / or identification number using the appropriate forms.
3. Make sure the subject is comfortably seated.
4. Explain the procedure to the subject and obtain his / or her consent.

5. Put on gloves.
6. Position the subject's hand palm-side up.
7. Chose the finger from which the blood will be drawn (preferably, middle or ring finger) **Note: Do not prick a finger that has a ring on it.**
8. Apply intermittent pressure to the finger to help the blood to flow
9. Cleanse the finger tip with 70% alcohol swab. Start in the middle and work outward to prevent contaminating the area where blood will be collected. Allow the area to dry.
10. Prepare the lancet for pricking.
11. Hold the finger firmly and prick the side of the fingertip.
12. Wipe away the first drop of blood with gauze pad or cotton ball.
13. Collect the specimen using microtainer. Blood may flow best if the finger is held lower than the elbow. **Caution: Do not milk the finger.**
14. Apply a gauze pad or cotton ball to the puncture site until the bleeding stops.
15. Properly dispose of all contaminated supplies in appropriate waste containers as described in safety manual.

Limitations
Subject's history of any bleeding disorders.

References
WHO
CDC (include Job aids)

**Collection of capillary blood samples by the Toe prick method for infants aged 4 – 10 months and weighing less than 5Kg**

**Revision Date: March,** 2009
Staff able to collect sample: Laboratory Technician /Technologist

**Purpose**
This SOP is to guide the user on how to safely collect capillary blood from a subject.

**Principle**
Capillary blood is collected in cases when you need to collect small volumes of whole blood for testing. Blood is collected by pricking the finger with a safety lancet and filling a microtainer.

Requirements
Gloves
Lab coats or aprons
Sharps containers
Cotton wool
70% Methylated spirit or alcohol wipes
Safety Lancet
Microtainer (anti-coagulated with EDTA)
Gauze
Biohazard waste container
Goggles or face shields
Bench mats

**Safety precautions**
In order to prevent injury and infection from occurring to subjects and health workers collecting blood, all personnel have a responsibility to adhere to and enforce this SOP at all times and avoid complacency. In addition, universal precautions for handling infectious and/or potentially infectious material must be adhered to.

- Use a new lancet for each subject
- Use a new microtainer for each subject
- Use a new pair of gloves for each subject

Determine if subject has any bleeding disorders before performing finger prick procedure. If the subject has any bleeding disorder, do not proceed with the procedure.

Procedure

1. Gather required supplies.
2. Identify the subject by name and / or identification number using the appropriate forms.
3. Make sure the subject is a comfortably seated/held.
4. Explain the procedure to the subject and obtain his / or her consent.

5. Put on gloves.
6. Position the subject's with the foot down.
7. Chose the toe from which the blood will be drawn
8. Apply intermittent pressure to the finger to help the blood to flow
9. Cleanse the toe tip with 70% alcohol swab. Start in the middle and work outward to prevent contaminating the area where blood will be collected. Allow the area to dry.
10. Prepare the lancet for pricking.
11. Hold the toe firmly and prick the side of the fingertip.
12. Wipe away the first drop of blood with gauze pad or cotton ball.
13. Collect the specimen using microtainer. **Caution: Do not milk the toe.**
14. Apply a gauze pad or cotton ball to the puncture site until the bleeding stops.
15. Properly dispose of all contaminated supplies in appropriate waste containers as described in safety manual.

Limitations
Subject's history of any bleeding disorders.

References
WHO
CDC (include Job aids)

**Collection of capillary blood samples by Heel method for infants aged 4 – 10 months, weighing less than 5Kg and with very small toes**

**Revision Date: March,** 2009
Staff able to collect sample: Laboratory Technician /Technologist

**Purpose**
This SOP is to guide the user on how to safely collect capillary blood from a subject.

**Principle**
A skin puncture procedure performed on the heel will be conducted for survey participants 6 months of age who have very small fingers. The heel stick is preferred for this age group because the bones of the distal phalanx (located in the thickest part of the finger) may be injured by a lancet puncture. The heel stick is performed on the lateral or medial portions of the foot (left and right), never the central area of the foot, the arch, or the back of the heel.

Requirements
Gloves
Lab coats or aprons
Sharps containers
Cotton wool
70% Methylated spirit or alcohol wipes
Safety Lancet
Microtainer (anti-coagulated with EDTA)
Gauze
Biohazard waste container
Goggles or face shields
Bench mats

**Safety precautions**
In order to prevent injury and infection from occurring to subjects and health workers collecting blood, all personnel have a responsibility to adhere to and enforce this SOP at all times and avoid complacency. In addition, universal precautions for handling infectious and/or potentially infectious material must be adhered to.

- Use a new lancet for each subject
- Use a new microtainer for each subject
- Use a new pair of gloves for each subject

Determine if subject has any bleeding disorders before performing fingerpick procedure. If the subject has any bleeding disorder, do not proceed with the procedure.

Procedure

1. Gather required supplies.

2. Identify the subject by name and / or identification number using the appropriate forms.
3. Make sure the subject is a comfortably seated/held.
4. Explain the procedure to the subject and obtain his / or her consent.
5. Put on gloves.
6. Position the subject's with the foot down.
7. Select the skin puncture site from which the blood will be drawn (Either foot can be used)**.**
8. Apply intermittent pressure to the skin to help the blood to flow
9. Cleanse the skin with 70% alcohol swab. Start in the middle and work outward to prevent contaminating the area where blood will be collected. Allow the area to dry.
10. Prepare the lancet for pricking.
11. Hold the foot firmly and prick the lateral or medial portions of the foot (left and right), **never the central area of the foot, the arch, or the back of the heel.**
12. Wipe away the first drop of blood with gauze pad or cotton ball.
13. Collect the specimen using microtainer tube by applying light pressure opposite the puncture site until a drop appears. **Caution: Do not milk or scrape the side of the foot to collect the blood.**
14. Apply a gauze pad or cotton ball to the puncture site until the bleeding stops.
15. Properly dispose of all contaminated supplies in appropriate waste containers as described in safety manual.

Limitations
Subject's history of any bleeding disorders.

References
UNICEF
CDC (include Job aids)

## Appendix 10 Blood Smear Collection and Malaria Microscopy

### Blood smear collection

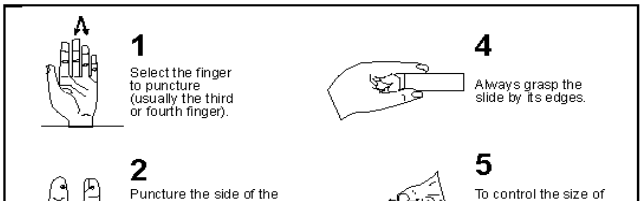
Revision Date: March, 2009
Staff able to collect sample: Laboratory Technician /Technologist

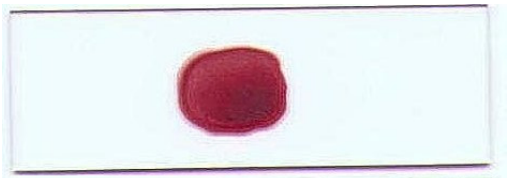
Purpose
A thick blood film or smear is a large drop of fresh blood, spread in a circular manner on a glass slide and allowed to dry. It consists of many layers of blood cells on top of each other. In this way a large volume of blood can be examined rapidly.

In thick blood films, the blood is not fixed. The red cells are lysed (destroyed) during staining, allowing parasites and white blood cells to be seen in a much larger volume of blood.

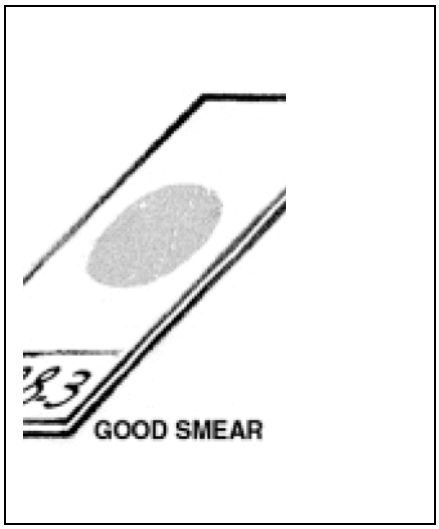
Requirements
Gloves
Clean glass slides
Sterile safety lancets
Cotton wool
Ethanol 70%
Sharps disposal container
Slide box or cover to protect drying blood smear
Pencil and ball point pen
Data capture form
Pre-printed labels/lead pencils

Procedure
1. Register subject details on the data capture form
2. Label the slide with a pre-printed label/lead pencil.
3. Follow the same steps for the finger prick
4. Use completely clean, grease-free microscope slides. Work quickly and handle the slides only by the edges.
5. Collect two drops of blood on the slide.
6. The quantity of blood spot is very important for the thick film: too thin smear will make the checking more difficult (you may miss some of the parasites). Too thick smear cannot be stained and examined properly.
7. Quickly spread the blood spots evenly with a few circular movements.
8. The circle of the thick film should be about 1.5 cm in diameter (1/2 inch).
9. Let the thick smear dry horizontally, while protected from direct sunlight and dust, and in a place where there is no risk of anyone or anything (flies!) touching the slide.

