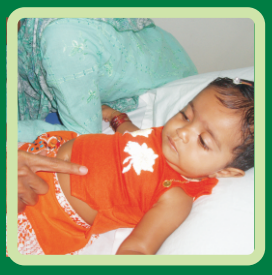
Project Report
National Micronutrient Survey 2007
Republic of Maldives

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Executive Summary

The National Micronutrient Survey 2007-2008 (NMS) provides a recent standard for assessing the status of nutrition in women and children in the Republic of Maldives. The survey provides previously unavailable information on the bio-chemical levels of various elements constituting nutrition. It is presented as a landmark for assessing the nutrition situation in Maldives. The objectives were to review the current nutrition situation, establish the trends, look for associate factors that influence the nutritional status and identify issues relating to policy and those of programmatic importance. In order to provide for policy formulation both at national and regional level, the sample was designed such that data from the survey is representative for the whole country as well as for each of the six geographic regions.

Thirty by fourteen cluster technique was used with two-stage cluster sampling by proportionate to the population size (PPS). The sample was drawn from all parts of the country; all Islands, atolls and regions were included. The area comprises 2,520 households, and 180 clusters. Each region was divided into 30 clusters and 14 households were chosen systematically from each cluster. Important biochemical analysis were performed for seven subjects of each group i.e. women of reproductive age and children of six months to five years of age. Additionally, seven children of ages between 6 and 12 years were included for urinary iodine analysis, stool examination and other related information.

Questionnaires were developed and pre-tested prior to the field activity to collect information at household and subject level. There were 4 sections and 11 modules in the questionnaire mainly collecting household information for all groups, reproductive and antenatal care history, micronutrient and physical health status with related information about woman of reproductive age, and information on feeding behaviours and practices. Also included were micronutrient and physical health status with related information about children from 6 months to 12 years of age, and physical health and micronutrient status with related information about children from 6 to 12 years of age. Furthermore, Vitamin A health system coverage data from all targeted clusters and retailers information was also collected.

Collection and transportation of biochemical specimens were major challenges due to the geographic distribution of islands, aggravated by the absence of an efficient transport mechanism from islands to Malé, the capital city of Maldives. WHO Standards and guidelines[1] were used for the collection and transportation of specimens. Biochemical assessment including serum haemoglobin level and stool analysis was done at the field, whereas Ferritin, CRP, Vitamin A, Folic acid , Vitamin B 12, Zinc and Urinary Iodine were analyzed at the Nutritional Research Laboratory of Aga Khan University, Karachi, Pakistan.

After completion of field activity, all forms were scanned for backup (to avoid possible loss during transportation) and were dispatched to Aga Khan University, Karachi for data entry and analysis. The forms were entered twice using specially designed software; dual and consistency checks were performed before analysis. Clean data set was analyzed by senior members of statistical unit of Aga Khan University, Karachi.

[1] http://www.saftpak.com/catalog.asp

The national micronutrient survey targeted 2,520 households. Information was gathered from 2,370 (94.04%) households as 150 households were unreachable (temporarily locked, refused, etc). The target sample for biochemical assessment of all three groups was 1,260. About 1,304 and 1,262 blood samples were collected from women of reproductive age and children 6 months to five years of age respectively. About 1,283, 1,214 and 1,219 urine samples were collected from women of reproductive age, children 6 months to five years of age and children 6 to 12 years of age respectively. About 779 and 696 stool sample were collected and analyzed in children 6 months to five years of age and children 6 to 12 years of age. Malé region was excluded from stool analysis because of the shortage of Kato Katz Kits.

All the household survey respondents were females, and the majority (71%) of the respondents was married. Information collected from different regions of Maldives showed that in the Malé region, majority of people were living on the extreme ends of the socio-economic scale, the poorest, as well as the richest. This trend is more visible in male' but not observed in other regions (p-value <0.001). About three-fourths of the respondents were aware of the use of micronutrients (iron, iodine and Vitamin A). The survey assessed the respondents' perceptions about foods containing micronutrients. A total of 38.9% reported that vegetables and fruits contain iron; 47.4% and 24.2% respondents reported that iodine is present in iodized salt and liver/meat products/fish respectively whereas 48.3% reported that vegetables and fruits contain Vitamin A. Talking about the effects of micronutrient deficiencies, 24.1% of the respondents said that iron deficiency may cause anaemia while 9.9% respondents mentioned that iron deficiency may lead to lethargy/loss of appetite/breathlessness. Around 91.1% respondents (both women of reproductive age and mothers or caretakers of children) reported they have heard about iodized salt and 99.2% reported using iodized salt in preparing food.

The current health status assessment of women of reproductive age showed that headache was the most common complaint of any illness (34.5 %). Others were flu (24.7%), constipation (22.7 %), and abdominal pain (15.6 %). Only 5.9 % women were diagnosed to have worm infestation, whereas 77.9 % of women said that they had received de-worming medicine in the last one year. Of the women, 20.4 % were hospitalized due to aches/pain, 16.5 % because of fever/flu and 13.1 % for surgery/accidents. Additionally, 11.6% pregnancy-related causes were reported (delivery/miscarriage etc) for which the women sought care at hospital.

Married respondents of the survey reported that 45.6 % of the women became pregnant up to two times whereas 14.3 % of the women became pregnant for about five times; nearly 97 % of the women sought antenatal care during their last pregnancies. The majority of these women consulted antenatal care from a gynaecologist (89.4 %); about 45 % received ANC during the first month of pregnancy, 85.3 % of the women were counselled for eating more nutritious food, 83.4 % were counselled for exclusive breast feeding to the new-born up to 6 months, 77.6 % were advised extra rest during pregnancy and 55.1 % were informed about the hazards of smoking and drug misuse. Only 3.4% of married women had difficulty in seeing clearly at night during their latest pregnancies. About 71.3 % married women had either received or bought iron supplements during their latest pregnancies. About 33 % of the women had ANC health record. De-worming medicine was taken by 1.3 % women for intestinal worms during latest pregnancy.

Physical examinations were performed for targeted subjects – women and children. The prevalence of pallor was found in all regions for all three targeted groups, more remarkably in the North central region.

This is due probably to the high rates of anaemic population in the area or the difficulty in distinguishing pallor from other pale conditions like jaundice. Community health workers also examined goiter during the survey. Findings show that overall only 0.8% women were found with goitre and out of these, the highest proportion of women with grade II goitre lived in south central region (2.1%).

In light of the results of biochemical analysis, the prevalence of anemia was found to be lower among the women of reproductive age compared to the previous studies (51% reported in MICS II, 2001). In this survey, overall, 15.4% women of reproductive age were found to be anemic to some degree: 0.3% were severely anemic and 15.1% were moderately anemic. Among children 6 months to 5 years of age overall 26.3% of children were found to be anaemic (<10 g/dl). Regional differences in the prevalence of anaemia are substantial, ranging from 10.4 % in the South to 41.8 % in the North. Prevalence of anaemia is considerably higher among children 6 months to 5 years of age compared with the prevalence among women.

Overall, 38.4% women of reproductive age were found to be iron deficient. Regional differences in the prevalence of iron deficiency are substantial, ranging from 33 % in the South central to 44.2 % in the South. Among children 6 months to five years of age, 57.3% were found iron deficient. The lowest prevalence of iron deficiency among children were found in North central region (50.2%) and the highest in South central.

Overall, 26.8 % women of reproductive age have been found to be deficient in zinc. The lowest prevalence was reported in North Central region (13.4%) and the highest in North (54.6%). Among children six months to five years of age, 16% were found to be zinc deficient. Regional differences in the prevalence of zinc deficiency range from 2.9 % in the North central to 36.8% in the North. Women of reproductive age were observed to be more deficient in zinc.

Regarding vitamin A deficiency in reproductive age women, overall 4.7% woman of reproductive age were severely deficient in Vitamin A, while 39.3% were moderately deficient. The high prevalence (6%) of severe Vitamin A deficiency was recorded in North region and moderate Vitamin A deficiency in Malé region (45.5%). Among children 6 months to 5 years of age, 5.1% were found to be severely and 50.1% moderately deficient in Vitamin A. High prevalence (6.4%) of severe Vitamin A deficiency was found in North region and moderate in South Central (63.2%).

Regarding iodine deficiency only 1.4% women of reproductive age were found with severe iodine deficiency, 8% were with moderate and 17.4% with mild iodine deficiency. Majority of severe and moderately deficient women belonged to Malé region. Among children 6 months to 5 years of age, only 0.7% children were found to be severely deficient, 5.2% were moderately deficient and 12.9% mildly deficient. Majority of severe and moderately deficient children belonged to the South central region.

1. Introduction and Background

1.1: Background – Highlights on the global situation of micronutrients

Human body needs small amounts of essential micronutrients especially vitamins (Vitamin A and folic acid) and minerals (iodine, iron and zinc) for normal, healthy growth and development. More than half of the world's population throughout the economic spectrum, in both urban and rural settings, does not consume enough of these nutrients in their diet[2]. Micronutrient deficiencies impair intelligence, strength and energy, sapping individuals of much of the needed vitality, productivity and initiative for economic development.

A third of the world's population is affected by Vitamin A, Iron and Iodine deficiencies. Another two billion people throughout the socioeconomic spectrum, in both urban and rural settings, are marginally deficient in Micronutrients and unable to achieve their mental and physical potential as parents, workers and citizens[1]. Correcting deficiencies in micronutrient deficient populations can improve population-wide IQ by 10-15 IQ points; reduce maternal deaths by one-third, decrease infant and childhood mortality by 40%, and increase strength and work capacity by 40%. It eliminates nutritional blindness and endemic cretinism, and dramatically reduces birth defects, stillbirths and congenital deafness.

Iron, anaemia and Vitamin A deficiency in pregnant women may also have significant implications on their babies who may be born with low stores. Vitamin A Deficiency (VAD) may increase morbidity and mortality risk and can affect vision, while anaemia and iodine deficiency disorders may lead to cognitive defects. Other nutrients are important at certain times in life, such as calcium and folate in adolescence. Iron deficiency and resultant anaemia affect more than 3.5 billion people in the developing world. While accurate prevalence estimates are difficult to obtain and periodically revised, all public health and nutrition experts agree that this is a huge problem.

Predictably, the prevalence of anaemia in developing countries is three to four times higher than in industrialized countries. The most highly affected population groups in developing countries are pregnant women (56%), school-age children (53%), non- pregnant women (44%), and pre-school children (42%). But another group demands attention as well: Older adults, half of whom are anaemic (51%).

Iodine deficiency is another leading micronutrient deficiency which is causing panic at different levels of public health. In a joint effort, WHO, UNICEF, and International Council for the Control of Iodine Deficiency Disorders (ICCIDD) recently presented data on the status of Iodine Deficiency Disorder (IDD) at regional and global levels. Of the 191 countries assessed, 130 are affected by IDD. Of the remaining 61 countries, IDD has been eliminated, or is not known to be present in 20. Data is insufficient for 41 countries, more than half of which are small island states, where IDD is unlikely to be severe. Almost every country in Africa has IDD.

Another important deficient micronutrient is Vitamin A. Clinical VAD, manifest as eye lesions, is decreasing. It is not known whether VAD's impact on severe illness and mortality is decreasing, but with

[2] The problem of Micronutrient malnutrition at: http://www.sph.emory.edu/PAMM/problem.htm

more national surveys and eventual trend estimates for VAD, it should be possible to make reasonable inferences about likely impact on Vitamin A - preventable mortality.

The majority of countries where Vitamin A deficiency is known to be a major public health problem, have policies supporting regular supplementation for children, an approach of known effectiveness that can reach the sub-populations affected by VAD. Supplementation coverage has increased significantly in the last few years, spurred on by the linkage of supplementation to immunization. Since 1994, WHO/UNICEF is working on integrating the administration of Vitamin A supplementation with immunization services which reach 80% of the world's children./ However, progress has been slow and limited. In contrast, the addition of Vitamin A to Polio Vaccination Campaigns has been quick to catch on and is proving to be one of the most successful implementation strategies for reaching large numbers of children at risk.

Other approaches have been slower to develop and more difficult to implement. These are based on modified food selection, improved availability of Vitamin A-rich foods, and possibly genetic modification of staple foods to enhance Vitamin A availability, as with iron.. However, progress is being made. Innovations include promotion of egg consumption by children in Indonesia, which has shown promising results.

Moreover, deficiencies often interact. Vitamin A supplementation at appropriate levels has been found to improve not only Vitamin A status but also iron metabolism in pregnant women and pre-school and school-age children. It should be considered where iron deficiency is common. A combined Iron and Vitamin A supplement has been found to be 40% more effective in reducing anaemia than an iron supplement alone. Such findings are not specific to supplementation.

Folic acid is one of the essential vitamins. Each year, almost 4,000 pregnancies are affected by birth defects of the spine and brain, called spina bifida and anencephaly. Spina bifida is a defect of the spinal column that occurs during the first 28 days of pregnancy. It can lead to serious disabilities among women such as deformities in the knees, feet, paralysis in the feet and legs, incontinence, learning disabilities and mental retardation. Babies with anencephaly do not develop a brain or only develop a partial brain. These babies die either before birth or shortly afterwards.

The Centre for Disease Control and Prevention estimate that up to 3,000 of these neural tube birth defects could be prevented each year if women consumed folic acid daily before pregnancy and during the early months of pregnancy. Since half of all pregnancies in the U.S. are unplanned, many women may not find out that they are pregnant until well after the ideal time to prevent these birth defects. Therefore, Public Health Service recommends that all women of childbearing age consume 0.4 mg of folic acid each day to prevent spina bifida and anencephaly.

Folic acid is also important for women at every age, because it helps prevent heart disease and stroke. However, too much folic acid can mask the symptoms of Vitamin B12 deficiency, which affects one in five people between 65 to 95 years of age.

Vitamin B-12 deficiency may be the most common nutritional deficiency in the developing world. Once it was thought that B-12 deficiency was rare (in most populations) because it is so efficiently reabsorbed from bile. B-12 (cobalamin), is important in neurological development and function. It is bound to proteins in

food, especially to animal protein. Stomach acids and enzymes help separate the cobalamin from the protein, freeing the nutrient for absorption into the blood. A small amount is excreted into bile by way of the gall bladder, and then reabsorbed into the bloodstream. Bacteria and some parasites living in the digestive tract might interrupt this process.

Zinc deficiency is widespread in many populations and the risk is greater in growing children and pregnant women because they require higher amounts of zinc. Inadequate dietary intake of absorbable zinc is the primary cause of zinc deficiency. Intervention studies have confirmed the critical importance of adequate zinc nutrition to support normal growth, reduce the risk of infections, prevent adverse outcomes of pregnancy, and improve other aspects of human health and function. Efforts are on to define more precisely the risk of zinc deficiency in vulnerable populations and to develop appropriate strategies to control this condition.

Appropriate intrauterine development and exclusive breastfeeding are a guarantee that an infant's requirement of iron and zinc will be met during the first six months of life. However, after this period, complementary foods should meet such demand, which may be more complicated in the second and third years of life. In the last few years, zinc deficiency has been of great importance to developing countries, due to the low intake of animal protein and high intake of phytate.

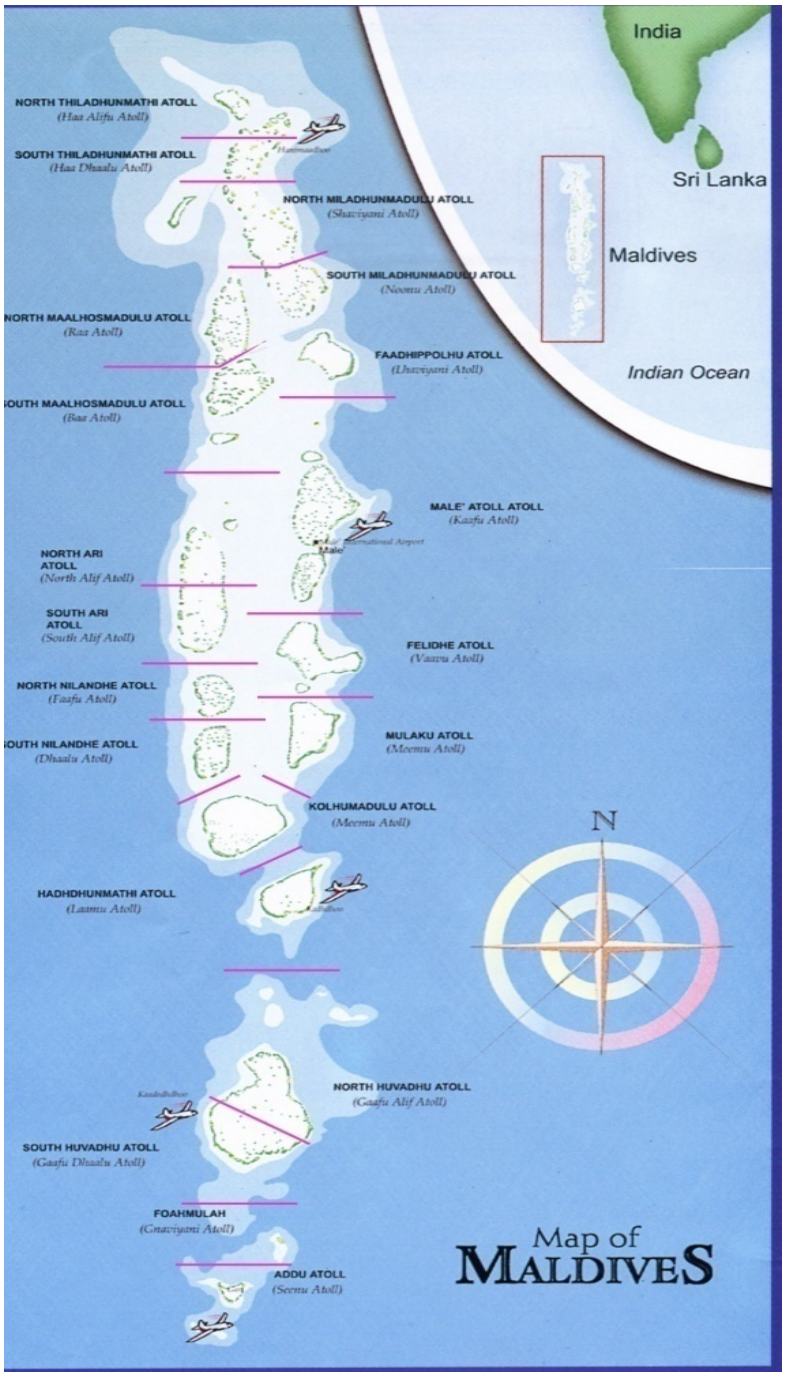
The diagnosis of zinc deficiency is often based on clinical manifestations, such as dermatitis, failure to thrive, hypogonadism, dysgeusia, and anorexia. Measurement of plasma zinc levels is the key to determining dietary intake of zinc in infants and children. There is some evidence that malnourished children gain weight more quickly when they are given zinc supplementation.

Zinc deficiency affects the growth hormone (GH) metabolism, and may be a limiting factor in growth regulation. Results of a meta-analysis have shown that zinc supplementation has a positive effect on the growth of malnourished children with low plasma zinc levels. The status of zinc deficiency in many parts of the world is still unknown and has a direct impact on weight, height, levels of haemoglobin, haematocrit, serum iron and serum zinc in children less than five years of age.

Worm infestation remains one of the main problems of child development. This is especially a greater health hazard in developing countries. Impure water, low socio-economic status, poor sanitation coupled with low literacy rates of parents – particularly the mothers – are the main causes of this prevalent malady. Worm infestation is one of the major causes of childhood malnutrition, anaemia, stunted physical and mental growth, psycho-social problems and along with repeated gastrointestinal and upper respiratory tract infection, it contributes to high morbidity in children and is a major cause of high infant and child mortality. Around two billion people, mostly in developing countries, harbour these infections, while 300 million are severely ill with worms. Of these, at least 50 per cent are school-age children. This group of infections, caused mainly by roundworms, whipworms and hookworms, is a major public health problem in all countries of the Region.

1.2: Study Sites and their characteristics

This study was conducted in all regions of the Republic of Maldives including Male'. The Republic of Maldives is an archipelagic state located 600 kilometres south of India. The Republic is divided into 20 administrative units, also called atolls. Every atoll has an atoll chief, who heads the atoll office and handles the atoll-based administration, and is appointed by the President. Each inhabited island has an island office, which handles the island-based administration on behalf of the atoll office.



The population of the Maldives is estimated to be 298,842 (Population and Housing Census, 2006). About one third of the population lives in the capital island of Malé.

The population density of Maldives is 800 persons per km^2 compared with 30,000 persons per km^2 in Malé, indicating a very high and increasing pressure on land in the capital city. The islands are geographically scattered and at great distances from one another, raising the cost of transportation which impacts effective delivery of services. Lack of adequate communication facilities between islands will remain a major challenge in improving quality of life for the inhabitants. Despite such inherent constraints, Maldives has managed to initiate many development projects to increase the number of target beneficiaries. Distribution of investment projects among the 20 atolls of the Republic, development of predetermined growth centres, and expansion of infrastructure development throughout the country, are some of the positive steps taken by the Government for achieving better distributive equity.

1.3: The Nutrition and Health Situation in Maldives

In Maldives, 31% of children are underweight and 9 % are severely underweight. Under-nutrition among children typically starts after six months of age. The proportion of undernourished children is the highest in the age group 6 to 11 months. The Multiple Indicator Cluster Survey (MICS) conducted in the year 1996 and 2001 revealed the following trends:

a. The proportion of children under 5 years who are underweight decreased from 43 per cent in 1995 to 30 per cent in 2001;
b. The proportion of stunted children decreased from 30 per cent to 25 per cent;
c. The proportion of 'wasted' declined from 17 per cent to 13 per cent during the same period.