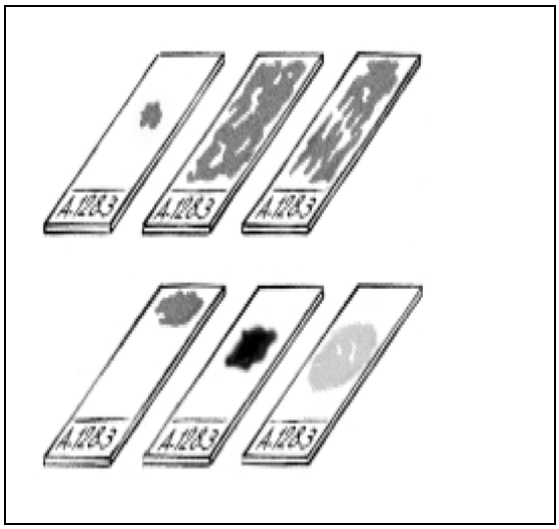




Example of a good smear




Example of a bad smear



References
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2. Manual of Basic Techniques for a Healthy Laboratory. Second edition. WHO Geneva. 2003
3. Laboratory manual for laboratory technician training, Burma border programme and Shoklo Malaria Project, Mae Hong Son – Mae- Sod Thailand. 2002

Revision Date: March, 2009

Staff able to perform test: Laboratory Technologist/ Technician

Method
Microscopy of thick blood film using Field's Stain A and B

Purpose
To detect and identify malaria parasites microscopically in blood film.

Test Principle
The malaria parasite consists of cytoplasm, which is basic in nature and a nucleus, which is acidic in nature. When a malaria parasite is stained with Romanowsky stain, such as Field's Stain A (Acidic dye) and B (Basic dye) the cytoplasm stains blue due to the acidic dye and the chromatin and Schuffner's dots stain red due to basic dye.

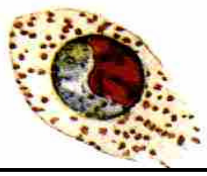
Specimen
Capillary blood.
Requirements
Microscope with oil immersion objective
Slides (Clean and grease-free)
Waterproof labels
Safety lancets
Spirit swabs
Staining jars x 4
Field's stain A
Field's stain B
Immersion oil
Tap water

Test Procedure
1. Prepare two thick smears on the same slide.
2. Start preparing the smear on the end of the slide and then one on the centre. Smears should be 10 -12 mm in diameter (two tambala coin).
3. To determine the correct thickness of the film, place the slide on a piece of newspaper. Small prints should just be visible through the blood.
4. Air dry the film on a flat surface.
5. Make 15 dips in Field's stain A and wash in tap water.
6. Make 5 dips in Field's stain B and wash in tap water.
7. Wipe the back of the slide
8. Leave slide to dry in an upright position at room temperature.
9. Examine under X100 (oil immersion) objective for the presence or absence of malaria parasites.

Results

Absence of parasites on film = No parasites seen

Presence of parasites on film = Name the species, stage and grading.

| | | *P. falciparum* | *P. vivax* | *P. malariae* | *P. ovale* |
|---|---|---|---|---|---|
| Trophozoites | Young | | | | |
| | Old | | | | |
| Schizonts | Immature | | | | |
| | Mature | | | | |
| Gametocytes | Male | | | | |
| | Female | | | |  |

Interpretation and Reporting

Smears are graded between one and four plus, as follows:

| | | |
|---|---|---|
| + | = | 1 - 10 parasites per 100 thick film fields. |
| ++ | = | 11 - 99 parasites per 100 thick film fields. |
| +++ | = | 1 - 10 parasites per single thick film field. |
| ++++ | = | more than 10 parasites per single thick film field. |

- Positive results should be presented as species, stage and grade
- All stages and species of malaria parasites (i.e. trophozoites, gametocytes, schizonts) and malaria pigment in white blood cells should be reported.

Quality Control

- Smears should not be too thick or too thin
- Stains in the staining troughs should be filtered daily before use
- Replace with new stains once every week.
- Record dates when changes and filtering was done on appropriate chart.
- Duplicate smear reading should be done and recorded by another laboratory technician (at least 10% of the days work as an internal quality control)
- All new reagents should be tested with known positive and negative smears.

Safety precautions
Dispose off blood lancets in 'sharps' box
All tested slides should be kept for future use

Reference

Cheesbrough M. District *Laboratory Practice in Tropical Countries.* Part 1. (Pages 245 - 254). Tropical Health Technology, 1998, ISBN 09507434
Mae Hong Son –2002. Laboratory manual for laboratory technician training, Burma border programme and Shoklo Malaria Project, Mae- Sod, Thailand.

## Appendix 11 Hemoglobin Estimation using *Hemocue 201+*

**Revision Date: March,** 2009
**Staff able to perform test:** Laboratory Technician /Technologist

Method
*HemoCue 201+* non-dilution photometric technique

Purpose
To estimate Haemoglobin (Hb) concentration in whole blood. Hb is measured to detect anaemia and its severity.

Principle of the test
A small drop of blood is drawn by capillary attraction into a specially designed single use microcuvette containing dry reagents. A modified azidemethaemoglobin reaction takes place inside the microcuvette. The red cell membranes are disintegrated by sodium deoxycholate, releasing the haemoglobin. Sodium nitrite converts the haemoglobin iron from the ferrous to the ferric state to form methaemoglobin, which then combines with azide to form azidemethaemoglobin. The absorbance is read photometrically in a *HemoCue 201+* meter at two wavelengths (565 and 880 mm). The latter reading compensates for any turbidity in the sample.

Type of specimen
Capillary blood.
Requirements
*HemoCue Hb 201+* analyser
(with batteries or connected to mains power)
*HemoCue Hb 201+* disposable cuvettes
Disposable blood safety lancets
Cotton wool swabs
Methylated spirits or other skin disinfectant
EDTA microtainer/capillary (To confirm with CDC)
Disposable gloves
Sharps disposal container

Test Procedure
1. Load the battery cells into the instrument (if first test of the day).
2. Perform a daily quality control check and record the results before first sample (Refer to quality control SOPs).
3. Switch "power on" on the HemoCue instrument.
4. Pull out the cuvette holder.
5. Use either anticoagulated whole blood or capillary blood.
6. For capillary blood, clean the skin with 70% alcohol. Allow the alcohol to dry.
7. Puncture the fingertip with a sterile lancet. Wipe away the first drop.
8. Fill the cuvette by placing the tip of the cuvette into the drop of blood. The correct volume is drawn into the cuvette by capillary action.

9. For microtainer blood, completely mix the blood sample and fill the cuvette with blood in the same manner. (To confirm with CDC)
10. Wipe off any excess blood on the cuvette. The cuvette should be entirely filled with blood but not overfilled. **No air bubbles should be present**.
11. Insert the cuvette into the instrument. Push the cuvette holder into the instrument until it stops.
12. The result is displayed within 15-60 seconds.
13. Read and record the result and remove the cuvette and discard into the sharps disposal bin.
14. Push the cuvette holder back into the instrument.
15. If last test of the day, unload battery cells from the instrument.

Results and interpretation

- Report results in g/dl
- Normal haemoglobin levels vary according to age and gender and the altitude at which a person lives.
- A low Hb will indicate anaemia
- A high Hb may indicate primary or secondary polycythaemia or dehydration

***Reference ranges*** *(guideline figures taken from Dacie and Lewis, Practical Haematology, 9th Edition, 2001):*

| | |
|---|---|
| Adult males | 13.0 – 17.0 g/dl |
| Adult females | 12.0 – 15.0 g/dl |
| Pregnant women | 11.0 – 13.8 g/dl |
| Children (6y – 12y) | 11.5 – 15.5 g/dl |
| Children (2y – 5y) | 11.0 – 14.0 g/dl |
| Neonates | 14.0 – 22.0 g/dl |

Quality Control

Checking the Photometer

The analyser is factory calibrated against the ICSH method and cannot be re-calibrated. The *Hemocue 201+* system has an internal electronic self-test. Every time the analyser is turned on, it will automatically verify the performance of the optronic unit. This electronic test is performed every 2 hours if the analyser is left on. This function means that a control cuvette is no longer needed.

**Note:** The results of this exercise should be recorded in the daily data sheet.

2. Cuvette use and shelf life

The *Hb 201+* microcuvettes have no wings and cannot be used in other HemoCue Hb systems or vice versa.

The *Hb 201+* cuvettes, in sealed 50-cuvette vials, are stable for 2 years from the date of manufacture. Once the seal is broken, they are stable for 3 months.

**Note:** Record the date when opening cuvette container and ensure the cuvettes are kept dry and used within 3 months.

Safety precautions
Wear gloves when pricking the subject and handling human blood
Dispose safety lancets and cuvettes in 'sharps box'
Incinerate all the medical waste

References
*Hemocue 201+* product literature and information. Supplied by: HemoCue AB, Kuvettgatan 1, SE-262 23 Ängelholm, Sweden
Dacie and Lewis. Practical Haematology (pages 23 and 594). 9th Edition, Churchill Livingstone, 2001. ISBN 0443063788.
Cheesbrough M. District Laboratory Practice in Tropical Countries. Part 2. (Page 306). Cambridge University Press, 2000. ISBN 0421665450

## 2009 NATIONAL MICRONUTRIENT SURVEY

## HemoCue Hemoglobin Results Form

**HemoCue Serial Number _____** **Team number _____**

**Region: North Centre South** **Cluster number _____**

**Supervisor Checked: _____**

**Quality control for blood hemoglobin results (grams per deciliter - g/dL)**

| | Morning | | | | Midday or whenever applicable | | | | Evening | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date<br><br>2009 | Low Target: 7.9 ± 0.4 (7.5 - 8.3) | Normal Target: 11.9 ± 0.6 (11.3 -12.5) | High Target: 16.0 ± 0.8 (15.2 - 16.8) | Lab Tech's ID # | Low Target: 7.9 ± 0.4 (7.5 - 8.3) | Normal Target: 11.9 ± 0.6 (11.3 -12.5) | High Target: 16.0 ± 0.8 (15.2 - 16.8) | Lab Tech's ID # | Low Target: 7.9 ± 0.4 (7.5 - 8.3) | Normal Target: 11.9 ± 0.6 (11.3 -12.5) | High Target: 16.0 ± 0.8 (15.2 - 16.8) | Lab Tech's ID # |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
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**Additional Comments:**

_____

## Appendix 12 Stool Collection and Microscopy

### Stool collection

**Revision Date: March,** 2009

**Staff able to receive sample:** Laboratory Technician /Technologist

**Purpose**

The examination of faeces for parasitological diagnosis is done to detect:

- Ova and cysts (main focus for this survey)
- Adult worms
- Segments of tapeworms
- Larvae
- Trophozoites
- Cellular exudates such as WBCs, RBCs, macrophages and Charcot-Leyden (CL) crystals

For this, the sample should be properly collected and preserved.

**Procedure**

1. Give the subject a sterile container labelled with the subject's ID number to use for urine collection
2. Tell the subject to collect stool into the container
3. Tightly close the container.
4. Send freshly passed faeces in a closed, sterile container
5. Urine or water must not contaminate the stool
6. Do not overfill container
7. Submit this to the field laboratory for analysis as soon as possible (within 30 minutes)
8. Leaking containers will not be accepted by the lab.

**Handling and transport**

Stool specimens should never be frozen and thawed or placed in an incubator because parasitic forms deteriorate very rapidly.

**References**

1. Cheesbrough M. District Laboratory Practice in Tropical Countries. Part 2. (Pages 299 - 303). Cambridge University Press, 2000. ISBN 0421665450
2. Manual of Basic Techniques for a Healthy Laboratory. Second edition. WHO Geneva. 2003

**Stool Microscopy**

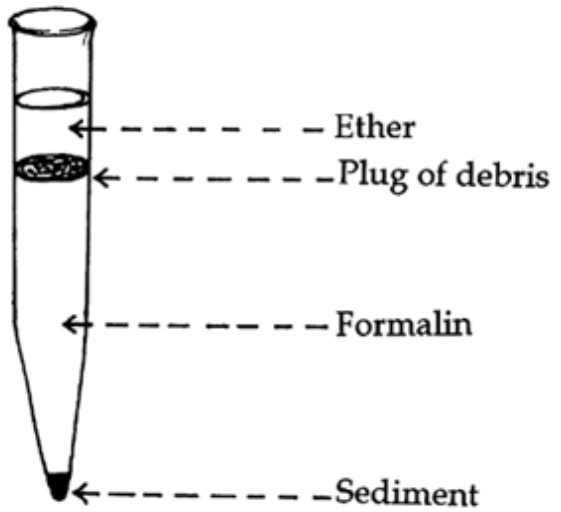
**Revision Date:** March, 2009
Staff able to perform test: Laboratory Technician /Technologist

Purpose
To detect the presence of intestinal parasites including ova, larvae, trophozoites and cysts.
Specimen

A fresh stool specimen is preferred. A small portion of faeces (about the size of a 1 Kwacha coin) is collected in a clean wide-mouthed, leak-proof container. Advise clients to bring portions of stool which contain blood or mucous.

**Formal Ether (Sedimentation) Concentration Technique**

In this technique the eggs and cysts settle down at the bottom.




**Requirements**

Formal water, 10% (prepared by mixing 50 ml of strong formaldehyde solution with 450 ml of distilled or filtered).
Diethyl ether.
Sieve (strainer) with small holes, preferably 400 – 450 µm in size.
Microscope
Glass slides
Cover slip (22 x 22)
Applicator sticks
Pasteur pipettes

0.9% saline
Labels
Gloves
Filter funnel
Centrifuge tubes
Tube rack
Disinfectant
Bucket

**Test Procedure**

1. Using applicator stick, emulsify an estimated 1 gram of faeces in about 4 ml of 10% formal water contained in a screw cap tube.
2. Add further 3 – 4 ml 10% v/v formal water; cap the bottle, mix by shaking for 20 seconds.
3. Sieve the emulsified faeces, collecting the sieved suspension in the centrifuge tube.
4. Transfer the suspension to a conical tube made of strong glass or polypropylene. Add an equal volume of ether, i.e. 3 – 4 ml.
5. Stopper the tube and mix for 1 minute. If using a vortex mixer, leave the tube un-stopped and mix for about 15 seconds.
6. With a tissue or piece of cloth wrapped round the top of the tube, loosen the stopper (considerable pressure will have built inside the tube). Centrifuge immediately at 750 – 100 g (approximately 3000 rpm) for 1 minute. After centrifuging, the parasites will have collected to the bottom of the tube and the faecal debris will have collected in a layer between the ether and formal water.
7. Using a stick or the stem of a plastic bulb pipette, loosen the layer of faecal debris from the side of the tube and rapidly invert the tube to discard the ether, faecal debris, and formal water. The sediment will remain.
8. Return the tube to its upright position and allow the fluid from the side of the tube to drain to the bottom of the tube.
9. Using a plastic pipette or Pasteur pipette, mix the sediment. Transfer all sediments to a slide, and cover with a cover glass.
10. Examine microscopically the entire preparation using the 10x objective with a condenser iris closed sufficiently to give good contrast. Use the 40x objective to identify the small cysts and eggs.
11. Count the number of each type of parasite in the entire preparation. This will give the approximate number of each parasite per gram of faeces.

**Disadvantage**

The basic disadvantage of sedimentation technique is that examination of the sediment is often difficult due to the presence of the excessive faecal debris that may mask the presence of the parasites.

Trophozoite forms are not detected in this method.

**Biosafety**

Follow general laboratory principles for biosafety such as washing of hands, wearing of gloves, disinfecting work place and practising good personal hygiene measures.

- Handle the chemicals with care. Special precautions should be taken to store explosive chemicals and flammable solvents such ether, xylene etc.
- Equipment and glassware should be handled carefully to minimize risk of injury and aerosol production.
- Dispose off infectious material appropriately.

**Disposal of morbid material**

- After examination the stool specimen should either be incinerated or soaked in disinfectant solution and then buried in disposable specimen container.
- Used glass slides should be discarded in a pot containing 1% hypochlorite solution and cleaned if to be reused or buried if not to be used again.

Results
Report presence or absence of ova, larvae and cysts.