The Multiple Indictor cluster Survey of 2001 showed the following nutritional situation. Fifty one per cent of children received one dose of Vitamin A supplement within the last 4 to 6 months and 15 per cent received a Vitamin supplement during 24 hours prior to the interview conducted. Considerable regional variations exist in Vitamin A supplementation. Over two per cent of children report difficult vision in daylight while 1.2 per cent have difficulty seeing at dusk. Another 1.9 per cent of children find difficulty in recognizing people at dusk. Thus, more than 5 per cent children suffer from Vitamin A deficiency in the country. This indicates severe Vitamin A deficiency among children in Maldives[3].

Amongst women aged 15-49 years who have children below 5 years of age or have given birth during the 12 months preceding the survey, 11 per cent had difficulty in seeing in daylight while 6 per cent suffered from night blindness. Improved Vitamin A supplementation is required both for children and women. More appropriate strategies are to be identified and implemented effectively and immediately.

Anthropometric measurements show that the mean height of women was 150 cm; the proportion shorter than 145 cm was 17 per cent. Mean body mass index was 23.5; chronic energy deficiency was observed in more than one-fifth of the women (23 per cent). Greater deficiency of energy was found among younger women (15-24 years).

Eighty five per cent women of the sample were tested for haemoglobin levels. More than half (51 per cent) were found to be anaemic to some degree: 41 per cent were mildly, 10 per cent moderately and 1 per cent were severely anaemic. Regional differences in the prevalence of anaemia are substantial, ranging from 38 per cent in the South to 64 per cent in the North. Prevalence of anaemia is considerably higher among women in the age group of 15-19 years. Amongst the households where salt iodization was tested (93 per cent of the total selected households), only 44 per cent used iodized salt to the recommended level of 15ppm or more. About 3 per cent of the households used totally non-iodized salt and 46 per cent used minimally-iodized salt. Regional variations in the use of iodized salt were substantial, ranging from 69 per cent of the households using appropriately iodized salt in Malé as compared to 31 per cent in North.

Anaemia was found to be highly prevalent amongst women. The unsettling fact that half of the women suffer from anaemia needs serious attention. This condition persists despite the fact that almost universally

[3] http://www.unicef.org/maldives/MICS_2002.pdf page 47

women are checked during the antenatal period for any possible deficiencies that could affect their health and that of their children.

Deficiencies of micronutrients such as Iron, Iodine, and Vitamin A affect nearly one-third of the world's population, and the consequences can have long lasting effects on child survival, growth and development. Maldives has made dramatic economic growth over the past decade. The health status of the population has also improved considerably as the infant, under-five and maternal mortality, along with the incidence of vaccine preventable diseases, has steadily decreased since the year 2000. Iron / Folic acid intake among pregnant women has also increased (from 50% in 1999 to 87% in 2004 -RH Survey 2004). A study conducted to assess the prevalence of Iodine Deficiency Disorder (IDD) in 2002, showed a Total Goitre Rate of 25.7% in 6-12 years age group.

Health Conditions in Maldives

Following are indicators provided by the Vital Registration System in 2006:

Life Expectancy	Male: 71, Female: 72
Infant Mortality Rates Crude Birth Rates Crude Death Rates Still Birth Rates	16/ 1000 live births 20/ 1000 population 4/ 1000 population 10/ 1000 live births
Maternal Mortality Rates	69/ 100,000 live births

The under-five mortality rate stood at 48 per 1,000 live births in the year 1990. By the year 2003, the rate had reduced to 18 per 1000 live births. The MDG target 5 as applicable to Maldives is to reduce the under-five mortality rate to 16 per 1000 live births by the year 2015. Achievements in reducing the infant mortality rate (IMR) can be regarded as the key factor in the reduction in child mortality rate. Significant progress has been achieved over the past 15 years in reducing the IMR. From 34 per 1,000 live births in 1990, IMR has been reduced to 16 per 1,000 live births by the year 2006. For over 10 years, Maldives has maintained almost universal vaccination coverage for diseases under the Expanded Programme of Immunization (EPI) and has one of the highest vaccine coverage within the South Asia region. Furthermore, the country has attained self procurement of all EPI vaccines hence further strengthening the immunization programme. According to the Multiple Indicator Cluster Survey conducted in 2001, Maldives has achieved close to universal coverage for vaccines in the EPI programme. For measles, the total coverage stands at 92 per cent, with 92 per cent coverage for males and 93 per cent coverage for females. The fully immunised status for all EPI vaccines stood at at 85 per cent for the country.

During the past few years, the Maternal Mortality Ratio has remained stable. With the introduction of a Maternal Death Audit in year 1997, more reliable data on maternal mortality is available now. As reported by the vital registration system the MMR stood at around 258 per 100,000 live births in 1997. By 2003, the rate had fallen to 78 per 100,000 live births. In 2006, MMR stood at 69/100,000 live births. The target for

year 2015 based on 1990 baseline is to reduce the MMR to 125 per 100,000 live births. The MMR had been lower than this target in the years 1999, 2000 and 2003 but lacks consistency. Thus, it cannot be said with confidence that this target has been achieved until lower figures are recorded consistently for a few years.

1.4: Rationale of the Survey

A national survey has been conducted to address the deficiencies of previous studies and utilize the greatly expanded global body of knowledge on the nature, scale, significance and impact of micronutrient deficiencies and the associated burden of parasitic disease in women of reproductive age and children.

1.5: Study Objectives

To conduct a household survey for collection of information related to micronutrient and nutritional status in a representative sample of women of reproductive age (15–49 years) and children (6 months–5 years old) in the Republic of Maldives including relevant information on:

- Socio-demographic status;
- Micronutrient status of women of reproductive age and children;
- Maternal and Child Health and Nutrition behaviours and practices;
- Biochemical analysis on a representative sample for Haemoglobin, Haematocrit, Serum Ferritin, Serum C Reactive Protein (CRP), Serum Retinol, Serum Zinc, Folic acid, Vitamin B 12 and Urinary Iodine, as part of the National Micronutrient Survey in Maldives;
- Stool specimens for ascertaining the national Helminthiasis status by Kato Katz Kits in the representative population of Maldives.

Consequently, the information provided by the survey will be used to develop a National Nutrition Policy and strategies to address the nutritional issues especially in regards to micronutrients.

2. Methodology

2.1: Study Type

The study was conducted using a stratified representative cross-sectional survey for the population of Maldives, including all islands and atolls. Information was collected at household level, with relevant questions regarding socio-demographic status, maternal and child health, nutrition indicators, micronutrient status and health seeking behaviours.

2.2: Components of the Survey

Following were the major components of the survey:

1- Interviews with women of reproductive age (WRA) (15–49 years of age) or mother/caretaker of children 6 months to 5 years of age and children 6 to 12 years of age in selected households;
2- Physical examination;
3- Collection of blood, urine and stool samples of selected participants;
4- Vitamin A health facility coverage data.

2.3: Target Population

Following were the target populations of the National Micronutrient Survey:

1. Women of Reproductive Age (15 – 49 years) ;
2. Children: 6 months – 5 years old;
3. Children 6 – 12 years old (Urinary Iodine and stool examination only);
4. Health Care Facilities (For Vitamin A coverage data of the sampled 6 months to 5 years old children) excluding Male' Region**.**

3: Sampling Design and Cluster Allocation

For the National Micronutrient Survey, 30 by 14 cluster with two-stage cluster sampling technique was used. Before the sampling, the population was divided into complete sets of non-overlapping sub-populations, usually defined by geographical or political boundaries. These subpopulations are called clusters.

In the first stage, 30 clusters per region were sampled by using probability proportionate to the size (PPS). Sampling with probability proportionate to size allows the larger clusters to have a greater chance of being selected. The population information from 2006 census was used as the sampling frame. All inhabited islands of the country were divided into 6 regions. Male', the capital island was taken as a separate region. Republic Each region was sub-divided into 30 clusters, hence forming 180 clusters in total. 14 household were selected from each cluster and 2520 household in total.

3.1: Sample Size estimation

Biochemical analysis of Haemoglobin, Haematocrit, Ferritin, CRP, Vitamin A, Folic acid, Vitamin B12, Zinc and Urinary Iodine along with stool examination for worm infestation have been major tasks of the survey. Although the sample size for the main survey was calculated as above, the required sample size for biochemical assessment was further determined to ensure the adequacy of biochemical sampling. The sample size for this biochemical analysis was calculated using the prevalence data (and ranges) for various micronutrient deficiencies. The sample size calculation was done on the basis of the following assumptions and formula for each micronutrient.

$$n = \frac{1.96^2\, p(1-p)(DEFF)}{d^2}$$

Where:
DEFF = Design Effect taken
p= Estimate of the expected proportion of micronutrient deficiency
d=Desired level of absolute precision

The expected precision at regional level was further estimated using the national sample size and the reduction in sample size at regional level by two separate methods. In general, precision is proportional to 1/sqrt(n) where n is the sample size. So if the sample size at the regional level is reduced by a factor of the order of 6 (~420 households c.f. a national sample of 2500), the imprecision will be increased by a factor of srt (6) = 2.4. So a precision of +/- 4% would become, roughly, a precision of +/- 10%, which will be sufficient for estimation of trends and analysis of risk factors by region.

The sample size estimation for key indicators is given below;

Indicator	Prevalence Point Estimate	Absolute Precision at National Level	Absolute Precision at Regional Level	Design Effect	Estimated Sample Size
Haemoglobin	51 %	4 %	10%	2	1103
Urinary Iodine Deficiency	43%	4 %	10%	2	1192
Serum Vitamin A	53%	4 %	10%	2	1182

A comparison of regional and national estimates was made for various nutrition indicators using a range of prevalence values, and estimated the relevant precision of estimates and the requisite power. (Details of this is given Appendix 1. Given that there is little information on the prevalence of several biochemical indicators from Maldives, a maximum sample estimate as calculated for iodine was taken i.e. 1192 samples and uses that to further correct for non-response rates.

3.2: Sampling Frame

The population of the Republic of Maldives resides in 195 inhabited islands in the year 2007. Each inhabited island is an administrative unit with an island office that handles the island-based affairs. The islands are re-grouped to form atolls, which is a higher level administrative unit with an atoll office and an atoll chief. There are 21 atolls in total in Maldives. The atolls are regrouped to form 6 geographical regions. There are six geographical regions. Malé alone forms a region. In Maldives, there is no urban rural differential for the residential households within an atoll. All residential households in the 20 atolls outside of Malé are considered as rural; all residential households in Malé are considered as urban. The islands were the primary sampling units and a household listing was carried out in all clusters. These lists served as sampling frame for selection of households. The Maldives Population and Housing Census (MPHS) 2006 census household listing was used. The household lists gathered from census data base was updated by islands offices.

3.3 List of Regions and Atolls

S. No	Region	Atolls
1	North Region	Haa Alif, Haa Dhaal and Shaviyani
2	North Central Region	Noonu, Raa, Baa and Lhaviyani
3	Malé Region	Malé (06 Wards)
4	Malé Economic Region	Kaaf, Alif Uthuru, Alif Dhaal & Vaavu
5	South Central Region	Meemu, Faafu, Dhaalu, Thaa and Laamu
6	South Region	Gaaf Alif, Gaaf Dhaalu, Gnaviyani and Seenu

3.4: Cluster Definition

Cluster is a geographical sub-population unit, defined by geographic or political boundaries containing households in that geographical area. The list of the selected clusters by location and population and household information is provided in Appendix.

3.5: Selection of Islands and Clusters

In selecting the survey sites for the National Micronutrient Survey, the basic goal was to select representative islands/wards of the area to be studied. Following criteria was used to select islands/wards and households within the selected islands and wards in Malé by using PPS sampling methodology:

The samples (islands and wards) were selected using probability proportional to population size methodology and followed the steps given below.

(1) A list of all the islands and wards with their corresponding populations by region was developed. The list of the islands/wards by region was obtained from the Maldives Population and Housing census 2006 database.
(2) The cumulative population was calculated by each island /ward for each region.
(3) The sampling interval (k) was calculated using the following formula.

Sampling interval = Total cumulative population of each region / 30 (Number of clusters to be studied)
For example, the sampling interval calculated for North region by using the above-mentioned formula = 42,151/30 =1405

A random number (x=52) between 1 and the sampling interval (k = 1405) was chosen as the starting point using random number tables, and the sampling interval was added cumulatively. The islands/wards surveyed are those with the (x+n)th person, the (x+2n)th, (x+3n)th, person and so on up to the (x+30n)th person. The detail of the selected clusters by Region and Atoll and the sample weightage is detailed in Appendix A (1).

3.6: Segmentation of the Islands with More Than One Cluster

The islands of Maldives vary in the number of households they contains. There are some large islands/wards *(See* Appendix*)* that have more than one cluster. For example, the Hinnavaru Island located in Lhaviyani Atoll was divided into two clusters with respect to its geographical /political subdivision. In case of no defined sub-divisions for a large island, following steps were taken to sub-divide the island into the required number of clusters:

- Number of households/number of clusters = size of the cluster
- Total number of households in Hinnavaru Island = 482
- Total number of clusters required = 2
- Households per cluster 482/2 = 241

Hence, each segment in Hinnavaru comprised around 241 households and from each segment, 14 households were selected for interview and biochemical analyses.

A map was used to divide the larger island into the required number of clusters using recognizable outer boundaries for the cluster. Areas for which record was unavilable, a map was drawn with the help of a local guide, marking the boundaries of the cluster by identifying major roads, lanes, streets and showing land marks such as mosques, public offices. After completion, the required segmentation of the island has been shared with the island office to ensure that the clusters defined on the map contain the desired number of households for the survey.

3.7: Selection of the Households

Updated map and list of households with children 6 months to 5 years old has been collected from the Island office. Before segmentation or selection of household, it was checked and reconfirmed that the lists exclude abandoned/empty households and internally displaced persons (IDPs).

"*The household was defined as a family with one head of household, sleeping under the same roof. The head of Household is the person who is acknowledged as a head by the members of the household and who is usually responsible for the upkeep and maintenance of the household*".

In this survey, households were selected by two methods. Systematic selection technique was used to select the households in islands where lists of households were available. In Malé region, households were selected at random as listing was not available. Both techniques for the selection of households are explained in the Appendix.

3.8: The Allocation of Households to the Team Members

According to the available map, households located in the same lane/street or blocks were allocated to one enumerator for data collection. The team leader assigned households to the enumerators for data collection and task of physical examination to CHWs and collection of specimen to the lab technicians.

3.9: Selection of the Respondents and Subjects

a) Women of Reproductive Age (WRA) (15 – 49 Years of Age)

One woman of reproductive age from each selected household was chosen for interview and physical examination and specimen collection. In households with more than one woman of 15 – 49 years of age, one was selected randomly by draw-a-chit method using the A3 eligible subject's sheet from the household questionnaire (Appendix). Questionnaire module D, E and F were filled from WRAs to collect all the relevant information.

b) Children 6 Months to 5 Years of Age

Same WRA selection procedure was followed to select a child 6 months to 5 years of age from each of the 14 selected households for interview. Mother or caretaker of the selected child was considered the respondent. Physical examination and specimen collection was done from the first seven children of 6 months-5 years of age or until the required minimum number was achieved (seven children of 6 months – 5 years of age). If a household included more than once eligible child, the youngest was selected for interview as well as physical examination and biochemical specimen collection. Questionnaire module G,H and I were filled for this groups.

b.1) Twenty-Four Hours Food Practices Questionnaire

The sub sample for 24-hours food practice assessment was performed among the children 6 months – 3 years of age. This was performed for the entire 14 selected household for 6 months – 5 years of age.

c) Children 6 to 12 Years of Age

Seven children of 6 – 12 years of age were selected for interview, physical examination and biochemical examination. Mothers or caretakers of the children were taken as respondents for the questionnaire module. In households with more than one eligible child, the eldest was selected for interview, physical examination and biochemical specimen collection. In case seven children of eligible age were not available from the selected households, a new list was generated through re-sampling by the same strategy for the remaining number of household from the target population (excluding the sampled household.) Questionnaire module J and K were filled for this age group.

Follow up/Revisits:

If mother/child was not available at the time of first visit, households were revisited twice. Replacement was not allowed for women of reproductive age and children (6 months – 5 years of age). Replacement was ONLY permitted for children 6 – 12 years of age.

4: Operational Procedures

4.1: Development of Instruments and Survey Protocol

AKU team developed detailed survey protocols and data collection instruments along with guidelines addressing the primary objectives of the survey. The major stakeholders i.e. Ministry of Health and UNICEF Maldives were involved in the process review and finalization.

4.2: Hiring/Selection of Field Team

Six field teams were hired by Ministry of Health Maldives to conduct the micronutrient survey. Supervised by a team leader, each team included data collectors, a lab technician and a community health worker/nurse.

4.3: Pre-Testing of Instruments

Prior to the field activity, pilot testing was performed on all aspects of the survey. The laboratory component was excluded on ethical consideration of "not using human blood for experience alone." The questionnaires were translated into the local language and then back to English. Upon finalization, questionnaires were pilot-tested to estimate the amount of time required to complete the survey in each cluster and to identify any potential problems with the survey instruments and protocol. Pilot testing was undertaken under conditions similar to the field to simulate the actual data collection.

4.4: Training of Field Staff

Intensive seven days' training was provided to the field staff. The training workshop was carried out in the following three phases:

During the first phase of training course, the trainers demonstrated conducting field work in front of the participants. During this phase of the training, different modules with reference to questions and instructions were discussed in detail. The trainees were given home work assignments for the evening. They practiced reading the questions aloud to another person to become comfortable with the exercise. This assignment was important to prepare the trainees for the next phase of training.

The second phase of training was role-play in which the trainees demonstrated their skills of interviewing. One trainee played the role of the enumerator and the other acted as a respondent. This provided participants with an opportunity to assess their knowledge of questions, their level of comfort with asking the questions, and their ability to cover the questions in a way which was thorough but not redundant.

The third phase of training was field practice interviewing. In this phase, participants actually interviewed respondents and were trained to check, edit the questionnaire and complete the assignment sheets like actual field work/interview.

Observation and supervision throughout the fieldwork was a part of the training and data collection process. The team leaders of respective regions played a central role in continuing the training and ensuring the quality of the data collected.

4.5: Data Collection, Monitoring and Validation

After the completion of training, two teams South Central and North started field activity from November 1, 2007 as planned. The remaining four teams began their field activity after a week.

Trained data collectors performed data collection at household level; they were allocated sets of households on a daily basis. Senior staff members of the team, who were especially trained for supervising the task, monitored the whole activity. The senior staff or the team leader checks the filled questionnaires. If any errors or inconsistencies were identified, the forms were returned to the data collectors to correct from the field.

The core team (AKU, MoH and UNICEF representatives) regularly monitored the survey activities by telephone. AKU team members along with the representatives of MoH and UNICEF Maldives performed an independent monitoring to observe and ensure the quality of the survey. All teams were visited twice in view of budgetary constraints and accessibility – first at the early stages of field activity and second after two weeks of its initiation. Monitoring at all aspects of project field activities was conducted on the standardized monitoring and quality assurance tools and was duly recorded.

4.6: Sample Collection, Storage and Transportation

4.6.1: Collection of Specimens

Trained lab technicians were deployed from MoH to perform this important and tedious task; a senior consultant from AKU also provided seven-day training to the lab technicians. Detailed procedures and guidelines were provided on this specific component. Drawing of blood and collection of stool and urine samples was done at respective health facilities.

4.6.2: Storage of Specimens

After collection, all samples were stored at the required temperature at atoll hospitals and in Safaris. Refrigerators with -20 degree centigrade temperature were arranged at atoll health facilities and at Safaris for daily storage of samples.

4.6.3: Transportation of Samples

WHO-recommended boxes with dry ice were used to transport the specimens from the regions to Malé, and from Malé to Karachi, Pakistan.

5: Results/Findings

Different types of instruments and techniques were used to capture required information from the target groups:

1. Household Survey Questionnaire (Women of reproductive age, children 6 months – 5 years of age and children 6 – 12 years.)

2. Physical Examination (Women of reproductive age, children 6 months – 5 years of age and children 6 – 12 years.)

3. Biochemical analysis
   i. *Blood sample collection (From women of reproductive age and children 6 months – 5 years of age)*
   ii. *Urine sample collection (From women of reproductive age, children 6 months – 5 years of age and children 6 – 12 years)*
   iii. *Stool samples collection (From children 6 months – 5 years of age and children 6 – 12 years)*

The following five sections present the results of the captured information:

Section I: Survey Outcomes, SES and KAP regarding Micronutrients

- Survey findings
- Respondents' information
- Household information (Socio-economic status)
- KAP regarding micronutrients

Section II: Women of Reproductive Age

- Reproductive history
- Antenatal care
- Health status of women
- Clinical examination
- Biochemical results

Section III: Children 6 Months to 5 Years of Age

- Feeding practices
- Child Health status
- Clinical Examination
- Biochemical results

Section IV: Children 6 to 12 Years of Age

- Child Health status
- Clinical examination
- Biochemical results

Section V: Correlates of Micronutrients Deficiencies

SECTION 1: SURVEY OUTCOMES, SES AND KAP REGARDING MICRONUTRIENTS

1.1: Survey Findings:

This study was conducted in the Republic of Maldives covering all the regions and atolls. There were a total of 6 regions including Male' and 20 atolls. Each region was divided into 30 clusters and 14 household were taken from each cluster (***see method of sampling section for details***). In total, 2520 household were targeted from 180 clusters by using 30 by 14 cluster sampling technique (14 households from each cluster). Alternate provision were not allowed during the sampling process and team reached 94 %(2370) households, the remaining were unreachable (temporary locked, abundant etc).

Table 1.Modules wise details of survey findings:

	North	North Central	Central	South Central	South	Male	Total
Total number of clusters by region	30	30	30	30	30	30	180
Targeted Household Household Information	420	420	420	420	420	420	2520
Module A (Household screening)	342	381	394	417	381	455	2370
Module B (SES & demographic data)	341	378	393	415	380	455	2362
KAP regarding Micronutrients							
Module C (KAP Micronutrients)	488	530	579	515	554	600	3266
Women of reproductive age							
Module D (WRA Health status)	329	381	394	415	367	427	2313
Module E (Reproductive history)	267	323	326	362	301	366	1945
Module F (physical examination)	251	240	303	233	234	250	1511
Children 6 months to 5 years							
Module G (Feeding behavior and practices)	327	378	385	391	371	421	2273
Module H (health status)	326	378	385	390	372	420	2271
Module I (physical examination)	272	295	312	267	228	238	1612
Children 6-12 years							
Module J (health status)	263	249	257	269	245	254	1537
Module K (physical examination)	216	232	231	213	215	213	1320

Module A: (Household screening): Module A was filled-in to collect information about all family members of the target households to identify study subjects i.e. youngest child from 6months-5years and oldest for 6-12 years and women of reproductive age 15-49 years (WRA) were selected randomly. A total of 2520 household were approached to identify target group for the study and information were collected from 2370 households.

Module B: (Socio economic & demographic data): Module B was filled from 2362 households, eight household refused to provide the SES information.

Module C: KAP regarding Micronutrients: Module C was filled from all the targeted groups. Information was collected from mother/care takers for children 6months to five years and 6-12 years as well as from the WRA. Information was not collected in case, mother/care taker selected as a sampled woman of reproductive age. In total 3266 KAP forms were filled for all three target groups from 2370 households.

Module D (WRA Health status), Module E (Reproductive history) and module F physical examination: Module D was filled from all the women of reproductive age and module E was filled from women with at least one child where as the physical examination were performed for sampled women. There were total 2370 women of reproductive age who participated in the survey, module D was filled for 2313 WRAs (information were not provided by 63 women). Module E was filled for1945 out of 2313 women who had had a child. Physical examination (Module F) was performed for 1511 women of reproductive age targeting at least 8 women of reproductive age women per cluster by first come first basis to meet the minimum sample size of 1260.

Module G, (Feeding behaviour and practices), Module H, Health status of children and module I physical examination: These three modules were filled from children 6month to five years of age children. Total 2273 children were present at the time of visit from 2360 household. Module G was filled for all (2273) children and module H for 2271 children (information were missing for two children's). The physical examination (module I) of children of 6 months to five years of age was performed for 1612 children targeting at least 8 children from each cluster by first come first basis to meet the minimum sample size of 1260.

Module J, health status of children and Module K Physical examination: Module J was filled from the mothers and care takers of children 6-12 years of age. 1535 children 6-12 years were identified during the survey and module J was filled for all the children. Physical examination (Module K) was performed for 1320 children targeting seven children per cluster to meet the total minimum sample size of 1260.

Table 1.1: Details of biochemical analysis, Vitamin A Health facility coverage and retailers interviews

			North	North Central	Central	South Central	South	Malé	Total
Total number of clusters by region			30	30	30	30	30	30	180
Targeted Household			420	420	420	420	420	420	2520
Blood samples	WRA	Targeted	210	210	210	210	210	210	1260
		Achieved	**218**	**214**	**214**	**211**	**204**	**243**	**1304**
	6months to 5 years	Targeted	210	210	210	210	210	210	1260
		Achieved	**217**	**202**	**206**	**215**	**212**	**210**	**1262**
Urine samples	WRA	Targeted	210	210	210	210	210	210	1260
		Achieved	**214**	**219**	**214**	**206**	**200**	**237**	**1283**
	6 months to 5 years	Targeted	210	210	210	210	210	210	1260
		Achieved	**187**	**201**	**204**	**206**	**213**	**203**	**1214**
	6 – 12 years of age	Targeted	210	210	210	210	210	210	1260
		Achieved	**192**	**202**	**214**	**198**	**202**	**211**	**1219**
Stools samples	6 months to 5 years	Targeted	117	177	96	135	226	*433	1184
		Achieved	**180**	**188**	**141**	**131**	**159**	**-**	**799**
	6 – 12 years of age	Targeted	117	177	96	135	226	433	1184
		Achieved	**124**	**167**	**125**	**123**	**157**	**-**	**696**

Vitamin A coverage data from health facilities		30	23	30	28	29	-	140
Retailers interviews per region	Targeted	14	15	8	11	18	35	100
	Achieved	**14**	**15**	**3**	**8**	**16**	**30**	**86**

The target samples for biochemical assessment of all three groups were 1,260 respectively. About 1,304 and 1,262 blood samples were collected from women of reproductive age and children 6 months to five years of age respectively. About 1,283, 1,214 and 1,219 urine samples were collected from women of reproductive age, children 6 months to five years of age and children 6 to 12 years of age respectively. About 779 and 696 stool sample were collected and analyzed in children 6 months to five years of age and children 6 to 12 years of age. Male region was excluded from stool analysis because of the shortage of Kato Katz Kits.

1.2: Age Distribution of Respondents

All study respondents (subject and caretakers of children) were female. The table below shows region-wise distribution of the age of the respondents.

Table 2: Age Distribution of Respondents

	North (n=342)	**North Central (n=381)**	**Central (n=394)**	**South Central (n=417)**	**South (n=381)**	**Malé (n=455)**	**Total 2370**
15–20 Years	55(16.1)	41(10.8)	52(13.2)	24(5.8)	56(14.7)	45(9.9)	273(11.5)
21–25 Years	49(14.3)	67(17.6)	109(27.7)	85(20.4)	75(19.7)	85(18.7)	470(19.8)
26–30 Years	82(24.0)	105(27.6)	96(24.4)	125(30.0)	85(22.3)	125(27.5)	618(26.1)
31–35 Years	70(20.5)	81(21.3)	56(14.2)	73(17.5)	65(17.1)	94(20.7)	439(18.5)
36–40 Years	44(12.9)	54(14.2)	49(12.4)	55(13.2)	56(14.7)	67(14.7)	325(13.7)
41–45 Years	25(7.3)	20(5.2)	16(4.1)	36(8.6)	32(8.4)	26(5.7)	155(6.5)
>45 Years	14(4.1)	13(3.4)	14(3.6)	13(3.1)	11(2.9)	13(2.9)	78(3.3)
Age not reported	3(0.9)	0.0	2(0.5)	6(1.4)	1(0.3)	0.0	12(0.5)
Mean age(SD)	29.8(8.2)	29.9(7.7)	28.5(7.8)	30.4(7.4)	29.7(8.1)	30.0(7.4)	29.7(7.7)

1.2.2: Marital status of the respondents

Overall, 71 % of the study participants were married

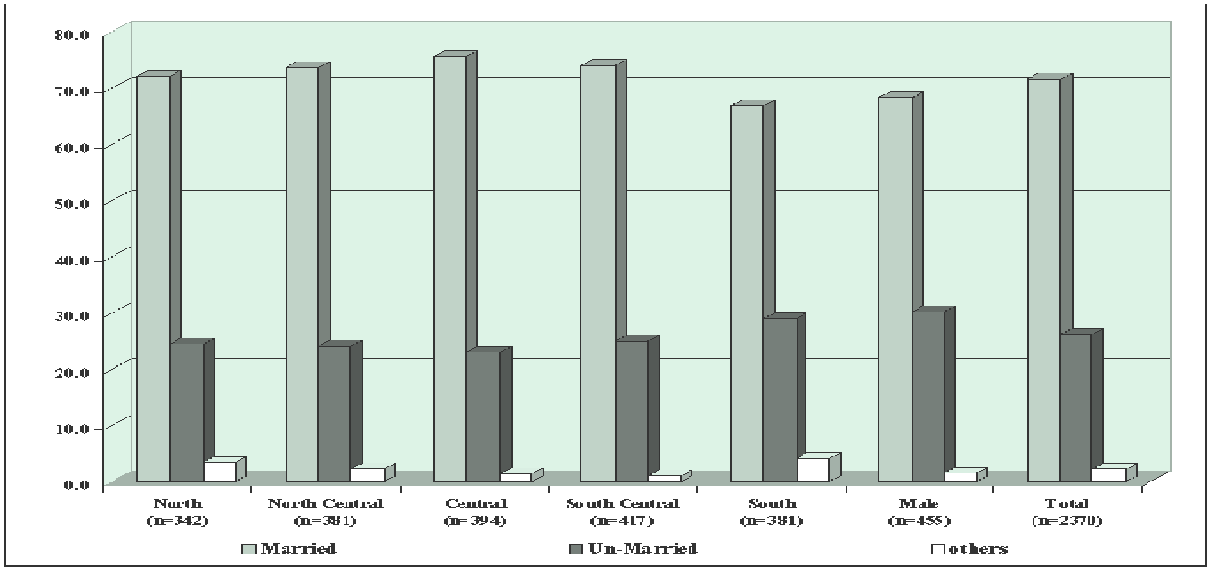


Figure 1: Marital Status of Respondents

1.3-Socio-economic and Demographic information

1.3.1: Ownership status of Respondents' Houses

Majority of the respondents in the atolls live in their own homes. However, nearly half of the respondents in Male live in rented homes. The highest proportion of respondents (over 90%) living in their own homes are found to be in the South Central and South regions.

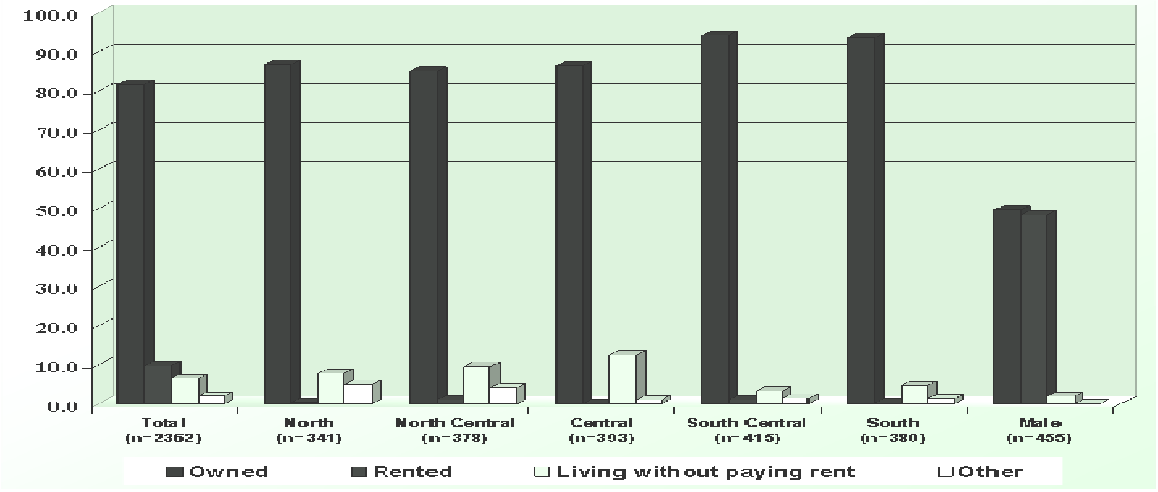


Figure 2: Ownership status of respondents' houses

1.3.2: Fuel Used for Cooking by Region

In North region, approximately 18.8 % households consume oil as fuel for cooking whereas 6.9 % in North Central region, 8.1% in Central, 6.5% in South Central, 6.6% in South and 0.2% households in Malé consumed oil as fuel for cooking. Thus the North region used oil the most (18.8 %). Consumption of oil for cooking is lowest (0.2 %) in Malé. Overall, 92% of households used gas for cooking. In the North approximately 80.9% households consumed gas as fuel for cooking. A total of 91.5% in North Central region, 91.9% in Central, 93.5% (total 415) in South Central, 92.4 % in South and 99.1% households in Malé consumed gas as a fuel for cooking. Thus more gas (99.1 %) used in Malé region whereas less Gas (80.9 %) was used in North region. Whereas the ratio of firewood (as a fuel) used for cooking is quite low in the regions. In North region, only 0.3% households use firewood as a fuel for cooking whereas 1.6 % in North Central region, 1.1 % in South and 0.7 % in Malé used firewood as fuel for cooking. It was also observed that no household in Central and South Central regions uses firewood as fuel for cooking. Despite the low ratio, more firewood (1.6 %) is used in North Central region.

Table 2.1: Fuel used for cooking by region

Regions	Total # of households	Type of fuel used For cooking by region		
		Oil	Gas	Firewood
North	341	64(18.8 %)	276(80.9 %)	1(0.3 %)
North Central	378	26(6.9 %)	346(91.5 %)	6(1.6 %)
Central	393	32(8.1 %)	361(91.9 %)	0.0 %
South Central	415	27(6.5 %)	389(93.5 %)	0.0 %
South	380	25(6.6 %)	351(92.4 %)	4(1.1 %)
Malé	455	1(0.2 %)	451(99.1 %)	3(0.7 %)
Total	**2362**	**175(7.4** %)	**2174(92.0** %)	**14(0.6** %)

1.3.3: Kind of Toilet Facility, Disposal of HH Waste and Practice of Hand washing with soap after defecation

In the North and North Central regions, approximately 2.9% households do not have toilet or latrine facility, while 4.1% households in the Central region and 7.5% households in the South Central region has no toilet or latrine facility. The South region and Male' have 1.8% and 1.3% households respectively with no toilet or latrine facility. Overall, 3.4% households have no toilet or latrine facility in all the regions.

Overall, 36.5% of household toilet facility is connected to sea in all regions. In Male' 98.2% of toilet facility is connected to the sea. Majority of the toilet facility in the outer regions are connected to septic tanks. Majority of toilet facilities in the North region, South region and South Central region are connected to septic tanks which amounts to 86.5% in the North region, 87.1% in the South region and 81% in the South Central region. The next highest proportion of toilet facility connected to septic tanks (62.5%) is found in the North Central region. In the central region only 37.4% in the Central region have toilet facility connected to septic tank.

Another observation was that a number of households in all regions used different methods for disposing waste. In the North region, 80.4% households disposed waste in garbage compound whereas approximately 83.1% households in North Central region, 75.6% in Central region, 74.2% in South Central region, 65.8%

in South region and 99.3% in Malé, disposed waste into garbage compound. Overall 80.2% households disposed waste through Garbage compound in all of the regions.

It was also observed that the practice of washing their hands with soap after defecation is universal. Overall 97.8% of residents of the households in all regions always washed their hands with soap after defecation. Broken down by region, residents of 99.1% households in the North region; residents of approximately 98.7% households in the North Central region; 99% household residents in the central region; 94% household residents in the South Central region; 98.2% household residents in the South region; and 98% household residents in Male' always washed their hands with soap after defecation.

Table 3: Percent Distribution of kind of toilet facility, disposal of household waste and hand washing with soap after defecation

	North	North Central	Central	South Central	South	Malé	Total
Number of households	**341**	**378**	**393**	**415**	**380**	**455**	**2362**
Type of latrine/ toilet facility							
No toilet	2.9 %	2.9 %	4.1 %	7.5 %	1.8 %	1.3 %	3.4
Toilet connected to sea	3.8 %	34.1 %	51.7 %	10.6 %	6.6 %	98.2 %	36.5
Toilet connected to septic tank	86.5 %	62.7 %	37.4 %	81.0 %	87.1 %	0.4 %	57.1
Other	6.7 %	0.3 %	6.9 %	1.0 %	4.5 %	0.0 %	3.0
Household waste disposal method							
Garbage compound	80.4 %	83.1 %	75.6 %	74.2 %	65.8 %	99.3 %	80.2
Sea site	2.9 %	2.9 %	0.5 %	15.9 %	4.5 %	0.0 %	4.5
Throwing it into bushes	11.7 %	2.9 %	0.3 %	3.1 %	0.5 %	0.0 %	2.8
Burning of garbage	3.5 %	10.3 %	22.9 %	6.5 %	27.9 %	0.0 %	11.6
Other	1.5 %	0.8 %	0.8 %	0.2 %	1.3 %	0.7 %	0.8
How frequently respondents wash hands with soap after defecation							
Always	99.1 %	98.7 %	99.0 %	94.0 %	98.2 %	98.5 %	97.8
Sometime	0.9 %	1.3 %	1.0 %	5.8 %	1.8 %	0.7 %	1.9
Never	0.0 %	0.0 %	0.0 %	0.2 %	0.0 %	0.9 %	0.2

1.3.4: Distribution of Households by Assets

In the North, North Central, Central region and Malé every household (100%) had electricity. In the South Central region 99.8% and in the South region 99.7% households had electricity. Therefore, overall in all regions 99.9% households had electricity.

Television was also commonly found in every household in every region. Region wise, 96.5% in North region, 97.1% in North Central region, 97.7 % in the Central region, 97.8% in the South Central region, 97.4% in the South region; and 98.2 % in Malé had television sets at home.

Table 4: Distribution of households by assets

Regions	North	North Central	Central	South Central	South	Malé	Total
Number of households	**341**	**378**	**393**	**415**	**380**	**455**	**2362**
Assets							
Electricity	100 %	100 %	100 %	99.8 %	99.7 %	100 %	99.9 %
Radio	93.8 %	83.6 %	92.6 %	87.7 %	82.9 %	82.9 %	87.0 %
Television	96.8 %	97.1 %	97.7 %	97.8 %	97.4 %	98.2 %	97.5 %
Mobile phone	98.5 %	96.8 %	99.2 %	97.3 %	97.1 %	99.3 %	98.1 %
Land phone	15.2 %	06.6 %	0.8 %	0.7 %	46.8 %	53.6 %	21.4 %
Refrigerator	64.5 %	80.2 %	84.5 %	73.3 %	81.8 %	97.4 %	81 %
Motorbike	18.8 %	15.6 %	18.3 %	28.7 %	55 %	74.3 %	36.5 %
Sewing machine	66 %	69.8 %	75.6 %	65.5 %	64.7 %	75.6 %	69.8 %
Washing machine	95.6 %	96.8 %	97.5 %	93.3 %	91.8 %	97.6 %	95.5 %
Computer	24.9 %	33.3 %	38.7 %	22.9 %	42.9 %	75.4 %	40.8 %
Fishing boat	5.9 %	5.8 %	14 %	8 %	3.7 %	3.5 %	6.8 %
Any other boat	9.4 %	6.3 %	10.7 %	7 %	5 %	3.5 %	6.9 %
Other	6.5 %	2.4 %	2.5 %	5.3 %	7.9 %	4.8 %	4.9 %

Mobile or cell phone utility is commonly found in almost every household. In North region, approximately 98.5 % households had cell phones while in North Central region 96.8 %, Central region 99.2 %, South Central region 97.3 %, South region 97.1 % and Malé 99.3 % households had cell phones. Overall, approximately 98.1 % households in all regions had cell phones.

Refrigerator was also commonly found in all regions (81%) but in varying proportions in different regions. Lowest use of refrigerator is found in the North region with approximately 64.5% households using it. In North Central region 80.2%, Central region 84.5%, South Central region 73.3 %, South region 81.8 % and Malé, 97.4 % households had refrigerators.

Motorbike was less commonly found in the regions. As seen from the table below apart from Male, use of motor bikes are higher in the South region (55%), reflecting the large land area to travel. The next highest use is found in the South Central region (28.7%). In Malé 74.3 % households had motorbikes.

Computer was also found in a number of households in all the regions. In North region, 24.9 % households had computers whereas in North Central region 33.3 %, Central region 38.7 %, South Central region 22.9%, South region 42.9 % and in Male' 75.4 % households had Computers. Overall, 40.8 % households had computers.

Possession of a fishing boat in the household is highest in the central region (14%). Next highest (8%) is found in the South Central region. In the North region and North Central region 5.9% and 5.8% households respectively are found to have fishing boats in their possession. The lowest proportion of households with fishing boats are found to be the South region and Male' which is 3.7 % in the South and 3.5 % in Malé. In addition to fishing boats other types of boats were also found in the regions as shown in the table above.

1.3.5: Socio-economic Status

SES quintiles: (Total score ranges from 0-9)

Quintile	I	II	III	IV	V
Ranges	< 6.42	6.42 to < 6.83	6.83 to < 7.17	7.17 to < 7.41	>= 7.41

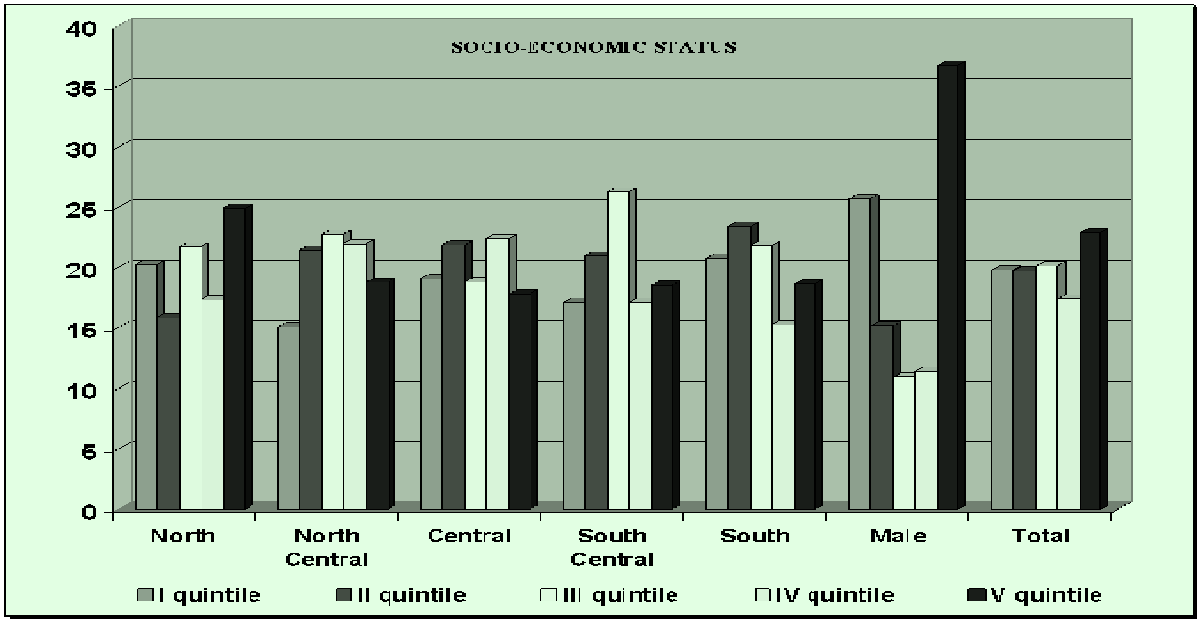


Figure 3: Region wise SES score

The graph shows the socio-economic status of individuals residing in different regions of Maldives. It can be observed that in Malé, the majority of people are at the two extremes of socioeconomic status – the poorest as well as the richest. Such a trend is not observed in other regions. In most regions a similar composition and proportion of socio-economic status quintiles are found with slight variations among the different regions.