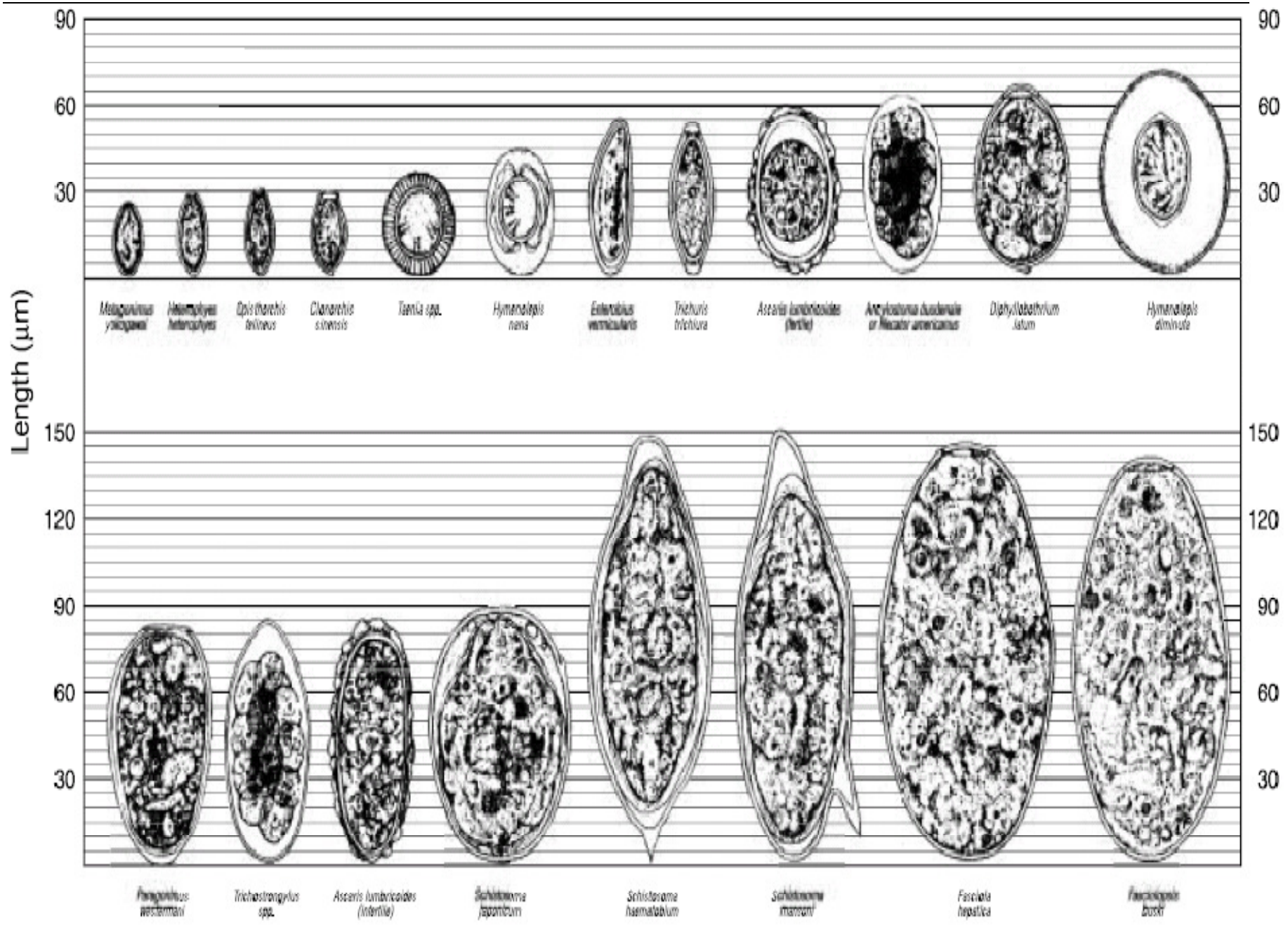
Reporting
***Macroscopic:***
Describe stool specimen: appearance, consistency (formed loose, watery etc.) and presence of worms, blood and mucus.

***Microscopic:***
1) Indicate the species of parasite, stage and grade
2) Absence of any parasite stages, report as "No ova, cysts or parasites seen"

Quality control

- Apply the coverslips gently and carefully to avoid air bubble formation.
- Ensure that the entire coverslip areas of unstained and stained preparations are examined for each patient.
- Check all positive results with parasite chart. The second technologist should confirm identity of positive findings.

References
Cheesbrough M. District Laboratory Practice in Tropical Countries. Part 1. (Pages 191 - 235). Tropical Health Technology, 1998. ISBN 09507434
WHO
CDC


Length (µm)
90
60
30
150
120
90
60
30
Metagonimus yokogawai
Heterophyes heterophyes
Opisthorchis felineus
Clonorchis sinensis
Taenia spp.
Hymenolepis nana
Enterobius vermicularis
Trichuris trichiura
Ascaris lumbricoides (fertile)
Ancylostoma duodenale or Necator americanus
Diphyllobothrium latum
Hymenolepis diminuta
Paragonimus westermani
Trichostrongylus spp.
Ascaris lumbricoides (infertile)
Schistosoma japonicum
Schistosoma haematobium
Schistosoma mansoni
Fasciola hepatica
Fasciolopsis buski

**Appendix 13 Urine Collection and Microscopy**

# Urine collection

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Revision Date: March, 2009
Staff able to receive sample: Laboratory Technician /Technologist

## Purpose

This SOP is to guide the subject on how to properly collect urine for parasitological and biochemical examination.

## Principle

Under normal circumstances urine is sterile. The lower part of the urethra and the genitalia are normally colonised by bacteria, many of which may also cause urinary tract infection. Since urine is a good growth medium for all sorts of bacteria, proper and aseptic collection assumes greater importance for this specimen.

## Specimen

For parasitological and biochemical examination urine must be collected between 10 am and 2 pm.

## Procedure

1.Give the subject a sterile container labelled with the subject's ID number to use for urine collection
2.Tell the subject to collect urine into the container
3.Tightly close the container.
4.Submit this to the field laboratory for analysis as soon as possible (within an hour)
5.Aliquot the urine into two duplicate cryovials immediately after reception (further analysis – urinary iodine)
6.Immediately place the duplicate samples in a cool box
7.Centrifuge 10mL of the remaining sample (field parasitological examination)

## References

1. Cheesbrough M. District Laboratory Practice in Tropical Countries. Part 2. (Pages 299 - 303). Cambridge University Press, 2000. ISBN 0421665450
2. Manual of Basic Techniques for a Healthy Laboratory. Second edition. WHO Geneva. 2003

**Microscopy Urine deposit (method for the examination of urine for Schistosoma haematobium eggs)**

Revision Date: March, 2009
Staff able to perform test: Laboratory Technologist/ Technician

**Purpose**
To detect parasites (*Schistosoma haematobium*), cells and other formed elements in urine.

**Specimen**
Urine, collected in a clean, oil-free, disinfectant-free bottle between 10:00am and 2:00pm.

***Requirements***
Microscope
Centrifuge
Centrifuge tubes 10ml
Disposable specimen containers (Monocontainers)
Glass microscope slides
Cover slips (22-x 22 mm)
Waterproof magic marker or grease pencil
Gloves
Disinfectant

**Test Procedure**
1.Observe the colour of the urine specimen and record in the data capture form.
2.Label a 10 ml centrifuge tube and two microvials with subject's registration number using the labels or magic marker.
3.Mix urine, aliquot 2ml of urine into each of the two microvials and pour 10ml of the remaining urine into the centrifuge tube
4.Place the two filled microvials of urine into the cooler box with frozen ice packs
5.Spin the 10ml of urine at 1000 r.p.m. for 5 minutes (indicate the volume spun).
6.Decant the supernatant into a bucket containing double strength disinfectant
7.Re-suspend the deposit in the residual fluid.
8.Label a glass slide with subject's registration number and place all the urine deposit onto it.
9.Apply a coverslip gently on it.
10.Place it under the microscope, lower the condenser to obtain a low light intensity.
11.Examine the preparation using the 10x objective and then 40 x objective for details.

12.Observe for pus cells (WBC), red cells (RBC), epithelial cells, casts (granular, blood and leukocyte), crystals, ova of *Schistosoma haematobium*, trophozoites of *Trichomonas vaginalis*, or yeasts.
13.Count the total number of *Schistosoma haematobium* ova per volume spun.

**Results and reporting**

- Report the appearance, turbidity and colour of the urine
- Report the number of WBC, RBC and epithelial cells per high power field (HPF).
- Report the presence of *Schistosoma haematobium*, *Trichomonas vaginalis*, yeasts, casts and crystals as "seen" or" not seen"
- Report the presence of any parasite that may be found in the urine e.g. microfilaria that can be found in urine (Onchocerca vulvulus Wuchereria bancrofti, Loa loa).

**Quality control**

Apply the coverslips gently on the deposits to avoid the formation of air bubbles.
The urine specimen should always be fresh, and should be examined within 4 hours of collection.