1.4:KAP Regarding Micronutrients

Knowledge Attitude Practices (KAP) information regarding micronutrients (module C) was collected from the entire target groups, Information was collected from mother/care takers for children 6months to five years and 6-12 years as well as from the WRA. Information was not collected in case, mother/care taker were selected as a sampled women of reproductive age. In total 3266 KAP forms were filled for all three target groups from 2370 households.

1.4.1: Knowledge Regarding Micronutrients

Three-fourths of the respondents had known about micronutrients – iron, iodine and Vitamin A. However, appropriate knowledge of food containing micronutrients and health problems related to micronutrient deficiencies is known to only a few (Foods containing Iron 7.8%, Foods containing Iodine 2.4% and Foods containing Vitamin A 7.4%) proportions of respondents. Overall 7.8 % respondents are found to have appropriate knowledge of foods containing iron and 4.7 has appropriate knowledge of health problems related to iron deficiency. Only 2.4% respondents has appropriate knowledge of foods containing iodine and 3.7% has appropriate knowledge of health problems related to iodine deficiency. About 7.4% respondent has appropriate knowledge of foods containing Vitamin A and 1.5 % has appropriate knowledge of health problems related to Vitamin A deficiency.

Table 5: Knowledge regarding micronutrients

	North	North Central	Central	South Central	South	Malé	Total
N	**488**	**530**	**579**	**515**	**554**	**600**	**3266**
Knowledge about iron	74.0	66.8	80.5	60.8	78.0	83.0	74.2
Knowledge about iodine	80.3	76.6	88.1	78.4	82.7	87.5	82.5
Knowledge about Vitamin A	71.5	72.5	83.6	67.2	79.8	84.5	76.9
*Appropriate knowledge of foods containing micronutrients							
Foods containing Iron	6.6	4.0	10.5	5.8	8.8	10.5	7.8
Foods containing Iodine	1.8	1.7	2.9	1.9	2.7	3.0	2.4
Foods containing Vitamin A	6.1	4.7	9.5	6.0	8.1	9.3	7.4
**Appropriate knowledge regarding health problems related to micronutrient deficiency							
Iron	3.3	1.9	8.3	4.3	3.8	5.8	4.7
Iodine	2.3	3.2	6.0	5.6	2.2	3.0	3.7
Vitamin A	1.0	0.9	2.8	1.6	0.2	2.3	1.5

* knowledge taken as appropriate if the response to question regarding foods containing Iron was foods from animal sources, and vegetables and fruits. For foods containing Iodine, appropriate response was taken to be red or white meat, fruits and vegetables and for foods containing Vitamin A, right response was food from animal sources,

**knowledge regarding health problems related to micronutrient deficiency, was considered appropriate if : For iron deficiency, the response was behavioral problems, lethargy/loss of appetite /breathlessness, failure to grow at expected rate, anaemia For Iodine deficiency, appropriate responses included goitre, cretinism, mental retardation/IQ loss/brain damage; For Vitamin A deficiency, right responses were night blindness and rough or dry skin.

1.4.2: Perceptions Regarding Foods Containing Micronutrients

To pursue the perception regarding the foods containing micronutrients, our questionnaire probed respondents to identify all sources for micronutrients.

Regarding foods containing Iron, overall 38.9% respondent reported that vegetables and fruits contained iron and 14.4% respondent reported that food from animal sources (liver/beef/mutton /chicken /fish /egg) contained iron.

Regarding foods containing Iodine, overall 47.4% respondents reported that iodized salt contained iodine and 24.4% mentioned food from animal sources (liver/beef/mutton /chicken /fish /egg.)

Regarding foods containing Vitamin A, overall 48.3% respondents reported that vegetables/fruits contained Vitamin A and 13.9% respondents mentioned food from animal sources (liver/beef/mutton /chicken /fish /egg).

Table 6: Perceptions regarding foods containing micronutrients

	North	North Central	Central	South Central	South	Malé	Total
N	**488**	**530**	**579**	**515**	**554**	**600**	**3266**
What foods contain Iron? †							
Vegetables and fruits	40.2	38.9	39.9	25.4	45.8	42.3	38.9
Animal source food (liver/beef/mutton /chicken /fish /egg)	11.1	6.6	17.6	11.8	17.3	20.2	14.4
Lentils/beans	3.1	2.1	8.1	5.2	4.0	4.5	4.6
Others	3.7	13.4	9.8	7.8	5.2	15.7	9.5
Don't Know	53.1	52.1	46.8	61.2	41.7	38.7	48.5
What foods contain Iodine? †							
Iodized Salt	42.2	35.8	60.6	42.5	41.0	59.3	47.4
Liver/Meat products/Fish	25.0	26.0	30.6	22.3	22.7	18.8	24.2
Dairy Products	0.6	1.5	2.2	1.9	1.1	1.3	1.5
Vegetables and fruits	4.3	3.6	8.3	6.0	8.7	6.7	6.3
Others	3.3	8.1	6.2	7.2	10.3	7.7	7.2
Don't Know	39.3	42.8	23.8	40.0	36.8	28.2	34.8
What foods contain Vitamin A? †							
Vegetables/fruits	46.5	43.6	50.1	37.9	54.7	55.2	48.3
Animal source food (Liver/Meat/fish/egg)	11.7	11.3	15.7	13.4	12.1	18.2	13.9
Lentils/Beans	1.6	0.9	3.6	2.3	2.0	1.7	2.1
Drumstick leaves	7.4	8.9	14.5	11.8	4.9	8.5	9.4
Others	5.3	8.3	2.8	2.1	6.0	11.7	6.1
Don't know	44.9	44.5	39.6	50.7	36.5	32.5	41.1

† Percentages based on multiple responses

1.4.3: Perceptions Regarding Health Problems Caused by Micronutrient Deficiency

To assess knowledge about health problems caused by micronutrient deficiencies, respondents were asked to identify specific causes. According to the findings, the majority (24.1%) of the respondents mentioned that anaemia may occur because of Iron deficiency and 9.9% respondents mentioned that Iron deficiency may lead to lethargy/loss of appetite/breathlessness.

Table 7: Perceptions regarding health problems caused by micronutrient deficiency

	North	North Central	Central	South Central	South	Malé	Total
N	**488**	**530**	**579**	**515**	**554**	**600**	**3266**
Health problems caused by Iron deficiency †							
Anaemia	25.8	17.7	32.6	20.2	19.0	28.0	24.1
Multiple complications (repeated infections/poor eyesight/weak bones/skin related problems etc.)	9.8	7.4	7.1	7.2	13.5	11.7	9.5
Lethargy/loss of appetite/breathlessness	6.6	8.7	13.5	7.8	12.3	10.0	9.9
Failure to grow at the expected rate	1.8	1.9	1.9	1.6	3.1	3.0	2.2
Abortions/stillbirths/growth retardation of foetus)	0.2	0.2	3.5	1.0	1.8	1.5	1.4
Behavioural problems	1.6	0.4	0.7	1.0	0.7	1.5	1.0
Others	1.0	4.5	2.9	4.5	6.9	6.0	4.4
Don't Know	61.7	65.3	52.8	67.0	54.7	53.7	58.9
Health problems caused by iodine deficiency †							
Mental retardation /IQ loss/brain damage	26.8	21.7	30.1	22.1	21.7	20.2	23.7
Goitre	12.7	8.3	12.6	13.2	8.5	11.7	11.1
Multiple complications (poor eyesight/anaemia/skin problems/weakness etc.)	9.4	9.6	6.7	7.2	17.5	18.8	11.7
Impaired growth and development	6.1	6.2	7.3	4.3	5.8	6.0	6.0
Cretinism	4.9	2.6	7.8	3.1	2.5	4.0	4.2
Others	1.2	4.7	4.5	3.7	3.8	3.8	3.7
Don't Know	50.2	54.9	45.6	56.9	48.7	47.8	50.5
Health problems caused by Vitamin A deficiency †							
Multiple complications (loss of vision/anaemia/Loss of IQ/weakness etc.)	10.2	13.8	7.4	11.7	25.3	19.3	14.8
Night blindness	13.7	10.4	19.5	11.1	9.0	19.2	14.0
Rough and dry skin	6.8	6.4	8.5	6.2	6.3	11.7	7.7
Growth retardation	6.4	7.4	8.8	4.3	5.4	4.0	6.0
Vulnerability to infections	7.0	2.8	4.7	4.9	2.5	3.0	4.1
Abortions/stillbirths/growth retardation of foetus	0.8	0.9	3.3	3.5	3.4	0.8	2.1
Don't know	62.5	64.9	57.3	66.6	54.0	50.7	59.0

† Percentages based on multiple responses

1.4.4: Knowledge and Use of Iodized Salt:

Surprisingly, 91.1% respondents were aware of iodized salt and 99.2 % reported use of iodized salt for cooking. Some regional variation was found with respondents in the North Central being comparatively less aware about iodized salt (85.5%).

Meanwhile, salt was tested with the Iodine test kit to check the iodine content. The kit tests salt with drops of stabilized starch based solution, which causes chemical reaction manifested by colour change. This provides a semi quantitative estimate of Iodine concentration at four levels based on the intensity of the change in colour – 0, 7 PPM, 15 PPM, and 30 PPM. The cut-off proportion of 15 PPM and above was considered as adequately iodized salt using the WHO/UNICEF reference indicators for monitoring of iodized salt.

According to the test, the proportion of households using adequately iodized salt was about 96.5%.

Table 8: Knowledge and Use of Iodized Salt

	North	North Central	Central	South Central	South	Malé	Total
N	488	530	579	515	554	600	3266
Knowledge and use of iodized salt							
Have you heard about iodized salt?	87.9	85.5	98.1	92.6	86.5	94.8	91.1
Are you using iodized salt for cooking?	99.4	99.1	99.8	99.6	98.4	99.0	99.2
Quantity of iodine in salt							
Non iodized – 0 PPM	0.4	1.5	0.5	0.2	0.5	0.3	0.6
7 PPM	0.0	0.6	0.0	0.0	0.5	0.0	0.2
15 PPM	0.6	4.2	3.3	0.8	0.9	1.0	1.8
30 PPM	95.7	90.6	93.3	95.5	96.9	96.0	94.7
No Salt in house	0.8	0.6	1.7	0.2	0.9	0.8	0.9
Salt not tested	2.5	2.6	1.2	3.3	0.2	1.8	1.9

1.4.5: Use of Tea and Coffee

We collected information about tea/coffee intake and attempted to determine the frequencies of its use and to determine the association of tea/coffee intake with iron deficiency status. Studies have shown that the absorption of micronutrients is strongly influenced by the blending of foods eaten in a given meal. Suitable food combinations to increase the amount of non-haem-Fe iron absorbed include foods rich in vitamin C, flesh foods of animals, birds, fish and other seafood, provided they are consumed at the same meal. Drinking tea or coffee at the same meal or shortly after has a marked inhibitory effect on Fe (ferritin) absorption. It is believed that the tannins contained in tea and coffee, when taken with meals, strongly restrain iron assimilation. According to Krause and Mahan tea consumed during meals can decrease the absorption of iron from the meal by as much as 50 percent (Krause and Mahan, 1984). It is therefore imperative to know about the practice of consuming tea and coffee in the population to have a clue of its association with Iron deficiency anemia if the latter prevails.

We found that 92% of the total population were taking tea/coffee, and out of those 60% are taking immediately after meals. The patterns of intake were similar in all regions of Maldives. Majority of the population (88%) were taking tea/coffee on a daily basis.

Table 9: Use of Tea and Coffee by region

	North	North Central	Central	South Central	South	Malé	Total
Do you drink tea or coffee? **N**	488	530	579	515	554	600	3266
Yes	95.9	92.5	93.8	90.7	94.8	88.0	92.5
Drink tea//coffee immediately after meal?(N)	468	490	543	467	525	528	3021
Yes	66.9	62.2	56.9	63.2	48.8	61.9	59.7
How often you drink tea/coffee? N	468	490	543	467	525	528	3021
Usually, every day	89.5	88.4	88.4	87.2	90.3	84.7	88.1
1-6 times/week	4.9	8.8	8.1	9.0	4.4	9.5	7.4
Once per week	3.6	1.6	2.0	1.7	2.5	2.5	2.3
Less than once per week	1.5	0.6	1.1	0.6	2.3	3.2	1.6
Don't know	0.4	0.6	0.4	1.5	0.6	0.2	0.6

1.4.5.1 Association of reported use of tea/coffee with iron deficiency anemia among Women of reproductive age

We attempted to determine if the population's tea/coffee drinking habit were associated with iron deficiency. The study showed that iron deficiency was most prominent among mothers who were taking tea/coffee (p-value = 0.03).

Association of reported uses of tea/coffee with iron deficiency anemia among women of reproductive age

Reported taking tea/coffee	Iron deficiency anemia		
	Women of reproductive age		
	YES	NO	Total
N	1,102	81	1,183
Taking tea /Coffee	166 (15.1%)	5 (6.2%)	171 (14.5%)
Not taking tea/Coffee	936 (84.9%)	76 (93.8%)	1,012 (85.5%)
p-value	0.028		

SECTION II: WOMEN OF REPRODUCTIVE AGE (15 TO 49 YEARS OF AGE) (WRA)

2.1: Health Status of Women of Reproductive Age by Region

In total 2313 forms were filled from women of reproductive age to assess the health status. One women of reproductive age were selected from each targeted household to acquire this information. The study shows that most common complaints of illness among women of reproductive age were headache (34.5 %), flu (24.7%), constipation (22.7. %), and abdominal pain (15.6 %).

Table 10: Health Status of Women of Reproductive Age by region

	North	N. Central	Central	S. Central	South	Malé	Total
Number of women	**329**	**381**	**394**	**415**	**367**	**427**	**2313**
Current illness†							
Headache	36.8	39.1	38.1	31.6	37.9	25.3	34.5
None	30.4	27.8	27.2	32.5	33	50.4	33.9
Flu	16.7	27	25.1	30.1	31.3	17.3	24.7
Constipation	24.9	23.1	25.1	24.8	23.2	15.7	22.7
Abdominal pain	17.6	16.5	18	18.8	15	8.2	15.6
Cough	11.9	19.4	13.5	13.3	15.3	9.8	13.8
Weakness	14	13.4	12.9	12.8	15.8	8.4	12.8
Skin rash, boils	12.2	15	17.8	12.5	10.4	8.4	12.7
Difficulty in breathing	14.3	10.8	15.5	13.3	10.1	8.7	12
Fever	4	9.4	4.6	8.9	11.2	4	7
Difficulty at micturation	9.4	8.1	4.3	6.3	4.4	3.5	5.9
Others	7.6	8.1	1.3	6	3.3	7.3	5.6
Vomiting	3.6	4.5	4.1	4.3	4.1	2.3	3.8
Hypertension	2.4	2.1	4.1	2.2	0.8	2.8	2.4
Diarrhoea/Dysentery	1.2	1.3	1.3	1.7	1.4	0.9	1.3
Worm infestation in last 1year	5.5	5.2	7.6	6.0	5.7	5.2	5.9
Reported use of de-worming medication in the last one year	94.4	60.0	90.0	80.0	57.1	81.8	77.9
Illness in past 1 year for which hospitalization was needed	19.1	20.7	24.9	20.0	22.1	16.2	20.4
Illness categories†							
Aches/pains	15.9	24.1	11.2	19.3	18.5	10.1	16.5
Fever/flu	23.8	19	9.2	16.9	8.6	2.9	13.1
Surgery/accidents	15.9	5.1	14.3	8.4	14.8	18.8	12.7
Pregnancy related causes (delivery/miscarriage etc)	7.9	16.5	5.1	13.3	8.6	20.3	11.6
Others	9.5	15.2	11.2	7.2	14.8	7.2	11
Infections	11.1	11.4	10.2	13.3	7.4	4.3	9.7
Diarrhoea/dehydration	7.9	6.3	6.1	13.3	8.6	8.7	8.5
General weakness	12.7	7.6	8.2	8.4	6.2	1.4	7.4
Missing	9.5	5.1	33.7	9.6	23.5	36.2	20.1
Number of women	329	381	394	415	367	427	2313

† Percentages based on multiple responses

Only 5.9 % women were diagnosed with worm infestation, whereas 77.9 % of the women said that they had received de-worming medicine in the last one year. A total of 20.4 % women were hospitalized in the last one year for aches/pain, 16.5 % of fever/flu and 13.1 % of surgery/accidents respectively whereas 11.6% were hospitalised for pregnancy related causes (delivery/miscarriage etc).

2.2: Marital and Current Living Status of Women of Reproductive Age:

Following information is presented on women who have had at least one child. A total of 1945 women respondents were in this category. Majority of these women (95 %) were married and 92.3 % of them were living with their husbands.

Table 1: Percentage Distribution of marital and current living status of women of reproductive age

	North	N. Central	Central	S Central	South	*Malé*	Total
Number of women	**267**	**323**	**326**	**362**	**301**	***366***	**1945**
Marital status of women							
Currently married	93.6	96.9	95.1	96.7	91.7	*95.4*	95.0
Widowed	0.4	0.3	0.9	1.4	0.3	*0.5*	0.7
Divorced	5.6	2.8	4.0	1.7	7.6	*4.1*	4.2
Others	0.4	0.0	0.0	0.3	0.3	*0.0*	0.2
Current status of married women							
Living with husband	92.0	88.2	89.7	97.7	86.6	*97.4*	92.3
Living separately in different HH	0.0	0.0	1.9	0.3	0.7	*0.6*	0.6
Husband working in another island	8.0	11.5	5.5	1.4	12.3	*2.0*	6.4
Others	0.0	0.3	2.9	0.6	0.4	*0.0*	0.7
Age distribution of married women							
15 – 20 Years	2.8	0.6	1.6	1.4	2.9	*3.2*	*2.1*
21 – 25 Years	13.3	16.3	30.1	19.3	18.2	*17.5*	*19.3*
26 – 30 Years	28.6	32.6	29.4	33.7	28.7	*32.1*	*31.1*
31 – 35 Years	26.2	25.2	15.5	20.7	21.1	*22.9*	*21.8*
36 – 40 Years	15.3	15.0	14.2	13.8	17.1	*16.6*	*15.3*
41 – 45 Years	8.5	6.1	4.5	8.4	8.4	*5.7*	*6.8*
>45 Years	5.2	4.2	4.5	2.6	3.6	*2.0*	*3.6*
Mean age	32.1 (31.3-33.0)	31.7 (30.9-32.4)	30.1 (29.3-30.9)	30.9 (30.2-31.6)	31.5 (30.7-32.4)	*30.9 (30.2-31.5)*	*31.2 (30.8-31.5)*
N	248	313	309	347	275	*349*	*1841*

2.3: Pregnancy Details per Woman

The study shows that 45.6 % of the women became pregnant once or twice whereas only 14.3 % of the women became pregnant five or six times.

Table 12: Pregnancy details per woman

	North	N Central	Central	S Central	South	Malé	Total
Number of women	**267**	**323**	**326**	**362**	**301**	**366**	**1945**
Number of pregnancies							
Missing information	0.4	0.0	0.3	0.0	0.3	2.5	0.6
1 – 2 times	34.8	42.7	47.9	42.3	49.5	53.8	45.6
3 – 4 times	28.5	30.0	27.6	29.6	22.3	28.7	27.9
5 – 6 times	18.0	14.6	13.8	14.4	16.6	9.8	14.3
7 – 8 times	9.4	7.4	6.4	8.3	6.0	2.5	6.5
>8 times	9.0	5.3	4.0	5.5	5.3	2.7	5.1
Average # of pregnancies/women	4.07±2.7	3.5±2.4	3.2±2.2	3.6±2.4	3.3±2.4	2.7±2	3.4±2.4
Pregnancy outcome							
Average # of miscarriages/woman	0.39±0.98	0.26±0.63	0.22±0.5	0.22±0.5	0.22±0.62	0.29±0.71	0.26±0.67
Average # of stillbirths/woman	0.029±0.2	0.09±0.4	0.03±0.2	0.02±0.17	0.05±0.3	0.05±0.2	0.04±0.3
Average # of live births/woman	3.64±2.5	3.07±2.2	2.12±2.3	1.28±2.4	3.01±2.2	2.4±1.7	2.5±2.3
Children mortality	21.34	14.24	19.01	18.23	14.61	6.55	15.37
Distribution of average mortality by age							
Early neonatal deaths(0–7 days)	0.09±0.32	0.12±0.45	0.08±0.44	0.08±0.32	0.07±0.67	0.02±0.2	0.08±0.4
Late neonatal deaths(8 – 28 days)	0.03±0.16	0.009±0.09	0.01±0.12	0.01±0.10	0.03±0.17	0.005±0.07	0.01±0.12
Post neonatal deaths(29–364 days)	0.03±0.16	0.03±0.19	0.02±0.15	0.04±0.21	0.04±0.24	0.03±0.22	0.03±0.20
Child deaths(12 – 59 months)	0.04±0.18	0.01±0.15	0.02±0.14	0.03±0.19	0.01±0.13	0.008±0.15	0.02±0.16
Child deaths(5 – 15 years)	0.02±0.13	0.01±0.11	0.01±0.1	0.01±0.13	0.006±0.08	0.003±0.05	0.01±1.0
Average deaths (All ages)/woman	0.2±0.5	0.19±0.5	0.15±0.6	0.18±0.5	0.17±0.81	0.07±0.35	0.16±0.55

2.4 Antenatal care Seeking Behaviour

Overall, nearly 97 % of the women sought antenatal care (ANC) during their latest pregnancies. The majority of these women sought it from gynaecologists (89.4 %) while 9.3 % sought it from other doctors. Women did not experience the role of CHW/FHW/TBA as ANC providers. Majority of the women – about

(45 %) – received ANC during the first month of pregnancy. In fact, almost 83% women made their first ANC visit in the first trimester. Over 93% of women reported to receive antenatal care on more than 4 visits. Nearly 85.3 % of the women were counselled regarding eating more nutritious food, 83.4 % on exclusive breast feeding, 77.6 % about extra rest whereas 55.1 % on smoking and drug use.

Table 2: Details of Antenatal Care (ANC) visits during last pregnancy

	North	North Central	Central	South Central	South	Malé	Total
N	**267**	**323**	**326**	**362**	**301**	**366**	**1945**
Sought Antenatal Care	98.1	97.2	96.3	99.4	96.7	94.3	97.0
Examined by whom	**262**	**314**	**314**	**360**	**291**	**345**	**1886**
Gynaecologist	82.8	79.6	84.4	94.2	93.8	99.4	89.4
Other doctor	15.6	17.2	15.3	3.9	5.2	0.9	9.3
CHW/FHW/traditional birth attendant	1.5	2.2	3.5	0.8	0.3	0.0	1.4
Others	0.8	2.9	1.6	1.4	1.4	0.0	1.3
Time of first ANC visit							
Within first month of pregnancy	44.3	40.8	36.3	49.2	46.0	52.2	45.0
First trimester	79.39	76.75	75.16	85.56	86.60	92.75	82.98
Second trimester	16.79	18.79	18.47	10.00	9.28	5.22	12.83
Last trimester	1.91	1.27	4.46	3.33	2.41	0.58	2.33
Don't know	1.91	3.18	1.91	1.11	1.72	1.45	1.86
Number of ANC visits							
Once	1.1	3.5	2.9	0.6	6.9	0.3	2.4
Twice	3.1	1.6	2.2	0.6	1.7	0.3	1.5
Thrice	1.9	1.6	2.9	0.8	0.3	0.3	1.3
Four times	0.8	2.6	1.0	1.4	2.8	0.9	1.5
More than four times	93.1	90.7	91.1	96.7	88.3	98.3	93.2
ANC parameters							
Weight measurement	98.5	97.1	97.1	99.2	98.3	99.7	98.4
BP measurement	95.8	95.2	93.6	98.9	97.9	99.7	97.0
Urine sampling	91.2	88.9	90.8	94.7	96.9	96.2	93.2
Blood sampling	90.8	89.2	92.0	93.9	96.9	98.8	93.7
Ultrasound scan	81.3	82.8	89.2	86.4	90.7	98.3	88.4
Others	2.3	3.5	1.3	0.8	1.4	4.3	2.3
Counselling provided during ANC							
Eating more nutritious food	87.4	88.9	90.1	83.3	80.4	82.0	85.3
Exclusive breast feeding	85.5	87.6	90.1	77.5	79.4	81.4	83.4
Anti-smoking and drug misuse	45.4	53.2	64.6	51.7	53.3	60.6	55.1
Extra rest	78.6	78.3	86.0	70.6	77.0	76.2	77.6
Others	2.3	2.9	1.6	3.1	2.4	7.2	3.3
None	6.5	4.5	6.1	10.6	11.3	11.0	8.4
ANC Card status							
Health Record Card not available	40.4	53.3	62.9	73.8	67.4	56.3	59.7
Card available	55.4	35.3	28.8	16.9	25.2	40.4	33.0
No card available	4.1	11.5	8.3	9.4	7.3	3.3	7.4

2.5: Signs of Vitamin A Deficiency, Difficulty in Seeing Clearly at Dusk, Status of Health Record

Majority of the women mentioned that they did not experience any difficulty in seeing clearly at dusk during their latest pregnancy while only 3.4% married women reported having this difficulty during their latest pregnancy. Regarding supplementation with iron tablets/syrup during last pregnancy, only 71.3 % said that they had either received or bought iron supplements. Nearly 33 % of the women reported having health record, whereas only 11.3 % of the women had received drugs for intestinal worms during their latest pregnancy.

Table 14: Feeling difficulty in seeing clearly, and medication for worm infestation during last pregnancy

	North	N. Central	Central	S. Central	South	Malé	Total
Number of women	**267**	**323**	**326**	**362**	**301**	**366**	**1945**
Feeling difficulty in seeing clearly at dusk	2.6	3.4	4.9	2.5	4.3	2.7	3.4
Reported use of iron folate tablets/syrup	76.0	64.1	66.3	74.0	68.8	77.9	71.3
Use of drugs for worm infestation	12.7	11.1	17.2	11.9	11.0	4.6	11.3

2.6 : Physical Examination of Women of Reproductive Age

Micronutrients are vitamins and minerals required in minute amounts by the body for normal growth and development and include iron, iodine and vitamins. During the cross sectional survey, physical examination was performed on 1511 reproductive age women to assess the status of micronutrient deficiencies (looking for clinical anaemia, Vitamin A deficiencies, iodine deficiencies, and zinc deficiency).

2.6.1: Health Status of Women of Reproductive Age

Community Health Workers (CHW) performed clinical examination for oedema, jaundice, pallor, thyroid and goitre examination for women of reproductive age, the figure below shows the findings of physical examination.

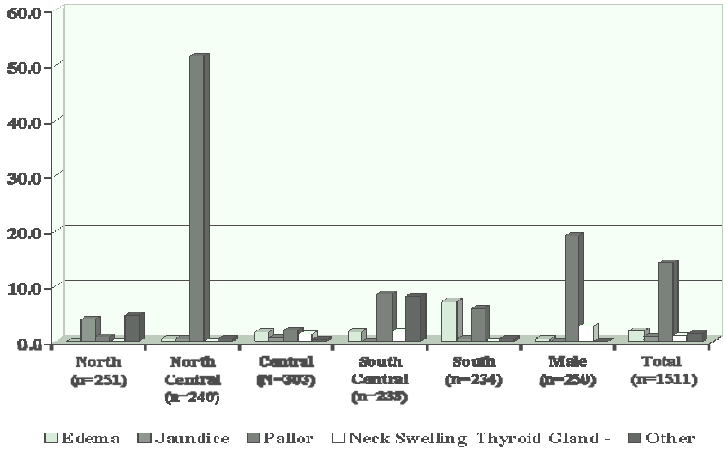


Figure 4: Health Status of Women of Reproductive Age

The proportion of pallor was found to be high in some regions. The proportion was more remarkable for women in the North Central region, probably due to the high rates of anaemic women in the area, or because of the difficulty in distinguishing pallor from other pale conditions.

2.6.2: Goitre Examination

Community Health Workers also examined women for goitre during the survey. Findings show that overall only 0.8% women are with goitre. The highest proportion (2.1%) with grade II goitre was found in the South Central region.

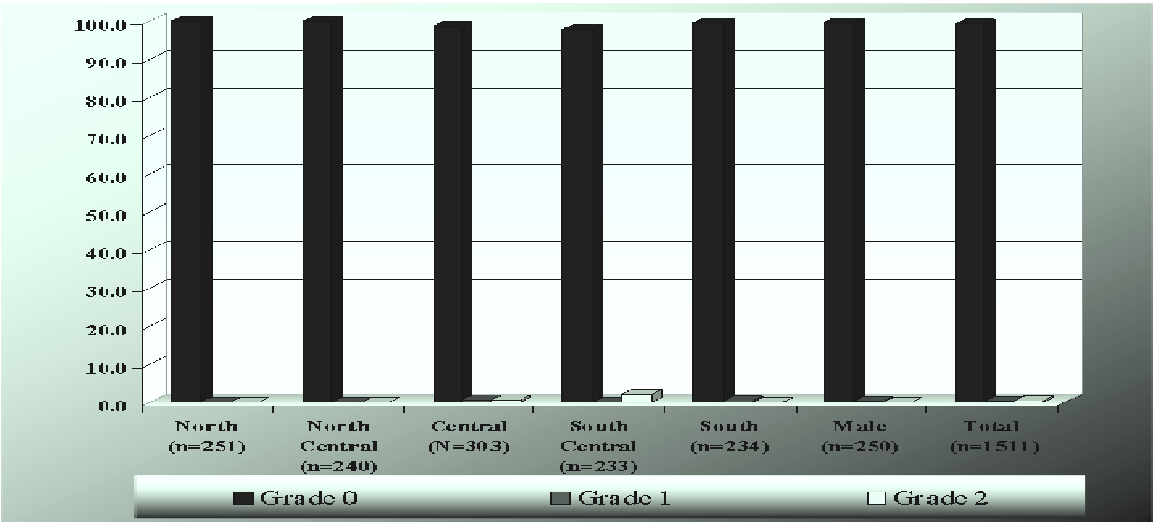


Figure 5: Goitre Examination

2.7: Results of Biochemical Analysis on Women of Reproductive Age

Analysis was done on important and essential biochemical assessments to determine the status of micronutrient deficiencies described below in women of reproductive age and children 6 months to 5 years.

Vitamin Deficiencies: Vitamin A is an essential micronutrient required for normal vision, growth and development, immune function and reproduction. Vitamin A deficiency is a contributing factor in the 2.2 million deaths each year from diarrhoea among children under 5 and nearly 1 million deaths from measles. Severe deficiency can also cause irreversible corneal damage, leading to partial or total blindness.

Iodine: Iodine deficiency leads children to suffer from varying degrees of brain damage, physical impairment, mental retardation and goitres.

Zinc: Zinc deficiency is associated with complications of pregnancy and birth outcomes, impaired immune function, and increased duration and severity of diarrhoea in children. It also causes growth retardation, and several studies have shown that zinc supplementation can produce significant growth response in height and weight-for-height.

Iron: Iron deficiency anaemia adversely affects the cognitive ability of children. It is estimated that the decline of half a standard deviation in adult IQ and cognitive test performance is the outcome of iron deficiency anaemia in child hood.[4]

2.7.1: Haemoglobin Levels with CI and % Estimates of Anaemia

Haemoglobin results were given for a total of 1284 respondents. The result of biochemical analysis shows that the prevalence of anaemia among women is low. Overall 15.4% women of reproductive age were found to be anaemic to some degree: 0.3% was severely anaemic and 15.1% moderately anaemic. Regional variations are noted in the prevalence of anaemia. Moderate anaemia in the North region is found to be comparatively higher (27%) and lower in the South region (7%). The result of anaemia prevalence does not match with the result of the physical examination of pallor in the North Central region (12.6%, slightly lower than the national average) and hence can be confirmed that it was a faulty recognition of paleness.

Table 3: Hemoglobin levels with CI and prevalence

	North	North Central	Central	South Central	South	Malé	Total
Valid N	**208**	**207**	**210**	**209**	**207**	**243**	**1284**
Mean Haemoglobin (95% CI)	11.8 (11.6-12.1)	12.4 (12.1-12.6)	12.4 (12.2-12.6)	12.7 (12.4-13)	12.4 (12.2-12.6)	12.0 (11.8-12.2)	12.2 (12.1-12.3)
Severe anaemia (<7 g/dl)	0.0	0.5	0.0	0.5	0.0	0.4	0.3
Moderate anaemia (7-10.9 g/dl)	26.9	12.6	11.9	10.5	6.8	17.3	15.1
Normal (>=11 g/dl)	73.1	87.0	88.1	89.0	93.2	82.3	84.6

Sample size is weighted to account for sample design

2.7.2: Ferritin Levels with CI and Prevalence Estimates at Standard Cut-off

Overall, 38.4% women of reproductive age were found to be iron deficient. Regional differences in the prevalence of iron deficiency are substantial, ranging from 33 % in the South Central to 44.2 % in the South. The minimum sample size for biochemical sample size were 1260 and ferritin results given for 1304 women.

Table 4: Ferritin levels with CI and prevalence

	North	North Central	Central	South Central	South	Malé	Total
Valid N **Unadjusted**	218	210	212	212	208	244	1304
Mean Ferritin,(95% CI)	34.3 (27.7-40.8)	34.2 (27.9-40.5)	37.2 (27.9-46.5)	39.5 (33.5-45.5)	30.1 (25.3-34.9)	32.8 (29.2-36.4)	33.7 (31.2-36.2)
<20 ng\ml	41.3	41.9	39.6	33.0	44.2	34.8	38.4
≥20 ng\ml	58.7	58.1	60.4	67.0	55.8	65.2	61.6

[4] Ross J; Horton

Adjusted N for CRP	214	204	202	205	201	239	1265
Mean Ferritin,(95% CI)	34.1 (27.6-40.6)	34.3 (28-40.6)	35.8 (26.6-45.0)	39.9 (33.8-46.0)	29.4 (24.5-34.3)	32.5 (28.9-36.2)	33.4 (30.9-35.9)
<20 ng\ml	41.6	41.7	40.6	33.2	44.8	35.6	38.9
≥20 ng\ml	58.4	58.3	59.4	66.8	55.2	64.4	61.1

Sample size is weighted to account for sample design

2.7.3: Zinc Levels with CI and Prevalence Estimates at Standard Cut-off

Overall, 26.8 % women of reproductive age were found with zinc deficiency. The lowest prevalence was reported in Central region (13.4%) and the highest in North region (54.6%). The minimum sample size for biochemical sample size were 1260 and Zinc results given for 1282 women.

Table 5: Zinc levels with CI and prevalence

	North	**N. Central**	**Central**	**S. Central**	**South**	**Malé**	**Total**
Valid N	**216**	**209**	**202**	**209**	**203**	**243**	**1282**
Mean Zinc (95% CI)	59.7 (58.1-61.2)	73.8 (69.9-77.7)	74.0 (71.2-76.8)	63 (60.1-65.8)	65.9 (63.6-68.1)	74.0 (71-77)	69.5 (68.2-70.8)
<60 ug\dl	54.6	15.3	13.4	43.1	32.0	16.9	26.8
>60 ug\dl	45.4	84.7	86.6	56.9	68.0	83.1	73.2

Sample size is weighted to account for sample design

2.7.4: Vitamin A (Unadjusted) Levels with CI Prevalence at Standard Cut-off

The table below describes the distribution of Vitamin A (unadjusted) levels by region. The mean level for Vitamin A was 46.5% (44.4-48.6) for all regions with the lowest mean for South and Malé 43.3 (39.5-47.2) and the highest for North 53.4(46.6-60.3). Regarding vitamin A deficiency, overall 4.7% women of reproductive age were severely deficient in Vitamin A and 39.3% were moderately deficient. The high prevalence (6%) of severe Vitamin A deficiency was in North region and moderate Vitamin A deficiency was found in Malé region (45.5). The minimum sample size for biochemical sample size were 1260 and Vitamin 'A' results given for 1297 women.

Table 6: Vitamin A (unadjusted) levels with CI prevalence

	North	**North Central**	**Central**	**S. Central**	**South**	**Malé**	**Total**
Valid N	**218**	**209**	**211**	**210**	**207**	**242**	**1297**
Mean vitamin A (95% CI)	53.4 (46.6-60.3)	49.8 (46.0-53.6)	49.9 (45.5-54.4)	44.5 (40.6-48.3)	43.3 (39.5-47.2)	43.3 (39.5-47.2)	46.5 (44.4-48.6)
Low (<20 ug/dl)	6.0	3.3	2.8	3.3	3.9	5.8	4.7
Moderate (20-40 ug\dl)	25.2	31.1	28.9	44.3	44.0	45.5	39.2
High (>40 ug\dl)	68.8	65.6	68.2	52.4	52.2	48.8	56.1

Sample size is weighted to account for sample design

2.7.5: Medians of urinary iodine results

Only 1.4% women of reproductive age were found with severe iodine deficiency, 8% with moderate and 17.4% were with mild iodine deficiency. Majority of severely and moderately deficient women belonged to Malé region.

Table 7: Medians of urinary iodine results

	North	North Central	Central	South Central	South	Malé	Total
Urinary Iodine (Valid N)	**215**	**208**	**211**	**205**	**204**	**234**	**1277**
Median UI, IQR	149.6 (96.4-225.9)	157.4 (89.5-242.0)	157.0 (102.5-223.0)	145.7 (84.5-219.7)	205.8 (13.5.1-292.2)	147.3 (83.7-218.7)	159.0 (97.5-234.2)
Severe (<20 mcg/L)	0.9	1.0	1.4	1.5	1.5	1.7	1.4
Moderate (20-49.9 mcg\L)	9.3	10.1	5.7	8.8	3.4	9.0	8.0
Mild (50-99.9 mcg\L)	16.7	16.8	17.1	19.0	12.3	19.7	17.4
No deficiency (>100 mcg\L)	73.0	72.1	75.8	70.7	82.8	69.7	73.3

Sample size is weighted to account for sample design

SECTION III: CHILDREN 6 MONTHS TO 5 YEARS OF AGE

3-Feeding Behaviour and Practices

Breastfeeding practices and introduction of complementary foods are important determinants of the nutritional status of children, particularly those under the age of two years. With improved nutritional status, the risk of mortality among children under five years can be reduced and their psycho-motor development enhanced. Early breastfeeding practices determine the successful establishment and duration of breastfeeding. To assess the feeding behaviour and practices Module G were filled from 2273 mother/care takers of children 6months to 5 years of age children.

3.1: Child Feeding Characteristics

3.1.2: Breastfeeding

Our survey showed that Breastfeeding rates were found to be high (98.9%) in all six regions of Maldives. Overall, timely initiation (within one hour of birth) was reported for 80.5% of the children. The lowest percentage of early initiation was in Malé region (68.9%) while the highest was in the central region (89.4%). Nearly 94.5% of the children were breastfeed within 24 hours of birth.

Table 20: Distribution of breastfeeding practices

	North	North Central	Central	South Central	South	Malé	Total
N	**327**	**378**	**385**	**391**	**371**	**421**	**2273**
Did you ever breastfeed?	99.1	99.5	98.4	99.0	98.4	99.0	98.9
Initiation of breastfeeding							
Within one hour	82.9	77.8	89.4	82.1	83.3	68.9	80.5
1- 12 hours	10.4	13.5	5.2	10.0	10.5	19.7	11.7
13- 24 hours	3.7	5.3	1.8	3.1	1.9	4.3	3.3
>24 hours	2.1	2.9	2.1	3.8	2.7	6.2	3.4
Never	0.9	0.5	1.6	1.0	1.6	1.0	1.1

3.1.3: Prelacteal Feeds

Only 5.2% children received prelacteal feed soon after birth (within a day of birth) and the rest (92.3%) received breast milk as the first feed. About 54.6 % of those mothers who had given pre-lacteal feed to the child instead of breast milk soon after birth cited fears of potential illnesses "*that the direct initiation of breast milk soon after birth may cause physical and mental illness to the child.*" Twenty per cent mentioned cultural practices as the reason.

Table 21: Distribution of prelacteal feed practices

	North	North Central	Central	South Central	South	Malé	Total
Prelacteal feeding (n)	327	378	385	391	371	421	2273
Given	4.9	4.5	3.6	4.6	4.3	9.0	5.2
Not given	94.5	93.9	92.7	91.8	94.1	87.4	92.3
Don't know	0.6	1.6	3.6	3.6	1.6	3.6	2.5
First thing given to child after birth							
Breast milk	94.5	94.4	94.0	92.3	93.8	86.0	92.3
Honey	2.4	2.6	1.3	0.8	1.9	2.6	1.9
Glucose water	1.2	0.5	1.0	1.5	0.3	1.4	1.0
Formula milk	1.2	0.8	1.3	1.3	2.2	4.8	2.0
Others	0.0	0.8	0.5	1.3	1.3	1.7	1.0
Don't know	0.6	0.8	1.8	2.8	0.5	3.6	1.8
Reasons for not breastfeeding N	**18**	**21**	**23**	**30**	**23**	**59**	**174**
Maternal illness	38.9	9.5	8.7	56.7	26.1	18.6	25.9
Child's illness	16.7	14.3	21.7	30.0	21.7	42.4	28.7
Religious/cultural reasons	22.2	52.4	17.4	6.7	26.1	15.3	20.7
Others	11.1	9.5	26.1	3.3	17.4	23.7	16.7
Don't know	11.1	14.3	26.1	6.7	17.4	5.1	11.5

3.1.4: Prevalence of Exclusive Breastfeeding

World Health Organization and the UNICEF recommend that children should be exclusively breastfed for the first six months of life. Considering this recommendation, women were asked "Until what age (in months) was the child exclusively breastfed [Exclusively breastfed means no other intake except breast milk not even water].

Nearly half (50.5%) of the children were exclusively breastfeed for six months and two-thirds (74.6%) of the children had been exclusively breastfed until 4 – 6 months of age. The mean age of children exclusive breastfed is 4.6 months with 1.9 standard deviation. These data must be interpreted with caution as the target age for the survey was 6-59 months of age and the practices in the first 6 months could be subject to recall bias.