**Safety precautions**

- After centrifuging the specimen, ensure that urine is decanted into a container of disinfectant. Do not tip urine down the sink.
- Soak used test tubes, slides and coverslips overnight in a container of disinfectant, prior to disposal.
- Always use capped buckets in the centrifuge to contain any spillage or aerosol. If a tube breaks, stop the centrifuge and leave for one hour before opening in order to allow aerosols to settle. Take out the capped centrifuge bucket and soak in disinfectant, prior to disposal of the contents and cleaning of the bucket. Never use hypochlorite disinfectant for centrifuge parts because it damages the metal and causes rusting.
- Clean bench spillages immediately with disinfectant

**References**

1. Cheesbrough M. District Laboratory Practice in Tropical Countries. Part 2. (Pages 107 - 111). Cambridge University Press, 2000. ISBN 0421665450
2. Cheesbrough M. District Laboratory Practice in Tropical Countries. Part 1. (Pages 236 - 239). Tropical Health Technology, 1998. ISBN 09507434

## Appendix 14 Urinary Iodine Analyses

Urinary iodine analyses were conducted by the Government Analyst Laboratory in Zimbabwe, established 1946. The laboratory established the iodine laboratory in 1992 with the help of UNICEF Zimbabwe, and since then it has been functional on daily basis. The laboratory analyses national samples, private samples and regional samples.

### Quality

The Program Against Micronutrient Malnutrition Laboratory (PAMM) has coordinated an international urinary iodine quality control program since 1992 to provide laboratories with an independent and unbiased assessment of their performance. Government Analyst Laboratory continues to participate in CDC's Ensuring the Quality of Urinary Iodine Procedures (EQUIP) program. The primary goal is to improve the precision and accuracy of urinary iodine measurements in the laboratory.

In current urinary iodine analysis, the laboratory runs three QC samples done concurrently with every batch of samples analyzed. The QC samples are QC A 2.6 ug/l, QC B 4.1 ug/l and QC C 33.4 ug/l. Previously analyzed CDC samples are also run with every batch analyzed. Results of analysis for the QC samples are plotted on a chart that is maintained. Urine collection cups, cryovials and transfer pipettes were prescreened for iodine to ensure no cross contamination.

Any further information on samples analysis is obtainable from Mr. F. Chinyavanhu at Government Analyst Laboratory.

Mr. F. Chinyavanhu.
Telephone: +263 4 792026/7
Cell +263 912 426 084 or +263 11 875 435
e-mail: fchinyavanhu@healthnet.org.zw or
fchinyavanhu@hotmail.com

## Appendix 15 Socioeconomic Status Index

A socioeconomic status index was created in order to categorize households. Table SES1 shows the items and scores used in the index. The range of index values was from 0 to 14. Low SES was designed as 0-2, moderate SES as 3-5 and high SES as 6-12.

**Table SES1. Socioeconomic (SES) index categories and scores, National Micronutrient Survey, Malawi 2009**

| Category | Response | Score |
|---|---|---|
| Type of fuel | Firewood | 0 |
| | Cow dung | 0 |
| | Paraffin | 1 |
| | Charcoal | 0 |
| | Electricity | 1 |
| | Gas/Propane | 1 |
| | Other | 0 |
| | Don't Know | 0 |
| Water supply | Piped water in dwelling | 1 |
| | Public tap | 0 |
| | Borehole | 1 |
| | Well/spring (protected) | 1 |
| | Well/spring (unprotected) | 0 |
| | Lake/river/small pond | 0 |
| | Other | 0 |
| Toilet facility | Flush toilet | 1 |
| | Pit latrine | 0 |
| | Ventilated improved pit (VIP) latrine/Sanplat | 1 |
| | Bush/river/lake | 0 |
| | Other | 0 |
| Roof | Reeds/grass | 0 |
| | Tin/metal | 1 |
| | Tile | 1 |
| | Wood planks | 0 |
| | Other | 0 |
| Floor | Earth smeared | 0 |
| | Earth natural, not smeared | 0 |
| | Bricks | 0 |
| | Cement | 1 |
| | Wood | 1 |
| | Ceramic tiles | 1 |
| | Carpet | 1 |
| | Other | 0 |
| Number of rooms* | Two rooms or less | 0 |
| | Three rooms or more | 1 |
| Radio | In household | 1 |
| | Not in household | 0 |
| Television | In household | 1 |
| | Not in household | 0 |
| Bicycle | In household | 1 |
| | Not in household | 0 |
| Motorcycle | In household | 1 |
| | Not in household | 0 |
| Car/truck | In household | 1 |
| | Not in household | 0 |
| Mobile phone | In household | 1 |
| | Not in household | 0 |
| Canoe/boat | In household | 1 |

| | | |
|---|---|---|
| | Not in household | 0 |
| Oxcart | In household | 1 |
| | Not in household | 0 |

**Mean number of rooms was 2.8, therefore the cut-point of 3 was chosen*

## Appendix 16 Sampling Weights

Sampling weights were calculated using the 2008 Census data to determine the total number of target population in each region and then dividing that by the number of target group individuals sampled in each region:

*Sampling weight=(Total target group population in region)/ Number of target group individuals sampled in each region)*

**Northern Region**

| Target Group | Total N for target group in region | Number of target group assessed in region | Sampling Weight |
|---|---|---|---|
| Child 6-59 mo | 272145 | 385 | 706.87 |
| Child 6-12 yr | 340769 | 260 | 1310.65 |
| Women 15-49 | 396243 | 282 | 1405.12 |
| Men 20-55 | 298315 | 76 | 3925.20 |
| Households | 345752 | 562 | 615.22 |

**Central Region**

| Target Group | Total N for target group in region | Number of target group assessed in region | Sampling Weight |
|---|---|---|---|
| Child 6-59 mo | 893674 | 368 | 2428.46 |
| Child 6-12 yr | 1077797 | 280 | 3849.28 |
| Women 15-49 | 1263381 | 274 | 4610.88 |
| Men 20-55 | 1028601 | 72 | 14286.13 |
| Households | 1222365 | 554 | 2206.44 |

**Southern Region**

| Target Group | Total N for target group in region | Number of target group assessed in region | Sampling Weight |
|---|---|---|---|
| Child 6-59 mo | 952500 | 372 | 2560.48 |
| Child 6-12 yr | 1147837 | 263 | 4364.40 |
| Women 15-49 | 1358032 | 248 | 5475.94 |
| Men 20-55 | 1035807 | 47 | 22038.45 |
| Households | 1389566 | 559 | 2485.81 |

## Appendix 17 Study Design Effects

| Age Group | Characteristics | N | DEFF | Avg cluster size |
|---|---|---|---|---|
| Under five children (6-59 months) | Weight-for-age | 987 | 1.5 | 8.2 |
| | Height-for-age | 980 | 2.1 | 8.2 |
| | Weight-for-height | 979 | 1.6 | 8.2 |
| | Malaria parasitemia | 916 | 2.6 | 8.3 |
| | Hemoglobin | 1003 | 2.5 | 8.4 |
| | Ferritin | 980 | 1.6 | 8.2 |
| | Transferrin receptor | 980 | 2.1 | 8.2 |
| School aged children | Body mass index | 682 | 1.6 | 5.8 |
| | Malaria parasitemia | 604 | 1.6 | 5.6 |
| | Hookworm infection | 528 | 1.6 | 4.9 |
| | *Schistosoma mansoni* infection | 528 | 3.5 | 4.9 |
| | *Schistosoma hematobium* infection | 576 | 3.6 | 5.3 |
| | Urinary iodine | 637 | 2.1 | 5.5 |
| | Hemoglobin | 671 | 1.9 | 5.7 |
| | Ferritin | 636 | 1.7 | 5.7 |
| | Transferrin receptor | 636 | 2.5 | 5.7 |
| Women (15-49years) | Body mass index | 596 | 1.3 | 5.0 |
| | Malaria parasitemia | 572 | 1.2 | 5.1 |
| | Urinary iodine | 590 | 2.2 | 5.0 |
| | Hemoglobin | 662 | 1.7 | 5.5 |
| | Ferritin | 624 | 1.4 | 5.2 |
| | Transferrin receptor | 624 | 1.6 | 5.2 |
| Household characteristics | Ownership of radio | 1673 | 2.0 | 14.0 |
| | Ownership of television | 1662 | 5.5 | 13.9 |

| | | | | |
|---|---|---|---|---|
| | Ownership of bicycle | 1670 | 1.8 | 13.9 |
| | Ownership of motorcycle | 1664 | 1.5 | 13.9 |
| | Ownership of ox-cart | 1666 | 1.2 | 13.9 |
| | Ownership of car or truck | 1672 | 5.1 | 13.9 |
| | Ownership of mobile phone | 1671 | 4.6 | 13.9 |
| | Ownership of canoe | 1649 | 2.1 | 13.7 |
| | Bednet ownership | 1652 | 2.2 | 13.8 |
| | Bednet knowledge | 1672 | 2.0 | 13.9 |
| | Salt rapid test | 1369 | 2.1 | 11.4 |
| | Salt titration tests | 745 | 1.2 | 6.3 |