Table 8: Distribution of prevalence of exclusive breastfeeding

	North	North Central	Central	South Central	South	Malé	Total
Age of exclusive breast feeding (n)	**324**	**376**	**379**	**387**	**365**	**417**	**2248**
Never exclusively breastfed	4(1.2)	3(0.8)	4(1.1)	1(0.3)	6(1.6)	5(1.2)	23(1.0)
Up to 4 month	261(80.6	282(75.0	303(79.9	317(81.9	261(71.5	30873.9	173277.0
Up to 6 month	191(59.0	196(52.1	189(49.9	197(50.9	180(49.3	182(43.6	1135(50.5
>6 month	11(3.4)	13(3.5)	9(2.4)	8(2.1)	9(2.5)	6(1.4)	56(2.5)
Mean months (SD)	4.9(1.8)	4.5(2.1)	4.7(1.6)	4.8(1.6)	4.4(2.1)	4.4(2.0)	4.6(1.9)

Table 9: Gender-wise distribution of exclusive breastfeeding by region

	North		North Central		Central		South Central		South		Malé		Total	
	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl
N	**133**	**173**	**149**	**190**	**161**	**173**	**159**	**186**	**138**	**117**	**193**	**193**	**933**	**1032**
Never exclusively Breastfed	2.3	0.6	1.3	0.5	2.5	0.0	0.0	0.5	2.9	0.9	1.6	0.5	1.7	0.5
Up to 4 month	79.7	82.7	77.9	73.2	80.7	80.3	78.6	83.3	75.4	70.1	76.7	71.5	78.1	77.1
Up to 6 month	57.9	61.3	56.4	50.5	50.9	51.4	51.6	51.1	51.4	47.9	45.6	42.5	51.9	50.8
>6 month	3.0	3.5	4.7	2.6	2.5	2.3	1.3	2.7	0.7	1.7	1.0	2.1	2.1	2.5
Mean months (SD)	4.9 (1.7)	4.9 (1.8)	4.7 (2.1)	4.5 (2.1)	4.8 (1.7)	4.8 (1.7)	4.7 (1.7)	4.8 (1.7)	4.6 (1.9)	4.3 (2.1)	4.5 (1.9)	4.3 (2.0)	4.7 (1.8)	4.6 (1.9)

3.1.5: Non-human Milk Practices

Non-human milk, either formula or animal, was given to 62.7 % of children. Nearly 32.6% children started non-human milk before four months of age, approximately two-thirds of the children started non-human milk before six months of life. The mean age for initiating non-human milk was 7.0 months though this varied from 5.7 months in Malé to 9.2 months in Central.

Table 10: Distribution of non-human milk (formula and powder milk) practices

	North	North Central	Central	South Central	South	Malé	Total
Initiated non-human milk	40.4	62.2	73.8	67.0	48.2	79.3	62.7
Age of initiation (n)	**132**	**235**	**284**	**262**	**179**	**334**	**1426**
<=4 month	48(36.4)	66(28.1)	68(23.9)	86(32.8)	56(31.3)	141(42.2)	465(32.6)
<= 6 month	100(75.8)	156(66.4)	141(49.6)	191(72.9)	133(74.3)	269(80.5)	990(69.4)
>6 month	32(24.2)	79(33.6)	143(50.4)	71(27.1)	46(25.7)	65(19.5)	436(30.6)
Mean months(SD)	6.1(4.4)	7.2(5.5)	9.2(6.5)	6.8(5.3)	6.5(5.4)	5.7(4.7)	7.0(5.6)

3.1.6: Introduction of Complementary Foods

Liquids were given to 21% of children of ages up to 4 months, 80.8% of these children had received liquids during before 6 months of age. Though these proportions vary among regions, surprisingly, the early initiation of weaning food proportions were high (28.2%) in Malé region which is the capital of Maldives, and the lowest proportions (18.6%) were in central region.

Table 11: Introduction of complementary foods

	North	N. Central	Central	S. Central	South	Malé	Total
N	**324**	**368**	**370**	**390**	**363**	**415**	**2230**
Age of initiation of liquids for the first time N	**324**	**368**	**370**	**390**	**363**	**415**	**2230**
<=4 month	19.1	20.4	18.6	23.6	18.2	28.2	21.6
<=6month	80.9	83.4	67.3	87.2	79.9	85.3	80.8
>6 month	17.9	14.4	30.5	9.2	17.9	13.5	17.1
Mean months(SD)	6.3(3.2)	5.7(2.2)	7.3(4.8)	5.8(3.0)	6.0(3.2)	6.0(4.2)	6.2(3.6)
Age of initiation of solid or semi solid food n	327	377	385	391	370	420	2270
<6 months	18.5	21.0	28.5	25.2	19.9	34.2	24.9
6-8 months	73.8	73.7	65.2	71.2	74.0	62.7	69.8
9-11 months	3.7	1.6	1.8	1.3	2.2	1.0	1.9
12-24 months	4.0	3.8	4.5	2.3	3.8	2.2	3.4
First food given to child (n)	327	377	385	391	370	420	2270
Fruit	84(25.7)	68(18.0)	143(37.1)	89(22.8)	77(20.8)	126(29.9)	58725.8
Vegetable	19(5.8)	14(3.7)	41(10.6)	31(7.9)	15(4.0)	64(15.2)	184(8.1)
Cereals	96(29.4)	81(21.4)	46(11.9)	26(6.6)	19(5.1)	11(6.4)	27(13.0)
poultry/meat	5(1.5)	3(0.8)	13(3.4)	7(1.8)	1(0.3)	6(1.4)	35(1.5)
Rice	42(12.8)	47(12.4)	67(17.4)	53(13.6)	35(9.4)	66(15.7)	310(13.6)
Biscuits	2(0.6)	23(6.1)	11(2.9)	22(5.6)	11(3.0)	11(2.6)	80(3.5)
Yogurt	10(3.1)	12(3.2)	56(14.5)	27(6.9)	17(4.6)	39(9.3)	161(7.1)
Commercial baby food|	115(35.2)	156(41.3)	191(49.6)	273(69.8)	193(52.0)	274(65.1)	1202(52.9)
Others	32(9.8)	45(11.9)	28(7.3)	20(5.1)	61(16.4)	28(6.7)	213(9.4)

3.2: Knowledge, Advantages and Disadvantages of Micronutrient Supplementation

About 29% of the respondents had knowledge about micronutrient supplementation, though these proportions vary among regions, these proportions with knowledge were very low (1.6%) in North central region and very high (56.8%) in Malé.

Table 12: Knowledge, advantages and disadvantages of micronutrient supplementation

	North	S.Central	Central	S. Central	South	Malé	Total
Number of children	**327**	**378**	**385**	**391**	**371**	**421**	**2273**
Knowledge about micronutrient supplements	43.4	1.6	39.7	17.4	14.3	56.8	29.1
Knowledge of the advantages of micronutrient supplements	66.1	74.6	83.9	58.1	63.9	59.9	67.6
Cited advantages of micronutrient supplements †(n)	**216**	**282**	**323**	**227**	**237**	**252**	**1537**
Physical strength	68.1	58.9	81.7	62.1	44.3	69.8	65.0
Mental strength	3.7	5.3	27.2	15.4	8.0	23.4	14.6
Others	14.4	17.7	7.1	27.3	33.8	23.0	19.8

3.3: Health status of children 6 months to 5 years of age

3.3.1: Health Status of Children in the Two Weeks Prior to the Household Visit:

Diarrhoea and ARI symptoms were recalled for every child during the last two weeks at the time of household visit. Regarding ARI symptoms, 39.1% of the children reported the symptoms, most dominating symptom being cough (28.4%) and maximal reporting from the South Central region (33.3%). Overall, 28.4% children were reported to have suffered from cough, 1.8 % from difficulty in breathing, and 8.8 % from both (difficulty in breathing and cough) in the two weeks period.

Regarding diarrhoeal symptoms, only 6.8% of the children reported diarrhoea, especially from the North (9.2%) and Central region (9.9%).

Table 13: Health Status of children in the past two weeks

	North	North Central	Central	South Central	South	Malé	Total
History of cough/difficulty in breathing							
Cough	18.7	31.0	24.4	33.3	32.3	29.3	28.4
Difficulty in breathing	4.9	0.8	1.8	1.5	1.6	1.2	1.9
Both	9.5	11.1	10.1	8.2	5.1	8.8	8.8
None	66.9	57.1	63.6	56.9	61.0	60.7	60.9
History of diarrhoea	9.2	7.7	9.9	4.6	6.2	4.0	6.8
N	**326**	**378**	**385**	**390**	**372**	**420**	**2271**

3.3.2: Current Health Status of the Children

Table 27 shows the current health status of children of ages 6 month to 5 years at the time of the household visit for data collection. Regarding ARI symptoms, 3.6% of the children had both cough and breathing difficulty, the proportion mainly contributed from North (4.3%) and North Central regions (4%). Regarding diarrhoea, only 2% reported to be suffering from diarrhoea at the time of the visit. Other symptoms were also assessed which included flu (40.6%), constipation (23.9%), skin rash (14.9%) and fever (14.4%).

Table 14: Current Health Status of children

	North	N Central	Central	S Central	South	Malé	Total
Number of children	**326**	**378**	**385**	**390**	**372**	**420**	**2271**
History of cough/difficulty in breathing							
Cough	3.1	2.1	2.3	1.5	0.8	0.2	1.6
Difficulty in breathing	3.1	2.1	2.3	1.5	0.8	0.2	1.6
Both	4.3	4.0	3.4	3.6	2.4	3.8	3.6
None	80.4	75.1	79.7	80.3	83.6	78.3	79.5
Cough/difficulty in breathing by observation							
Cough	6.1	1.9	8.3	8.7	3.8	8.3	6.3
Difficulty in breathing	2.8	2.4	1.6	1.5	1.9	0.5	1.7
Both	2.1	1.3	2.3	1.3	0.0	1.4	1.4
None	89.0	94.4	87.8	88.5	94.4	89.8	90.6

Chest in-drawing							
By history	2.8	4.0	2.1	3.1	2.7	2.1	2.8
By observation	1.8	2.9	24.4	2.6	2.7	1.2	6.0
Phenomena case							
By history	1.2	0.8	0.3	0.8	0.0	0.7	0.6
By observation	0.3	0.8	0.0	0.5	0.0	0.2	0.3
History of diarrhoea	2.5	1.1	3.6	2.1	1.9	1.0	2.0
Illness at the time of visit							
Flu	36.5	46.6	36.1	45.6	43.0	35.5	40.6
Fever	12.6	19.3	9.6	21.0	16.4	7.9	14.4
Dysentery	8.3	9.3	9.6	10.3	5.6	3.6	7.7
Vomiting	7.4	10.8	7.5	12.8	10.2	6.7	9.2
Abdominal pain	4.6	8.7	8.1	9.7	5.9	2.6	6.6
Constipation	29.1	29.6	21.3	31.5	16.7	16.2	23.9
Skin rash Boils	12.6	19.3	14.0	22.6	12.9	8.3	14.9
Crying at micturition	2.5	4.0	1.8	3.6	1.9	0.5	2.3
Others	3.7	4.5	1.0	2.8	0.5	2.9	2.6
None	35.9	28.8	36.4	24.1	40.3	46.9	35.5

3.3.3: Overall Health Status of Children 6 Months to Five Years Old:

The table below highlights the other overall health status of the children 6 months to five years old. Night blindness, a complication of Vitamin A deficiency, was present among 0.2% of the subjects. About 25% of the subjects were using medicines for different reasons. The predominant proportion was reported from Malé region (33.6%).

Recall was assessed from the subject to examine for any illness. About 17% responded as being hospitalized. South central region reported the highest percentage (23.3%) of hospitalization; about 50% were hospitalized for fever/flu, followed by diarrhoea/dehydration/vomiting (16%).

Table 15: Percentage distribution of overall health status of children

	North	N. Central	Central	S. Central	South	Malé	Total
N	**326**	**378**	**385**	**390**	**372**	**420**	**2271**
History of night blindness	0.0	0.8	0.3	0.0	0.0	0.2	0.2
Current use of medications	27.0	23.5	23.6	17.9	22.6	33.6	24.8
Hospitalization	16.3	16.1	16.1	23.3	14.2	13.3	16.6
Reasons for child hospitalization (n)	**53**	**61**	**62**	**91**	**53**	**56**	**376**
Flu/Fever	66.0	36.1	38.7	47.3	60.4	55.4	49.7
Diarrhoea/dehydration/vomiting	20.8	16.4	12.9	12.1	26.4	10.7	16.0
Surgery/Accidents	0.0	1.6	0.0	3.3	0.0	3.6	1.6
Infections	1.9	4.9	1.6	3.3	3.8	8.9	4.0
Fits	1.9	1.6	3.2	2.2	5.7	5.4	3.2
Others	7.5	8.2	8.1	5.5	3.8	8.9	6.9
Not mentioned	13.2	42.6	41.9	31.9	20.8	14.3	28.5

3.3.4: Vitamin A Supplementation and Status of Worm Infestation

The table below describes Vitamin A supplementation and the status of worm infestation in children of six months to five years of age. About 23% of the subjects reported to have been diagnosed with worm infestation in the last six months, especially from Central, South-Central and North-Central regions. About 65% of the children reported to have used de-worming medication with significant proportion contributed from North Central (74.9%), North (72.4%) and Central regions (71.2%). Overall, 2.9% of the subjects reported having worm infestation at the time of household visit during data collection, with the highest proportion reported from North region (4.9%). Overall, 69.9% of the subjects received vitamin A capsule supplementation, significantly large percentages were observed in all regions except Malé. Minimum (10%) coverage was reported in Malé region as it is not part of the current ongoing Vitamin A campaign through health system. About 30% reported that they were not advised by health care providers (doctors/health workers), and 26.4 % reported not being aware of Vitamin A supplementation.

Table 30: Vitamin A supplementation and status of worm infestation

	North	North Central	Central	South Central	South	Malé	Total
N	**326**	**378**	**385**	**390**	**372**	**420**	**2271**
H/O worm infestation (%) in the last six months	20.2	23.3	31.2	24.6	18.5	17.9	22.6
Reported use of de-worming medications in the last six months	72.4	74.9	71.2	65.4	52.4	56.0	65.1
worm infestation (%) currently	4.9	3.2	3.9	3.1	1.3	1.2	2.9

Table 30.1: Vitamin A Supplementation and status of worm infestation

	North	North Central	Central	South Central	South	Malé	Total
Vitamin A capsule supplementation (%)	83.4	87.8	74.0	91.5	80.4	10.0	69.9
Reasons for not receiving Vitamin A capsule supplement	**53**	**46**	**89**	**32**	**61**	**364**	**645**
Not advised by doctor/Health worker	18.9	15.2	18.0	9.4	29.5	38.7	30.2
Not aware that it is given	45.3	21.7	5.6	21.9	11.5	32.1	26.4
Child not eligible	9.4	10.9	9.0	9.4	4.9	0.8	4.2
Health facility/school do not provide Vitamin A	9.4	10.9	19.1	6.3	19.7	1.1	7.0
Parents do not want to give	0.0	2.2	1.1	0.0	3.3	5.2	3.6
No reason	0.0	4.3	1.1	0.0	4.9	6.3	4.5
Others	5.7	4.3	3.4	0.0	1.6	0.3	1.6
Don't know/Not mentioned	11.3	30.4	42.7	53.1	24.6	15.4	22.6
Time of the last dose of Vitamin A (n)	**272**	**332**	**285**	**357**	**299**	**42**	**1587**
<6 months	75.4	66.9	44.2	77.0	63.5	57.1	65.7
7-12 months	7.7	2.1	2.8	4.8	5.7	14.3	4.8
>12 months	2.9	1.2	1.8	0.6	0.3	2.4	1.3
Don't know	14.0	29.8	51.2	17.6	30.4	26.2	28.2
Vitamin A supplementation record (Child growth monitoring card)							

Card not available	30.1	8.2	9.9	10.5	12.1	23.3	15.5
Received Vitamin A supplement	46.9	37.8	48.1	52.8	53.0	11.2	41.0
Did not receive Vitamin A supplement	13.5	45.0	38.2	31.5	29.6	62.9	37.8
No information	9.5	9.0	3.9	5.1	5.4	2.6	5.8

3.4: Physical Examination (6 Months to 5 Years of Age)

3.4.1: General Physical Examination

Community health workers (CHW) performed clinical examination of children 6 months to 5 years old for jaundice, pallor, thyroid and goitre in the survey. The figure below shows the findings of physical examination. The proportion of pallor was found to be high in all regions. The proportion was more remarkable for children in the North Central region, probably due to the high rates of anaemic children in the area, or due to the difficulty in distinguishing pallor from other pale conditions like jaundice.

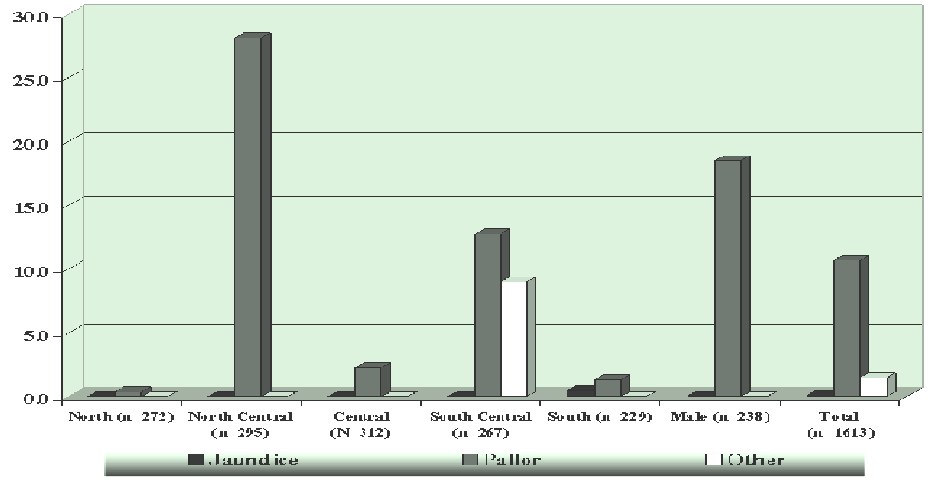


Figure 6: General Physical Examinations

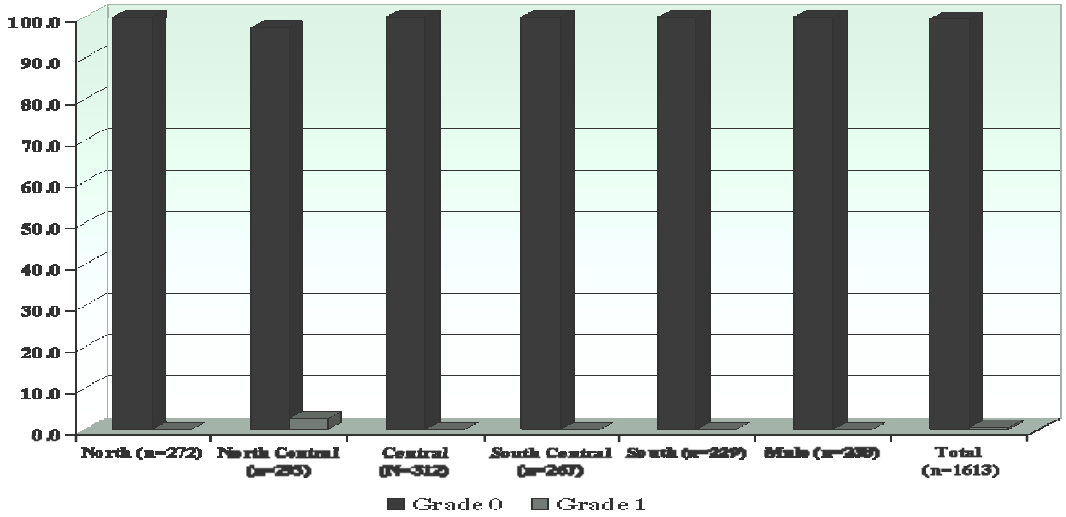


Figure 7: Goiter Examination

3.5: Biochemical analysis

3.5.1: Haemoglobin Levels with CI and Prevalence

Among children 6 months to 5 years of age, the prevalence of anaemia was also found to be low. Overall 26.3% were found to be anaemic (<20 ng\ml). Regional differences in the prevalence of anaemia are substantial, ranging from 10.4 % in the South to 41.8 % in the North regions. Malé reported to have the comparative maximum prevalence of anaemia.

Table 16: Hemoglobin levels with CI and prevalence

	North	N Central	Central	South Central	South	Malé	Total
Valid N	**201**	**207**	**184**	**211**	**202**	**215**	**1220**
Mean Haemoglobin,(95% CI)	11.2 (11.0-11.3)	11.4 (11.2-11.6)	11.8 (11.6-12.0)	11.9 (11.6-12.1)	12.1 (11.9-12.2)	11.5 (11.4-11.7)	11.6 (11.5-11.7)
Severe anaemia(<7ng\dl)	0.0	1.0	0.0	0.5	0.0	0.5	0.4
Moderate anaemia(7-10.9ng\dl)	41.8	30.9	26.1	20.4	10.4	27.0	25.9
Normal(>=11ng\dl)	58.2	68.1	73.9	79.1	89.6	72.6	73.8

Sample size is weighted to account for sample design

3.5.2: Ferritin Levels with CI and Prevalence at Standard Cut-off

Overall 57.3% children 6 months to 5 years old were found to be iron deficient. The lowest prevalence was reported in North central region (50.2%) and the highest in South central.

Table 17: Ferritin levels with CI and prevalence at standard cut-off

	North	N. Central	Central	S. Central	South	Malé	Total
Unadjusted (N)	218	209	208	215	208	210	1268
Mean Ferritin,(95% CI)	22.3 (18.7-25.9)	32.8 (13.3-52.4)	31.2 (10.8-51.6)	21.8 (18.0-25.6)	22.1 (17.4-26.8)	25.7 (20.4-31.1)	25.6 (21.8-29.2)
<20 ng\ml	57.3	50.2	58.2	63.3	62.0	55.7	57.3
>20 ng\ml	42.7	49.8	41.8	36.7	38.0	44.3	42.7
Adjusted for CRP (N)	214	203	206	209	204	208	1244
Mean Ferritin,(95% CI)	21.9 (18.3-25.5)	32.2 (12.0-52.3)	31.1 (10.6-51.7)	20.9 (17.1-24.8)	21.1 (17.8-24.5)	25.5 (20.1-30.9)	25.0 (21.4-28.7)
<20 ng\ml	58.4	50.7	58.7	65.1	62.3	56.3	58.0
>20 ng\ml	41.6	49.3	41.3	34.9	37.7	43.8	42.0

Sample size is weighted to account for sample design

3.5.3: Zinc Levels with CI and Prevalence at Standard Cut-off

Overall 16% children 6 month to 5 years old were found to be zinc deficient. Regional differences in the prevalence of zinc deficiency ranges from 2.9 % in the North central to 36.8% in the North. Prevalence of zinc deficiency was observed to be higher among women of reproductive age.

Table 18: Zinc levels with CI and prevalence at standard cut-off

	North	N. Central	Central	S. Central	South	Malé	Total
(Valid N)	**220**	**209**	**198**	**212**	**205**	**211**	**1255**
Mean Zinc,(95% CI)	65.0 (62.0-68.1)	87.6 (83.2-91.9)	82.5 (79.9-85.1)	67.7 (63.8-71.5)	68.5 (66.0-71.0)	82.2 (79.4-85.0)	76.4 (75.0-77.8)
<60 ug\dl	36.8	2.9	5.1	34.0	26.8	3.8	16.0
>60 ug\dl	63.2	97.1	94.9	66.0	73.2	96.2	84.0

Sample size is weighted to account for sample design

3.5.4: Vitamin A (unadjusted) Levels with CI and per cent at Standard Cut-off

Overall, 5.1% children 6 month to 5 years of age were found to be severely and 50.1% moderately deficient in Vitamin A. High prevalence (6.4%) of severe Vitamin A deficiency was recorded in North region and moderate in South Central (63.2%).

Table 19: Vitamin A (adjusted) levels with CI and percent at standard cut-off

	North	North Central	Central	S.Central	South	Malé	Total
Unadjusted (Valid N)	**218**	**203**	**204**	**212**	**203**	**207**	**1247**
Mean vitamin A,(95% CI)	43.8 (38.8-48.9)	42.5 (39.4-45.5)	40.6 (37.8-43.5)	37.1 (33.7-40.5)	38.9 (35.2-42.6)	40.9 (38.0-43.8)	40.8 (39.0-42.5)
Low(<20 ug/dl)	6.4	2.5	3.9	4.7	5.4	5.8	5.1
Moderate (20-40 ug\dl)	43.1	49.8	50.0	63.2	57.6	45.4	50.1
High (>40 ug\dl)	50.5	47.8	46.1	32.1	36.9	48.8	44.8

Sample size is weighted to account for sample design

3.5.5: Urinary Iodine Levels with CI and per cent Estimates at Standard Cut-off:

Urinary iodine excretion was also found to be very low. Only 0.7% children 6 months to 5 years of age were found to be severely deficient, 5.2% moderately deficient and 12.9% mildly deficient. Majority of severe and moderately deficient children belonged to South Central region.

Table 20: Median urinary iodine levels with CI and percent at standard cut-off

	North	N. Central	Central	S.Central	South	Malé	Total
Urinary Iodine Valid N	187	202	207	205	200	200	1201
Median UI,IQR	190.2 (112.6-404.7)	225.1 (136.1-408.9)	196.5 (118.9-284.2)	168.4 (89.9-260.7)	267.0 (184.6-540.1)	189.9 (116.7-280.5)	205.8 (121.4-373.3)

Severe (<20 mcg/L)	0.5	0.5	0.0	2.9	0.5	0.5	0.7
Moderate(20-49.9 mcg\L)	9.6	3.0	6.3	8.8	1.5	5.0	5.2
Mild(50-99.9 mcg\L)	13.9	12.9	10.6	17.6	8.0	14.0	12.9
No deficiency(>100 mcg\L)	75.9	83.7	83.1	70.7	90.0	80.5	81.2
Urinary Iodine							
Valid N	187	202	207	205	200	200	1201
<50 mcg\L	10.2	3.5	6.3	11.7	2.0	5.5	5.9
<100 mcg\L	24.1	16.3	16.9	29.3	10.0	19.5	18.8

Sample size is weighted to account for sample design

3.5.6: Stool Examination

Worm infections, especially the soil-transmitted helminthiasis (STH), commonly occurred in Maldives until a decade ago when over 92% of the children were affected. This survey aimed to assess the current prevalence rates of STH in the community and their relationship to other nutritional indicators. Kato-Katz technique, which is recommended by WHO for assessing the worm burden, was used to assess the prevalence and intensity of STH infections in the community. The table below shows the findings of stool examination. Only 4% children 6 months to 5 years of age were found having any kind of worm infection. High proportions of worm infections were found equally in North and South Central regions (6.1%).

Table 21: Results of stool examination *

	North	N. Central	Central	S. Central	South	Total
Stool test performed	**180**	**188**	**141**	**131**	**159**	**799**
Any infection (RW, WW, HW) found	6.1	2.7	4.3	6.1	1.3	4.0
Round worm present n (%)	0	2(1.06)	0	0	1(0.62)	3(0.38)
Round worm eggs per slide, Mean(SD)		43(25.4)			23(-)	36(21)
Round worm eggs per gram, Mean(SD)		1032(610.9)			500(-)	854(530.6)
Intensity (light) %		1.06			0.62	0.38
Whip worm present n(%)	11(6.1)	3(1.6)	6(4.2)	8(6.1)	2(1.2)	30(3.8)
Whip worm eggs per slide, Mean(SD)	13.4(17.6)	6.3(4.7)	8.3(6.6)	26(28.2)	2(0)	14.4(19.3)
Whip worm egg per gram, Mean(SD)	320.7(422.3)	152(113.4)	200(158.9)	639(677.4)	44(5.6)	346.1(464.8)
Intensity (light) %	81.8	33.3	100.0	75.0	100.0	80.0
Intensity (Moderate to heavy) %	18.2	66.7	0.0	25.0	0.0	20.0
Hook worm present n (%)	0	0	0	0	0	0

**Stools examination was performed in Malé region*

SECTION IV: CHILDREN 6 TO 12 YEARS OF AGE

4.1: Child Health Status (6 to 12 Years of Age)

4.1.1: Health Status of Children During the two Weeks Prior to Household Visit

Diarrhoea and ARI symptoms during the last two weeks were recalled for the child. Around 29.3% of the children reported ARI symptoms. Overall 21.3% children had suffered from cough, 1.2 % from difficulty in breathing, and 6.8 % from both (difficulty in breathing and cough) in the two weeks prior to the household visit.

Regarding diarrhoea symptoms recall for the same period, overall only 3.1% of the children reported suffering from diarrhoea, regionally the lowest percentage (1.1%) was reported in South central region and the highest (4.7%) was reported in Malé region.

Table 37: Health status of children during the two weeks prior to household visit:

	North	N. Central	Central	S. Central	South	Malé	Total
Number of children	263	249	257	269	245	254	1537
History of cough/difficulty in breathing in past two weeks							
Cough	17.1	20.5	20.2	24.5	22.0	23.6	21.3
Difficulty in breathing	1.9	1.6	1.2	0.4	2.0	0.4	1.2
Both	4.6	5.2	7.8	8.2	8.2	7.1	6.8
None	76.4	72.7	70.8	66.9	67.8	68.9	70.6
History of diarrhoea in past two weeks	2.3	2.4	3.9	1.1	4.1	4.7	3.1

4.1.2: Current Health Status of the Children

Table 37 shows the current status of children 6 to 12 years of age at the time of household visit for data collection. Twelve per cent of the children had cough and 2.5% had both cough and breathing difficulty. The proportion was mainly contributed from North central region (14.5%) for cough and Central region (4.7%) for both.

Regarding chest in-drawing, the overall reported proportion was 2.2% and observed were 5.8% and for both, pneumonia symptoms (cough + difficulty in breathing + chest in drawing currently) were reported for 2.1% children and observed proportion were 5.8%). Only 2% reported to be suffering from diarrhoea at the time of the visit. Other symptoms were also assessed which included flu (40.6%), constipation (23.9%), skin rash (14.9%) and fever (14.4%).

Table 38: Current health status of children 6 to 12 years of age

	North	N. Central	Central	S. Central	South	Malé	Total
Number of child	**263**	**249**	**257**	**269**	**245**	**254**	**1537**
History of cough/difficulty in breathing							
Cough	10.3	14.5	12.8	11.9	9.8	12.6	12.0
Difficulty in breathing	0.8	1.2	0.4	0.4	1.2	0.4	0.7
Both	2.3	1.6	4.7	1.9	2.9	1.6	2.5
None	86.7	82.7	82.1	85.9	86.1	85.4	84.8
cough/difficulty in breathing by observation							
Cough	5.3	0.4	8.9	5.6	4.1	5.1	4.9
Difficulty in breathing	1.1	1.6	1.2	0.0	0.8	0.4	0.8
Both	1.1	0.0	1.9	0.7	0.8	0.8	0.9
None	91.3	93.6	86.0	88.8	92.7	93.3	90.9
Not reported	1.1	4.4	1.9	4.8	1.6	0.4	2.4
Chest in drawing							
By history	1.9	1.2	3.9	2.2	2.9	0.8	2.1
By observation	2.3	0.0	26.1	0.7	4.9	0.8	5.8
Cough + difficulty in breathing + chest in drawing							
By respondent	0.0	0.4	1.6	0.7	1.2	0.4	0.7
By observation	0.4	0.0	0.4	0.4	0.8	0.4	0.4
History of diarrhoea	0.0	0.8	0.8	0.4	0.8	0.8	0.6
Illness at the time of visit							
None	50.6	43.4	53.3	43.9	53.1	61.8	50.9
Flu	22.8	33.3	28.4	31.2	29.0	18.5	27.2
Fever	5.3	8.0	7.0	11.5	12.7	3.1	7.9
Dysentery	5.3	4.8	5.4	4.8	4.5	1.6	4.4
Vomiting	3.4	2.0	1.6	4.1	4.5	2.0	2.9
Abdominal pain	11.4	11.2	10.5	15.2	11.8	10.2	11.8
Constipation	19.4	11.6	13.2	20.4	13.9	12.2	15.2
Skin rash boils	6.5	13.7	6.2	10.8	5.7	4.7	7.9
Crying at micturition	2.3	2.0	1.2	2.2	1.6	2.8	2.0

4.1.3: Hospitalization of Children 6 to 12 years of Age during the Past 6 Months

Table 38 highlights the overall health status of children aged 6 to 12 years. Recall was assessed from the subject to examine for any illness. About 9.2% reported having been hospitalized. South central region reported the highest percentage (12.3%) of hospitalization; about 39% were hospitalized for fever/flu, followed by diarrhoea/dehydration/vomiting (16%).

Table 39: Hospitalization of children 6 to 12 years of age in the past six months

	North	North Central	Central	South Central	South	Malé	Total
Number of children	**263**	**249**	**257**	**269**	**245**	**254**	**1537**
Hospitalization	8.0	5.6	11.7	12.3	8.6	8.7	9.2
Reasons for hospitalization (n)	**21**	**14**	**30**	**33**	**21**	**22**	**141**
Flu/Fever	81.0	14.3	20.0	15.2	61.9	59.1	39.7
Diarrhoea/dehydration/vomiting	9.5	0.0	0.0	9.1	9.5	0.0	5.0
Infections	0.0	0.0	0.0	0.0	4.8	0.0	0.7
Fits	0.0	7.1	0.0	0.0	0.0	0.0	0.7
Others	4.8	21.4	3.3	18.2	0.0	18.2	10.6
Not mentioned	4.8	57.1	76.7	57.6	23.8	22.7	43.3

4.1.4: Vitamin A Supplementation, Worm Infestation and De-worming Medication

Table 39 describes the status of worm infestation in children 6 to 12 years of age. About 7.2 % of the subjects reported to have been diagnosed with worm infestation in the last six months, especially from Central region (13.6 %). About 62.5% of the children reported to have used de-worming medication, with significant proportion contributed from North Central region (73.1%). Overall, only 0.9% of the subjects reported having worm infestation at the time of household visit during data collection, with the highest proportion reported from Central region (1.6%).

Table 40: Worm infestation among children 6 to 12 years of age

	North	N. Central	Central	S. Central	South	Malé	Total
Number of children	263	249	257	269	245	254	1537
History of worm infestation in the last 6 months	4.2	4.8	13.6	7.1	6.9	6.7	7.2
Reported use of f de-worming medication in last 6 months	54.8	73.1	63.8	64.3	50.2	68.5	62.5
Current history of having worm infestation	0.0	1.2	1.6	0.4	1.2	1.2	0.9

4.2: Physical Examination (6 to 12 Years of Age)

4.2.1: General Physical Examination (6 to 12 Years of Age)

Community Health Workers (CHW) performed clinical examination of children 6 to 12 years of age for jaundice, pallor, thyroid and goitre. The figure below shows the findings of physical examination. The proportion of pallor was found to be high in all regions. The proportion was more remarkable for children in

the North central region, probably due to the high rates of anaemic children in the area, or due to the difficulty in distinguishing pallor from other pale conditions, like jaundice.

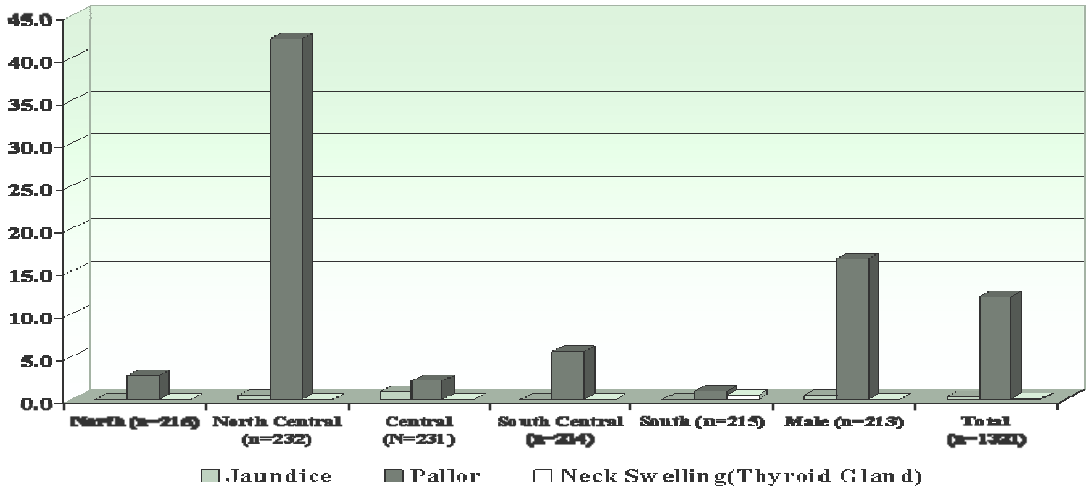


Figure 8: General Physical Examination (6-12 years children)

Goitre Examination

Goitre examinations were also performed by health worker at the time of household visit. Overall only 0.6% children were found with goitre.

Table 41: Goiter examination (children 6 -12 years)

	North	North Central	Central	S. Central	South	Malé	Total
Number of children	**216**	**232**	**231**	**214**	**215**	**213**	**1321**
Goitre Examination							
Grade 0	100.0	97.0	100.0	100.0	100.0	100.0	99.5
Grade 1	0.0	2.6	0.0	0.0	0.0	0.0	0.5
Grade 2	0.0	0.4	0.0	0.0	0.0	0.0	0.1

4.3: Stool Examination

The table below describes the findings of stool examination. Only 11 % children were found having any kind of worm infections. High proportion of worm infections was found in the North (34.7%) region.

Table 42: Results of Stool Examination

	North	North Central	Central	South Central	South	Total
Stool test performed	**124**	**167**	**125**	**123**	**157**	**696**
Any infection (RW, WW, HW) found Table 41: Results of Stool Examination	34.7	3.0	8.0	12.2	2.5	11.1
Round worm	4(3.2)	-	2(1.6)	-	1(0.64)	7(1.0)

present n(%)						
Round worm eggs per slide, Mean(SD)	181.3(16.4.8)		61(66.4)		17(-)	113(132.2)
Round worm egg per gram, Mean(SD)	4352(3957.1)		2976(543.8)			3801(2910.50)
Intensity (light) %	4(3.2)		2(1.6)		1(0.64)	7(1.0)
Whip worm present n(%)	43(34.6)	5(2.9)	9(7.2)	15(12.2)	4(2.6)	76(10.9)
Whip worm eggs per slide, Mean(SD)	33.9(51.6)	7(3.90	26(28.6)	53.5(95.2)	12.2(13.3)	33.8(58.2)
Whip worm egg per gram, Mean(SD)	816.8(1242.1)	164.6(101.1)	605.6(704.5)	1060.6(2172.8)	102(129.7)	754(1344.5)
Intensity (light) %	52.3	100.0	50.0	26.7	50.0	50.0
Intensity (Moderate to heavy) %	2.3	0.0	0.0	6.7	25.0	3.8
Intensity(Not mention) %	45.5	0.0	50.0	66.7	25.0	46.2
Hook worm present n(%)	0	0	0	0	0	0

Urinary Iodine Results:

The median urinary iodine for children 6 to 12 years of age was 176.2 (109.4-243.6) for all regions with the lowest mean for South central region 156.6 (102.1- 215.4) and the highest for South region 209.2 (131.1-409.1).

Table 43: Medians of urinary iodine in children 6 to 12 years of age

	North	**N. Central**	**Central**	**S. Central**	**South**	**Malé**	**Total**
Urinary Iodine (n)	192	206	205	199	202	208	1212
Severe (<20 mcg/L)	2.1	2.9	0.5	2.0	0.5	0.5	1.2
Moderate (20-49.9 mcg\L)	7.3	6.8	5.4	8.0	5.0	3.8	5.5
Mild (50-99.9 mcg\L)	13.5	18.0	14.1	13.6	10.9	17.8	15.3
No deficiency (>100 mcg\L)	77.1	72.3	80.0	76.4	83.7	77.9	78.0
Median UI, IQR	173.9 (109.7-246.5)	175.4 (91.9-243.4)	169.6 (110.2-222.9)	156.5 (102.1-215.4)	209.2 (131.1-409.1)	179.1 (110.1-251.7)	176.2 (109.4-243.6)

Sample size is weighted to account for sample design

SECTION V: CORRELATES OF MICRONUTRIENTS DEFICIENCIES

5.1: Relationship Between Maternal and Child Micronutrients Status:

A positive relationship was observed between maternal and child micronutrients levels i.e. levels of haemoglobin, zinc and Vitamin A. The strength of these relationships is moderate, as evident by r=0.30 for haemoglobin, r=0.35 for Zinc and Vitamin A respectively.

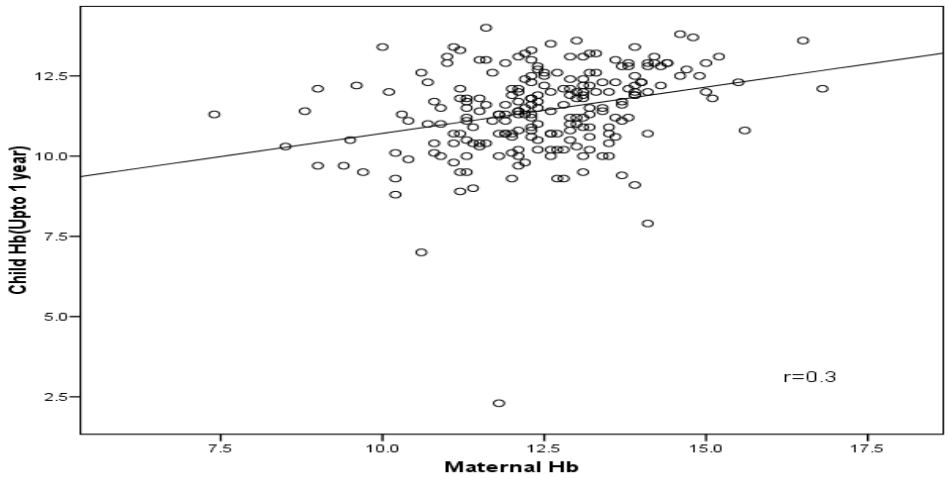


Figure 9: Relationship between maternal and child haemoglobin levels

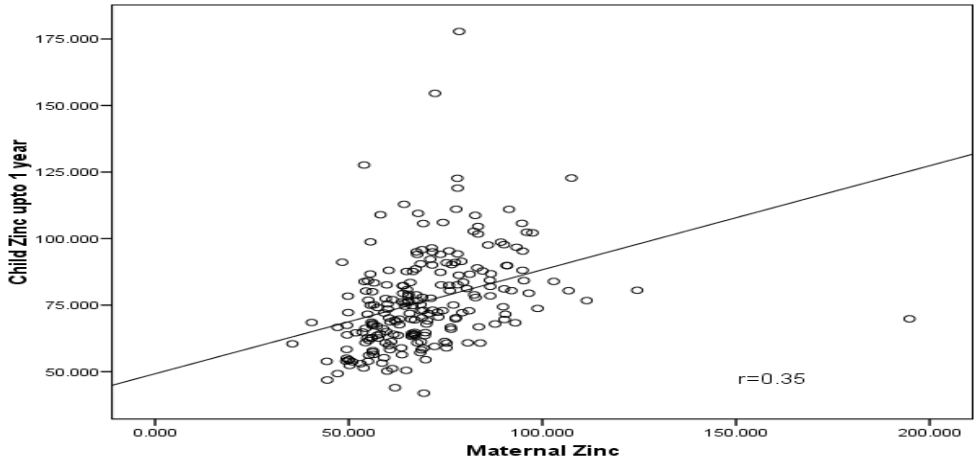


Figure 10: Relationship between maternal and child zinc levels

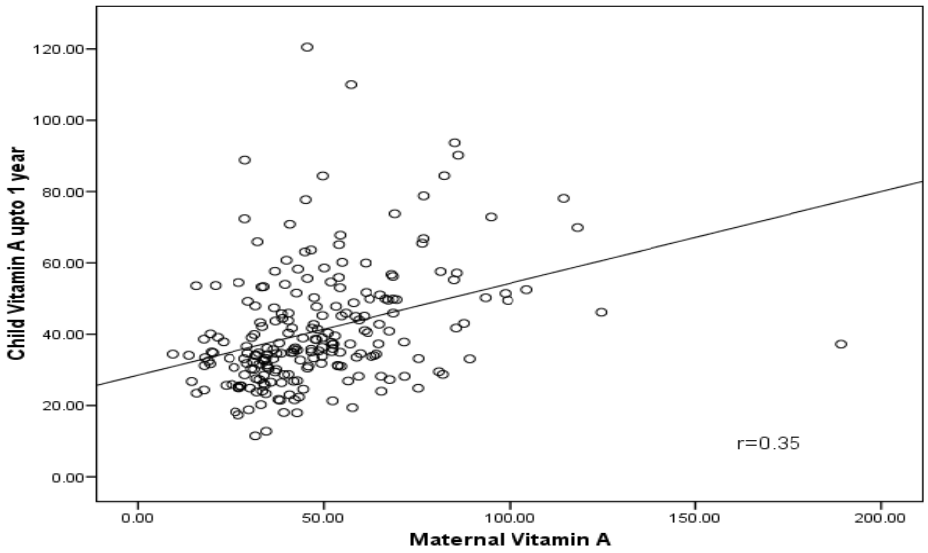


Figure 11: Relationship between maternal and child Vitamin A levels

5.2: Dietary Pattern of Children (6 Months to 3 Years of Age)

Based on 24 Hours Dietary Recall

Intensive dietary and nutrition assessments were undertaken in the field using standard and validated methods of food frequency and 24 hours recall with semi-quantitative intake.