**Appendix 18 Prevalence of iron deficiency as measured by serum ferritin[§] in under five children (6-59 months)**

| Characteristics of under five children | All under five children | | Excluding those with elevated CRP and/or AGP† | |
|---|---|---|---|---|
| | N | Percent iron deficient | N | Percent iron deficient |
| **Age (months)** | | | | |
| 6-11 | 122 | 12.1 (6.6-21.3) | 51 | 20.7 (10.9-35.6) |
| 12-23 | 226 | 5.3 (3.1-9.1) | 106 | 7.8 (3.9-15.0) |
| 24-35 | 234 | 5.1 (2.8-9.1) | 110 | 8.6 (4.2-16.6) |
| 36-47 | 225 | 89 (5.3-14.7) | 102 | 13.4 (7.2-23.7) |
| 48-59 | 173 | 4.7 (2.3-9.4) | 86 | 6.3 (2.4-15.3) |
| **Sex** | | | | |
| Male | 464 | 5.9 (3.6-9.3) | 206 | 9.3 (5.6-15.0) |
| Female | 505 | 7.9 (5.5-11.0) | 246 | 11.2 (7.3-16.9) |
| **SES** | | | | |
| Low | 391 | 3.5 (2.1-6.0)* | 155 | 6.3 (3.2-12.0) |
| Moderate | 345 | 6.7 (4.4-10.0) | 164 | 9.4 (5.7-15.6) |
| High | 244 | 12.6 (7.8-19.8) | 136 | 16.1 (9.1-26.9) |
| **Residence** | | | | |
| Urban | 121 | 19.8 (12.8-29.3)* | 68 | 25.1 (14.8-39.2)* |
| Rural | 859 | 5.2 (3.8-7.1) | 387 | 7.9 (5.4-11.5) |
| **Region** | | | | |
| Northern | 321 | 7.5 (4.9-11.3) | 191 | 10.5 (6.6-16.1) |
| Central | 327 | 5.5 (3.6-8.4) | 127 | 10.2 (5.8-17.3) |
| Southern | 332 | 7.8 (4.9-11.3) | 137 | 10.2 (5.5-18.2) |
| **National** | **980** | **6.8 (5.1-9.1)** | **455** | **10.3 (7.2-14.4)** |

*Data are weighted to account for survey design*

*§ iron deficiency is Ferritin<12 μg/L*

*† excluding all children with CRP≥5 mg/L or AGP≥1.0 g/L*

** p<0.05 test signifies variable differs across groups.*

**Appendix 19 Prevalence of iron deficiency as measured by serum ferritin[§] in school-aged children (6-12 years)**

| Characteristics of school-aged children | All school-aged children | | Excluding those with elevated CRP and/or AGP† | |
|---|---|---|---|---|
| | N | Percent iron deficient | N | Percent iron deficient |
| **Age group (years)** | | | | |
| 6-7 | 205 | 5.2 (2.3-11.4) | 148 | 6.2 (2.8-13.2) |
| 8-9 | 186 | 2.5 (0.7-8.0) | 133 | 3.7 (1.1-11.6) |
| 10-11 | 166 | 1.0 (0.2-4.7) | 124 | 1.4 (0.3-6.4) |
| 12 | 79 | 1.8 (0.2-11.8) | 57 | 2.5 (0.3-16.3) |
| **Education (years)** | | | | |
| 1 | 53 | 0 | 32 | 0 |
| 2 | 210 | 3.7 (1.3-9.5) | 147 | 4.6 (1.9-10.8) |
| 3 | 135 | 2.2 (0.6-7.7) | 91 | 2.9 (0.7-11.5) |
| 4 | 132 | 3.5 (1.3-9.0) | 107 | 4.4 (1.6-11.3) |
| 5 | 61 | 0 | 49 | 0 |
| 6-8 | 19 | 6.9 (0.9-36.8) | 15 | 9.4 (1.3-44.9) |
| **Sex** | 22 | 0 | 17 | 0 |
| Male | | | | |
| Female | 308 | 4.4 (2.4-7.9)* | 225 | 6.1 (3.3-10.8)* |
| **SES** | 318 | 1.2 (0.3-4.6) | 230 | 1.2 (0.4-3.6) |
| Low | | | | |
| Moderate | 274 | 2.2 (1.0-5.2) | 197 | 3.3 (1.4-7.4) |
| High | 198 | 4.0 (1.7-9.3) | 143 | 4.4 (1.9-10.6) |
| **Residence** | 162 | 2.5 (0.9-7.0) | 121 | 3.5 (1.3-9.5) |
| Urban | | | | |
| Rural | 53 | 5.6 (1.5-19.0) | 41 | 7.4 (1.9-24.8) |
| **Region** | 583 | 2.7 (1.4-5.1) | 421 | 3.4 (1.8-6.4) |
| Northern | | | | |
| Central | 214 | 3.3 (1.4-7.5) | 175 | 3.4 (1.3-8.9) |
| Southern | 235 | 3.4 (1.3-8.4) | 153 | 4.6 (1.9-10.7) |
| **National** | **187** | **2.1 (0.8-5.8)** | **134** | **3.0 (1.1-7.9)** |

*Data are weighted to account for survey design*

*§ iron deficiency is Ferritin<15 µg/L*

*† excluding all children with CRP≥5 mg/L or AGP≥1.0 g/L*

** p<0.05 test signifies variable differs across groups.*

## Appendix 20 Prevalence of iron deficiency as measured by serum ferritin§ in non-pregnant women (15-49 years)

| | All non-pregnant women | | Excluding those with elevated CRP and/or AGP† | |
|---|---|---|---|---|
| **Characteristics of women** | **N** | **Percent iron deficient** | **N** | **Percent iron deficient** |
| **Age group (years)** | | | | |
| 15-19 | 84 | 10.9 (5.5-20.4) | 72 | 10.7 (4.9-21.7) |
| 20-29 | 209 | 11.7 (7.1-18.7) | 167 | 13.1 (8.0-20.7) |
| 30-39 | 139 | 5.8 (2.8-11.6) | 109 | 5.9 (2.6-12.8) |
| 40-49 | 77 | 10.7 (5.2-20.6) | 67 | 12.3 (5.8-24.2) |
| **Education** | | | | |
| None | 65 | 17.2 (9.6-28.9) | 53 | 18.6 (9.6-33.0) |
| 1-5 | 163 | 7.0 (3.6-13.1) | 127 | 6.3 (2.7-13.8) |
| 6-8 | 170 | 7.5 (4.3-12.8) | 137 | 9.1 (5.2-15.6) |
| >8 | 97 | 12.2 (6.7-21.3) | 86 | 13.7 (7.3-24.0) |
| **SES** | | | | |
| Low | 197 | 6.4 (3.5-11.2)* | 165 | 7.4 (4.0-13.4) |
| Moderate | 153 | 9.2 (5.2-15.8) | 130 | 9.0 (4.8-16.2) |
| High | 159 | 15.0 (9.3-23.1) | 136 | 15.7 (9.9-23.9) |
| **Residence** | | | | |
| Urban | 87 | 14.5 (7.8-25.3) | 74 | 17.3 (8.9-30.9) |
| Rural | 422 | 9.1 (6.1-13.1) | 357 | 9.2 (6.2-13.4) |
| **Region** | | | | |
| Northern | 165 | 12.1 (7.9-18.2) | 145 | 13.1 (8.3-20.1) |
| Central | 177 | 6.8 (3.8-11.8) | 154 | 7.1 (3.9-12.8) |
| Southern | 167 | 12.0 (7.3-19.1) | 132 | 12.9 (7.7-20.8) |
| **National** | **509** | **9.8 (7.1-13.6)** | **431** | **10.4 (7.4-14.4)** |

*Data are weighted to account for survey design*

§ *iron deficiency is Ferritin<15 μg/L*

† *excluding all women with CRP≥5 mg/L or AGP≥1.0 g/L*

** p<0.05 test signifies variable differs across groups.*

**Appendix 21 Characteristics of under five children with evidence of inflammation (elevated C-reactive protein or a1-acid glycoprotein).**

| Characteristic | | Elevated CRP (≥5.0 mg/L) | | Elevated AGP (≥1.0 mg/L) | | Elevated CRP and/or AGP* | |
|---|---|---|---|---|---|---|---|
| | Total N | N | Row % | N | Row % | N | Row % |
| **Age group (months)** | | | | | | | |
| 6-11 mo | 122 | 50 | 43.8 | 58 | 55.5 | 71 | 63.8 |
| 12-23 | 226 | 93 | 45.3 | 100 | 48.9 | 120 | 58.3 |
| 24-35 | 234 | 92 | 41.0 | 110 | 49.5 | 124 | 55.7 |
| 36-47 | 225 | 84 | 41.7 | 110 | 52.9 | 123 | 59.1 |
| 48-59 | 173 | 70 | 42.0 | 75 | 45.9 | 87 | 52.9 |
| **SES** | | | | | | | |
| Low | 391 | 181 | 48.7 | 206 | 56.6 | 236 | 63.9 |
| Moderate | 345 | 132 | 41.4 | 158 | 49.3 | 181 | 55.6 |
| High | 244 | 76 | 33.9 | 89 | 40.6 | 108 | 49.3 |
| **Residence** | | | | | | | |
| Urban | 121 | 37 | 30.1 | 47 | 43.9 | 53 | 46.9 |
| Rural | 859 | 352 | 44.2 | 406 | 51.0 | 472 | 58.9 |
| **Region** | | | | | | | |
| Northern | 327 | 96 | 29.9 | 109 | 33.0 | 130 | 40.5 |
| Central | 321 | 154 | 47.1 | 176 | 53.8 | 200 | 61.2 |
| Southern | 332 | 139 | 41.9 | 171 | 51.5 | 195 | 58.7 |
| **National** | **980** | **389** | **42.6** | **453** | **50.3** | **525** | **57.6** |

** Those with elevated CRP and/or AGP were excluded from the analysis of the prevalence of iron deficiency.*

**Appendix 22 Characteristics of school-aged children with evidence of inflammation (elevated C-reactive protein or a1-acid glycoprotein).**

| Characteristic | | Elevated CRP (≥5.0 mg/L) | | Elevated AGP (≥1.0 mg/L) | | Elevated CRP and/or AGP* | |
|---|---|---|---|---|---|---|---|
| | Total N | N | Row % | N | Row % | N | Row % |
| **Age group (years)** | | | | | | | |
| 6-7 | 205 | 33 | 18.6 | 42 | 21.7 | 57 | 29.8 |
| 8-9 | 186 | 38 | 23.8 | 42 | 25.2 | 53 | 32.4 |
| 10-11 | 166 | 28 | 19.6 | 29 | 16.8 | 42 | 27.3 |
| 12 | 79 | 17 | 21.9 | 16 | 21. | 22 | 29.6 |
| **Education (years)** | | | | | | | |
| 1 | 53 | 14 | 29.7 | 15 | 29.9 | 21 | 43.3 |
| 2 | 210 | 40 | 20.9 | 47 | 24.1 | 63 | 32.1 |
| 3 | 135 | 28 | 24.0 | 32 | 229 | 44 | 33.7 |
| 4 | 132 | 19 | 16.3 | 21 | 16.8 | 25 | 21.2 |
| 5 | 61 | 8 | 15.8 | 8 | 12.2 | 12 | 21.7 |
| 6-8 | 19 | 2 | 13.7 | 3 | 19.0 | 4 | 25.9 |
| **SES** | 22 | 5 | 28.5 | 3 | 16.4 | 5 | 28.5 |
| Low | | | | | | | |
| Moderate | 278 | 52 | 21.5 | 57 | 22.9 | 77 | 31.2 |
| High | 200 | 28 | 16.1 | 46 | 23.9 | 55 | 29.3 |
| **Residence** | 166 | 36 | 25.9 | 25 | 14.8 | 41 | 27.9 |
| Urban | | | | | | | |
| Rural | 55 | 7 | 15.7 | 9 | 15.1 | 12 | 23.7 |
| **Region** | 591 | 109 | 21.2 | 120 | 21.9 | 162 | 30.4 |
| Northern | | | | | | | |
| Central | 218 | 20 | 9.4 | 34 | 15.9 | 39 | 18.2 |
| Southern | 214 | 57 | 24.3 | 61 | 26.0 | 82 | 34.9 |
| **National** | **187** | **39** | **20.9** | **34** | **18.2** | **53** | **28.3** |

** Those with elevated CRP and/or AGP were excluded from the analysis of the prevalence of iron deficiency. education (n=4); SES (n=2)*

**Appendix 23 Characteristics of non-pregnant women with evidence of inflammation (elevated C-reactive protein or a1-acid glycoprotein).**

| Characteristic | | Elevated CRP (≥5.0 mg/L) | | Elevated AGP (≥1.0 mg/L) | | Elevated CRP and/or AGP* | |
|---|---|---|---|---|---|---|---|
| | Total N | N | Row % | N | Row % | N | Row % |
| **Age group (years)** | | | | | | | |
| 15-19 | 84 | 8 | 10.1 | 8 | 9.8 | 12 | 14.9 |
| 20-29 | 209 | 33 | 16.2 | 18 | 9.8 | 42 | 21.2 |
| 30-39 | 139 | 25 | 19.6 | 17 | 13.6 | 30 | 23.7 |
| 40-49 | 77 | 8 | 11.3 | 4 | 4.3 | 10 | 13.5 |
| **Education (years)** | | | | | | | |
| None | 65 | 10 | 16.1 | 6 | 10.7 | 12 | 19.8 |
| 1-5 | 163 | 29 | 19.8 | 20 | 12.6 | 36 | 24.5 |
| 6-8 | 170 | 24 | 14.4 | 20 | 12.9 | 34 | 20.8 |
| >8 | 97 | 10 | 9.4 | 1 | 1.2 | 11 | 10.6 |
| **SES** | | | | | | | |
| Low | 197 | 28 | 16.2 | 22 | 13.4 | 38 | 22.2 |
| Moderate | 153 | 25 | 14.6 | 13 | 7.5 | 28 | 16.7 |
| High | 159 | 21 | 14.8 | 12 | 8.0 | 28 | 19.2 |
| **Residence** | | | | | | | |
| Urban | 87 | 14 | 17.9 | 5 | 6.3 | 15 | 19.8 |
| Rural | 422 | 60 | 14.9 | 42 | 10.6 | 79 | 19.6 |
| **Region** | | | | | | | |
| Northern | 165 | 20 | 12.1 | 12 | 7.3 | 25 | 15.2 |
| Central | 177 | 27 | 15.3 | 15 | 8.5 | 32 | 18.1 |
| Southern | 167 | 27 | 16.2 | 20 | 12.0 | 37 | 22.2 |
| **National** | **509** | **74** | **15.3** | **47** | **9.3** | **94** | **18.5** |

** Those with elevated CRP and/or AGP were excluded from the analysis of the prevalence of iron deficiency. Missing education (n=19)*

**Appendix 24 Characteristics of men with evidence of inflammation (elevated C-reactive protein or a1-acid glycoprotein).**

| Characteristic | | Elevated CRP (≥5.0 mg/L) | | Elevated AGP (≥1.0 mg/L) | | Elevated CRP and/or AGP* | |
|---|---|---|---|---|---|---|---|
| | Total N | N | Row % | N | Row % | N | Row % |
| **Age group (years)** | | | | | | | |
| 20-29 | 49 | 8 | 13.7 | 6 | 14.0 | 9 | 15.8 |
| 30-39 | 46 | 7 | 17.4 | 7 | 14.1 | 10 | 21.4 |
| 40-49 | 32 | 8 | 26.2 | 5 | 17.3 | 9 | 30.4 |
| 50-55 | 7 | 4 | 53.0 | 3 | 39.8 | 4 | 53.0 |
| **Education (years)** | | | | | | | |
| 1-5 | 32 | 4 | 11.6 | 4 | 14.1 | 6 | 18.6 |
| 6-8 | 57 | 14 | 25.1 | 10 | 18.6 | 15 | 25.6 |
| >8 | 36 | 7 | 18.9 | 5 | 12.9 | 9 | 22.7 |
| **SES** | | | | | | | |
| Low | 47 | 10 | 25.4 | 11 | 26.5 | 14 | 31.7 |
| Moderate | 45 | 8 | 14.3 | 4 | 8.1 | 8 | 14.3 |
| High | 42 | 9 | 20.4 | 6 | 14.4 | 10 | 23.2 |
| **Residence** | | | | | | | |
| Urban | 18 | 5 | 36.9 | 4 | 24.6 | 5 | 36.9 |
| Rural | 116 | 22 | 17.9 | 17 | 15.4 | 27 | 21.4 |
| **Region** | | | | | | | |
| Northern | 48 | 9 | 18.8 | 5 | 10.4 | 11 | 22.9 |
| Central | 55 | 13 | 23.6 | 13 | 23.6 | 16 | 29.1 |
| Southern | 31 | 5 | 16.1 | 3 | 9.7 | 5 | 16.1 |
| **National** | **134** | **25** | **20.0** | **21** | **16.4** | **32** | **23.1** |

** Those with elevated CRP and/or AGP were excluded from the analysis of the prevalence of iron deficiency. Missing education (n=9)*

**Appendix 25 Prevalence of iron deficiency anaemia (IDA) using ferritin among under five children**

| Characteristics of under five children | N | Percent IDA§ (CI) | N | Percent with IDA§ (CI) excluding those with inflammation † |
|---|---|---|---|---|
| **Age group (months)** | | | | |
| 6-11 | 113 | 9.9 (5.3-17.7)* | 47 | 17.2 (8.3-32.2) |
| 12-23 | 206 | 3.4 (1.6-7.1) | 99 | 6.0 (2.6-13.5) |
| 24-35 | 210 | 2.6 (1.1-6.4) | 96 | 4.6 (1.6-12.6) |
| 36-47 | 215 | 4.8 (2.3-9.8) | 96 | 7.4(3.4-15.2) |
| 48-59 | 161 | 1.3 (0.3-4.9) | 83 | 2.7 (0.7-10.0) |
| **Sex** | | | | |
| Male | 426 | 3.6 (2.1-6.1) | 186 | 6.7 (3.8-11.5) |
| Female | 469 | 4.4 (2.6-7.3) | 232 | 6.4 (3.7-10.8) |
| **SES** | | | | |
| Low | 360 | 2.7 (1.4-5.2) | 147 | 6.2 (3.1-12.2) |
| Moderate | 322 | 4.8 (2.8-8.2) | 153 | 6.9 (3.6-12.6) |
| High | 223 | 4.9 (2.2-10.7) | 121 | 6.2 (3.0-12.4) |
| **Residence** | | | | |
| Urban | 106 | 5.9 (2.6-12.9) | 58 | 6.1 (2.3-15.0) |
| Rural | 799 | 3.7 (2.5-5.7) | 363 | 6.5 (4.3-9.9) |
| **Region** | | | | |
| Northern | 289 | 4.5 (2.7-7.3) | 171 | 7.0 (4.2-11.6) |
| Central | 305 | 3.6 (2.0-6.3) | 121 | 8.3 (4.5-14.8) |
| Southern | 311 | 4.2 (2.2-7.7) | 129 | 4.7 (2.3-9.2) |
| **National** | **905** | **4.0 (2.7-5.8)** | **421** | **6.5 (4.4-9.4)** |

*Data are weighted to account for survey design, * p<0.05 test signifies variable differs across groups.*
*§ iron deficiency anaemia defined as Ferritin<15 mg/L and haemoglobin<11.0 g/dL, †excluding those with CRP≥5 mg/L or AGP≥1.0 g/L. missing values: Ferritin unadjusted sex (10)]*

**Appendix 26 Prevalence of iron deficiency anaemia (IDA) using ferritin among school-aged children (6-12 years)**

| Characteristics of school-aged children | N | Percent IDA§ (CI) | N | Percent with IDA§ (CI) excluding those with inflammation † |
|---|---|---|---|---|
| **Age group (years)** | | | | |
| 6-7 | 197 | 2.4 (0.7-7.6) | 142 | 2.5 (0.8-7.5) |
| 8-9 | 179 | 2.1 (0.5-8.5) | 127 | 3.2 (0.8-12.4) |
| 10-11 | 160 | 0.3 (0.0-1.9) | 120 | 0.4 (0.0-2.5) |
| 12 | 77 | 1.8 (0.2-12.1) | 56 | 2.5 (0.3-16.4) |
| **Education (years)** | | | | |
| 1 | 50 | 0 | 30 | 0 |
| 2 | 200 | 1.5 (0.3-6.6) | 140 | 1.4 (0.4-5.0) |
| 3 | 130 | 0.9 (1.2-6.6) | 86 | 1.4 (0.2-9.8) |
| 4 | 129 | 2.5 (0.7-8.4) | 105 | 3.1 (0.9-10.4) |
| 5 | 61 | 0 | 49 | 0 |
| 6-8 | 19 | 6.9 (0.9-36.8) | 15 | 9.2 (1.3-44.9) |
| **Sex** | 20 | 0 | 16 | 0 |
| Male | | | | |
| Female | 306 | 2.8 (1.2-6.2)* | 221 | 4.0 (1.7-8.8)* |
| SES | 297 | 0.4 (0.0-2.9) | 217 | 0 |
| Low | | | | |
| Moderate | 262 | 1.4 (0.5-4.3)* | 188 | 2.1 (0.7-6.2) |
| High | 197 | 3.0 (1.2-7.2) | 142 | 3.4 (1.3-9.0) |
| **Residence** | 152 | 0.3 (0.0-2.1) | 114 | 0.4 (0.0-2.8) |
| Urban | | | | |
| Rural | 52 | 3.0 (0.4-19.9) | 40 | 4.0 (0.5-25.0) |
| **Region** | 561 | 1.6 (0.7-3.7) | 405 | 1.9 (0.8-4.6) |
| Northern | | | | |
| Central | 203 | 1.5 (0.5-4.2) | 166 | 1.8 (0.6-5.1) |
| Southern | 228 | 1.8 (0.5-6.6) | 148 | 2.0 (0.5-8.3) |
| **National** | **182** | **1.7 (0.5-5.2)** | **131** | **2.3 (0.7-7.1)** |

*Data are weighted to account for survey design, * p<0.05 test signifies variable differs across groups.*
*§iron deficiency anaemia defined as Ferritin<15mg/L and haemoglobin<11.5g/dL, †excluding those with CRP≥5 mg/L or AGP≥1.0 g/L. missing values: Ferritin unadjusted [education (3), SES (2)*

**Appendix 27 Prevalence of iron deficiency anaemia (IDA) using ferritin among non-pregnant women of childbearing age (15-49 years)**

| Characteristics of childbearing women | N | Percent IDA§ (CI) | N | Percent with IDA§ (CI) excluding those with inflammation † |
|---|---|---|---|---|
| **Age group (years)** | | | | |
| 15-19 | 90 | 3.6(1.1-11.0) | 65 | 2.4 (0.5-11.1) |
| 20-29 | 234 | 5.0 (2.4-9.9) | 153 | 5.4 (2.6-11.1) |
| 30-39 | 142 | 2.3 (0.9-6.2) | 98 | 2.7 (0.8-8.8) |
| 40-49 | 83 | 3.6 (1.0-12.0) | 63 | 2.5 (0.5-11.3) |
| **Standard/Grade** | | | | |
| None | 70 | 5.7 (2.1-14.6) | 52 | 4.9 (1.4-15.9) |
| 1-5 | 176 | 2.8 (0.8-8.6) | 116 | 1.9 (0.3-12.7) |
| 6-8 | 182 | 2.8 (1.2-6.8) | 125 | 2.7 (0.9-7.8) |
| >8 | 105 | 5.0 (2.2-11.2) | 75 | 5.7 (2.2-14.0) |
| **SES** | | | | |
| Low | 210 | 3.4 (1.4-7.7) | 150 | 4.5 (1.8-10.8) |
| Moderate | 175 | 3.5 (1.4-8.3) | 114 | 2.3 (0.6-9.0) |
| High | 164 | 4.9 (2.1-11.4) | 115 | 4.1 (1.6-9.9) |
| **Residence** | | | | |
| Urban | 823 | 5.8 (2.5-12.6) | 60 | 6.8 (2.5-17.3) |
| Rural | 467 | 3.6 (2.0-6.3) | 334 | 3.3 (1.7-6.4) |
| **Region** | | | | |
| Northern | 185 | 6.0 (3.4-10.3) | 125 | 5.6 (2.7-11.1) |
| Central | 182 | 3.9 (1.7-8.3) | 130 | 4.6 (1.9-10.8) |
| Southern | 182 | 3.3 (1.4-7.8) | 124 | 2.4 (0.8-6.9) |
| **National** | **549** | **3.9 (2.4-6.2)** | **379** | **3.7 (2.1-6.5)** |

*Data are weighted to account for survey design, * p<0.05 test signifies variable differs across groups.*
*§iron deficiency anaemia defined as Ferritin<15mg/L and haemoglobin<12.0g/dL. †excluding those with CRP≥5 mg/L or AGP≥1.0 g/L, missing values: education (12)*

## Appendix 28 Prevalence of iron deficiency anaemia (IDA) using ferritin among men (20-55 years)

The prevalence of iron deficiency anemia using Ferritin was 0.4% (95%CI 0.2-6.2). Due to small number of men who had low ferritin levels, the associations between levels of ferritin and demographic characteristics were not assessed.