The graphs below (figure 12)shows that there is an increasing pattern of taking four or more than four food groups among children 6 months to 24 months of age.

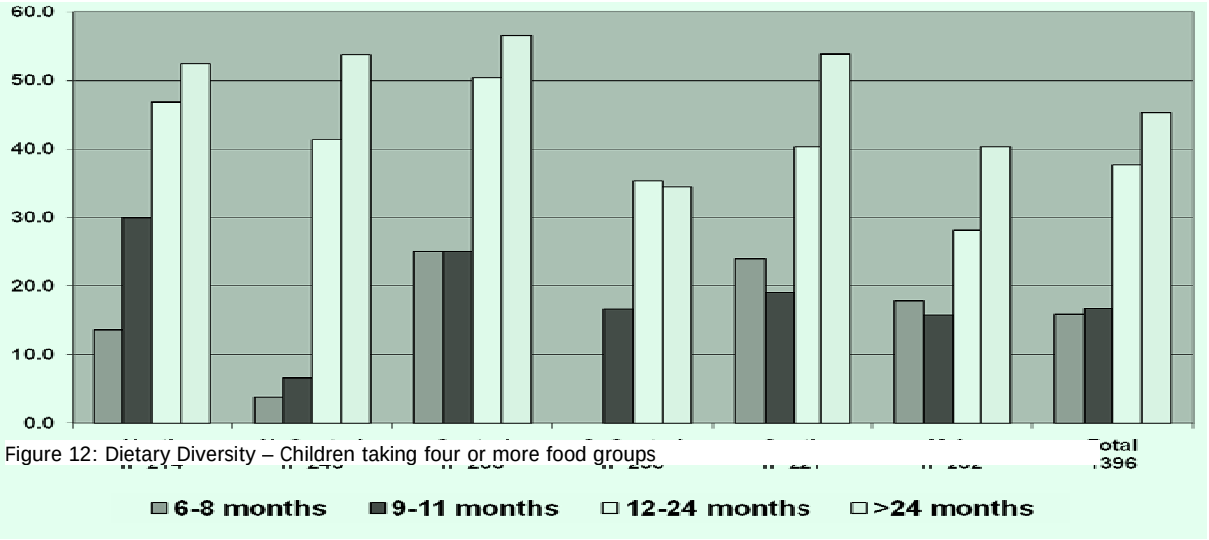


Figure 12: Dietary Diversity – Children taking four or more food groups

Frequency of Daily Intake of Food Groups:

The graph below shows the average daily mean intake of different food groups among children 6 months to three years of age. Grains, roots and tubers were found to be highly acceptable among all age groups.

Figure 13: Frequency of daily intake of food groups

Table 44: Consumption of foods rich in Micronutrients

	North	North Central	Central	South Central	South	Malé	Total
Consumption of Vitamin A rich foods 1(%)							
6-8 months	45.5	15.4	20.0	18.2	32.0	17.9	23.9
9-11 months	60.0	46.7	37.5	36.7	33.3	26.3	35.2
12-24 months	73.9	63.2	51.0	57.3	56.4	41.2	54.5
>24 months	88.5	66.7	65.2	55.2	80.8	56.1	65.0
Consumption of Iron rich foods 2(%)							
6-8 months	45.5	15.4	20.0	18.2	32.0	17.9	23.9
9-11 months	60.0	46.7	37.5	33.3	33.3	26.3	34.8
12-24 months	72.1	57.1	46.9	56.7	55.7	36.8	51.5
>24 months	85.2	63.0	47.8	51.7	80.8	50.0	60.0
Valid N	214	243	206	248	221	262	1394

1= Includes meat (organ meat), fish, poultry, eggs, red or yellow vegetables, carrots, dark GLV, mango, papaya and other fruits and vegetables that are rich in vitamin A
2= Includes meat (including organ meat), fish, poultry and eggs

Viewing the table above, an increasing age-wise pattern was seen among children 6 months to 3 years of age, for the consumption of both Vitamin A and Iron rich foods.

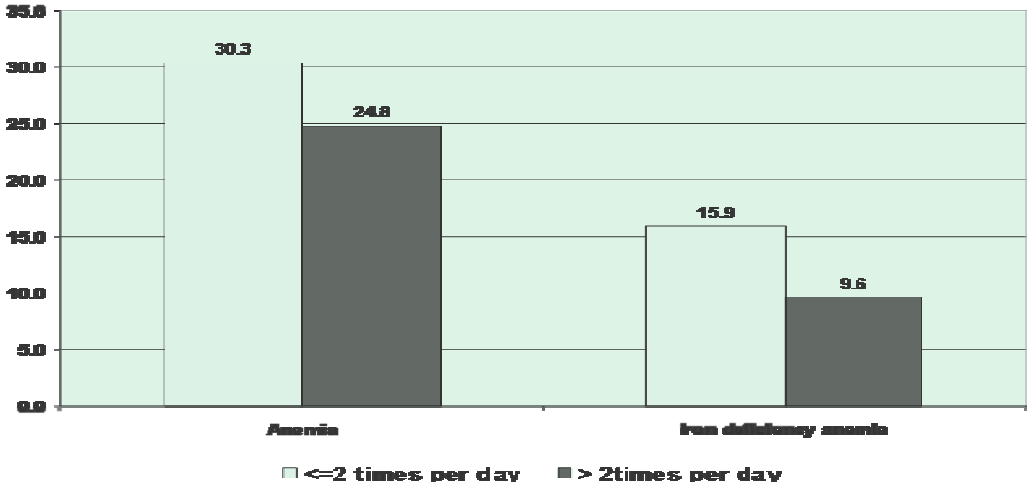


Figure 14: Iron deficiency by consumption of iron rich foods

Low iron deficiency was observed among children who consumed iron rich foods two or more than two times in a day, compared with those who consumed less. Findings suggest that 40-50% of anaemia observed among the children was due to iron deficiency.

Table 44: Vitamin A deficiency /consumption of Vitamin A rich foods

Consumption of Vitamin A rich foods	Vitamin A deficiency (<40 ug\dL)	Valid N
<=2 times per day	56.0	580
> 2times per day	47.4	108
p-value	0.18	

This shows that Vitamin A deficiency was less among children who consumed more vitamin A rich foods.

SECTION VI: SUMMARY CONCLUSIONS AND RECOMONDATIONS

Conclusions

The general status of health care and services in Malé for WRA and children appears to be satisfactory, with many indicators far ahead of regional averages. These are consistent with the available health indicators and the status of MNCH in Maldives.

However, notwithstanding the excellent status of maternal and child health, the survey suggests that micronutrient deficiencies are widespread with major regional differences representing a public health problem. Overall, 15.4% women of reproductive age were found to be anaemic to some degree: 0.3% were severely anaemic and 15.1% moderately anaemic. Of all the women evaluated, 38.4% women of reproductive age were found to be iron-deficient based on serum ferritin estimation. Regional differences in the prevalence of iron deficiency are substantial, ranging from 33% in the South Central to 44.2% in the South. Surprisingly, Vitamin A deficiency was common and overall 4.7% women of reproductive age were severely deficient in Vitamin A and 39.3% were moderately deficient. The high prevalence (6%) of severe Vitamin A deficiency was seen in the North region while moderate Vitamin A deficiency was highest in Malé region (45.5%). The prevalence of moderate to severe iodine deficiency based on urinary iodine estimation was about 9%. Some 26.8% of women of reproductive age were found to have biochemical zinc deficiency. The lowest prevalence was reported in North Central region (13.4%) and the highest in North region (54.6%).

Rates of micronutrient deficiencies among children were high. Overall 26.3% of children under 5 were found to be anaemic (haemoglobin < 10.9 g/dL). Overall 57.3% children 6 months to 5 years old were found to be iron-deficient (serum ferritin < 20 ng/ml). The lowest prevalence was reported in North Central region (50.2%) and the highest (65.1%) in South Central. Wide variation was noted in the prevalence of Vitamin A deficiency based on serum retinol level estimation. Some 5.1% children 6 month to 5 years of age were found to be severely and 50.1% moderately deficient in Vitamin A. High prevalence (6.4%) of severe Vitamin A deficiency was recorded in North region and moderate in South Central (63.2%). Overall 16% children 6 month to 5 years old were found to be zinc-deficient. Regional differences in the prevalence of zinc deficiency ranged from 2.9% in the North central to 36.8% in the North. Iodine deficiency also appears to be an issue in a proportion of the population despite widespread availability and use of iodized salt. While only 0.7% children 6 months to 5 years of age were found to be severely deficient, 5.2% had biochemical evidence of moderate deficiency and 12.9% were mildly deficient on urinary estimation. Majority of severe and moderately deficient children belonged to South Central region

These data are surprising given that in general, community awareness of micronutrients was very good but functional knowledge of food sources and prevention strategies was relatively limited. Among young children, lack of dietary diversity appears to be an issue which may predispose them to micronutrient deficiencies. Given the high rates of literacy, access to mass media, antenatal care, vaccination coverage and care seeking, there are ample opportunities to redress the situation readily through the available channels.

W hat should be considered by the public health authorities in Maldives?

General Recommendations

In general there is the opportunity to capitalize on existing awareness of the importance of micronutrients to increase functional knowledge and improve practices. The recent Lancet series on Maternal and Child Undernutrition (2008) offer a remarkable opportunity for introducing evidence-based interventions to redress micronutrient deficiencies and determinants.

Given the existing levels of knowledge about health and nutrition, there is an urgent need to improve dietary diversity and age at initiation of appropriate complementary feeding. With almost a quarter of families initiating complementary feeding well before 6 months of age, there is an urgent need to strengthen infant and young child feeding strategies, promote exclusive breastfeeding for 6 months and promote intake of a range of high quality locally available and affordable complementary foods.

The clear and wide variations between various regions of the country suggest that interventions need to have an equity focus, targeting areas with greater burden e.g. North. There is also a need to address determinants for differentials including poverty, social support and health system effectiveness.

Specific Recommendations

The following recommendations are germane to specific micronutrient deficiencies but it essentially be underscored that these must be layered on top of existing health and nutrition interventions and a robust infant and young child feeding strategy.

1. Iron Deficiency Anaemia

It does not appear that helminthiasis is a major issue in Maldives and therefore the widespread practice of deworming and existing programs of multiple dosings annually must be reviewed. The following specific recommendations can be made:

1. The existing maternal iron folate supplementation during the antenatal period could be improved in coverage and possibly replaced with multiple micronutrients after due analysis of feasibility and cost-effectiveness estimation;
2. Given the need to improve dietary intake of iron containing foods, the main intervention should be to promote dietary intake of adequate foods in pregnancy and period of complementary feeding. This is best done by strengthening the infant and young child feeding strategy and promotion of exclusive breastfeeding for 6 months. Dietary diversification and promotion of home available foods should be a priority and accompanied by appropriate mass media and health education messages;
3. Given that there will be the need to provide additional nutrients, we would recommend that the Government of Maldives actively consider a mix of fortification and supplementation strategies (for iron and zinc). While fortification of major staples such as wheat is feasible at source, there may be the need for trying out specific newer commodities to complement this such as home fortification with micronutrient formulations such as Sprinkles.

2. Vitamin A Deficiency

Vitamin A deficiency does not appear to be a huge issue and severe subclinical vitamin A deficiency appears to affect a relatively small proportion (5%) of children. However, rates of moderate deficiency are high indicating the need for continued Vitamin A supplementation programs. It is unclear as to why Malé is excluded from the national Vitamin A supplementation strategy and we would recommend inclusion.

Furthermore, we would recommend strengthening the existing Vitamin A supplementation programme and improve coverage with biannual dosing. Given the findings of multiple micronutrient deficiencies among women of reproductive age, we would also suggest to consider trying multiple micronutrients as a replacement of iron folate for pregnant women. This would require appropriate costing and feasibility.

3. Iodine related Interventions

The population prevalence of moderate to severe urinary iodine deficiency is under 6% and observed goitre rates are low. A large proportion of households (> 95%) use iodized salt and available salt iodization standards show some but small variation. Although some high urinary iodine levels were observed, we cannot entirely exclude the possibility of contamination during field work. We would strongly recommend continuing with the current programme for promoting the use of iodized salt and improving monitoring.

4. Emerging Issues

Among the emerging issues, the findings of zinc deficiency in both women and children are a major cause for concern. Zinc is increasingly being recognized as a public health issue and given other regional findings from South Asia, must be tackled through a combination of strategies. These include Nutrition counselling and dietary diversification programs to increase the use of zinc rich foods (red meats, fish, chicken liver etc). Additionally, the promotion of zinc use in diarrhoeal disease treatment programmes must be made a priority. Finally the authorities may consider possible iron and zinc fortification of available and imported dietary staples such as wheat. Further recommendations on zinc intervention strategies will be available soon from the IZiNCG.

In conclusion, while Maldives does appear to have a public health problem with multiple micronutrient deficiencies among women of reproductive age and children under 5, the strong and effective health system, coupled with a motivated work force means that much can be done with a little effort.

We trust that this survey report will facilitate this concerted action.

Appendix A

List of selected Islands and allocation of clusters through PPS

NorthRegion

Atoll Name	S. No	Island/Ward Name	Population	HH	Cluster
Haa Alif Atoll	1	Baarah	1203	241	16
	2	Dhidhdhoo	2512	454	25,
	3	Hoarafushi	2202	374	21,22
	4	Ihavandhoo	2447	305	23,24
	5	Kelaa	1200	262	14
	6	Thakandhoo	340	92	2
	7	Vashafaru	471	82	5
	8	Filladhoo	548	116	7
Haa Dhaal Atoll	9	Kunburudhoo	85	26	1
	10	Kulhudhuffushi	6998	1123	26,27,28,29,30
	11	Naivaadhoo	375	94	3
	12	Nellaidhoo	717	148	8
	13	Neykurendhoo	835	180	10
	14	Nolhivaramu	1554	291	18
	15	Makunudhoo	1045	198	12
	16	Vaikaradhoo	923	184	11
Shaviyani Atoll	17	Foakaidhoo	1201	191	15
	18	Funadhoo	1599	267	19
	19	Kanditheemu	1148	191	13
	20	Komandoo	1333	248	17
	21	Lhaimagu	529	101	6
	22	Maaugoodhoo	795	22	9
	23	Milandhoo	1637	221	20
	24	Narudhoo	426	67	4

NorthCentralRegion CentralRegion

Atoll Name	S. No	Island/Ward Name	Population	HH	Cluster
Noonu Atoll	25	Kedhikolhudhoo	1204	204	11
	26	Kudafari	373	72	3
	27	Landhoo	582	120	6
	28	Manadhoo	1201	200	10
	29	Miladhoo	784	143	8
	30	Velidhoo	1716	305	17
Lhaviyani Atoll	31	Hinnavaru	3017	482	26,27
	32	Kurendhoo	1218	235	12
	33	Naifaru	3687	605	28,29,30
Raa Atoll	34	Alifushi	1974	313	21,
	35	Hulhudhuffaaru	1516	285	14

	36	Inguraidhoo	1278	214	13
	37	Innamaadhoo	537	113	5
	38	Maduvvari	1558	265	15,16
	39	Meedhoo	1736	259	18
	40	Rasmaadhoo	487	111	4
	41	Ugoofaaru	2988	472	24,25
Baa Atoll	42	Dhonfanu	305	64	2
	43	Eydhafushi	2409	363	22,23
	44	Kamadhoo	231	61	1
	45	Kendhoo	858	130	9
	46	Thulhaadhoo	1759	313	19,20
	47	Dharavandhoo	740	137	7

Atoll Name	S. No	Location	Population	HH	Cluster
Alif Alif Atoll	48	Himendhoo	515	77	7
	49	Mathiveri	483	64	6
	50	Thoddoo	1199	183	19
	51	Rasdhoo	900	143	15
Kaafu Atoll	52	Dhiffushi	767	120	12
	53	Gaafaru	800	125	13
	54	Gulhi	662	105	10
	55	Guraidhoo	1220	182	20,21
	56	Himmafushi	1007	140	16
	57	Kaashidhoo	1696	277	24,25
	58	Maafushi	2000	180	29,30
	59	Thulusdhoo	1148	187	17,18
	60	Huraa	849	117	14
Vaavu Atoll	61	Felidhoo	448	74	4
	62	Rakeedhoo	158	33	1
Alif Dhaal Atoll	63	Dhangethi	624	128	9
	64	Dhigurah	420	75	3
	65	Fenfushi	560	101	8
	66	Hangnaameedhoo	458	82	5
	67	Maamigili	1671	247	22,23
	68	Mahibadhoo	1780	205	26,27,28
	69	Omadhoo	676	88	11
	70	Kunburudhoo	322	49	2

South Central South Region

Atoll Name	S. No	Island/Ward Name	Population	HH	Cluster
Faafu Atoll	71	Biledhdhoo	821	145	12
	72	Feeali	741	128	9
	73	Nilandhoo	1303	178	22
Dhaal Atoll	74	Bandidhoo	578	79	6
	75	Kudahuvadhoo	1639	272	25,26
	76	Meedhoo	919	125	16
	77	Vaanee	211	47	1
Meemu Atoll	78	Dhiggaru	909	153	15
	79	Kolhufushi	811	133	11
	80	Mulah	1129	182	17
	81	Naalaafushi	321	70	2
Thaa Atoll	82	Buruni	1130	182	18
	83	Guraidhoo	1137	180	19,20
	84	Hirilandhoo	845	136	13
	85	Kibidhoo	808	136	10
	86	Madifushi	720	120	8
	87	Thimarafushi	1237	222	21
	88	Dhiyamigili	452	96	4
Laamu Atoll	89	Dhanbidhoo	537	102	5
	90	Fonadhoo	1762	274	27,28
	91	Isdhoo	1559	267	24
	92	Kunahandhoo	602	98	7
	93	Maamendhoo	845	163	14
	94	Maavah	1373	242	23
	59	Mundhoo	372	49	3
	96	Gan	2502	399	29,30

Atoll Name	S. No	Island/Ward Name	Population	HH	Cluster
Gaaf Alif Atoll	97	Dhaandhoo	1113	186	8
	98	Dhevvadhoo	480	105	1
	99	Dhiyadhoo	79	25	
	100	Kolamaafushi	1087	189	7
	101	Vilingili	1976	346	12
Gaaf Dhaal Atoll	103	Fares Maathoda	936	193	4
	104	Gadhdhoo	1439	328	10
	105	Hoandedhdhoo	668	140	3
	106	Madaveli	1065	198	6
	106	Nadallaa	614	122	2
	108	Thinadhoo	4442	728	16,17,18
Gnaviyani Atoll	109	Fuvammulah	7636	1332	19,20,21,22, 23
Seenu Atoll	110	Feydhoo	2724	511	14,15
	111	Hithadhoo	9465	1493	24,25,26,27,28,29,30
	112	Hulhudhoo	1147	257	9

	113	Meedhoo	1458	347	11
	114	Maradhoo	2043	303	13
	115	Maradhoofeydhoo	1025	183	5

Male Region

Atoll Name	S. No	Island/Ward Name	Population	HH	Cluster
Male	116	Henveiru	23597	3177	15,16,17,18,19,20,21
	117	Galolhu	19414	2640	4,5,6,7,8,9
	118	Maafannu	29964	3983	22,23,24,25,26,27,28,29 ,30
	119	Machchangolhi	19580	2623	10,11,12,13,14,
	120	Villingili	6956	996	2,3
	121	Hulhumale'	2866	276	1

Appendix 2

Weighing Procedure for Atolls and Regions

In order to derive a correct overall estimate, sample weights were applied to each stratum to account for differences in population size in each. The general weighting procedure for MNS survey has been calculated in two stages:

P1: First stage selection probability of ith cluster in jth stratum

P2: Second stage probability of selection of household within ith cluster

Probability of selecting ith cluster from jth stratum will be

$$P_1 = \frac{a_h M_{ji}}{\sum M_{ji}}$$

Where, ah are the number of clusters in j^{th} stratum and Mji are the total numbers of household in i^{th} cluster and ∑Mjiistotalnumberofhouseholdinstratumj

The second stage's selection probability for each household in the cluster i is calculated as follows:

$$P_2 = \frac{g_{hi}}{Mji}$$

Where, ghi are the number of selected households in i^{th} cluster
The overall selection probability of each household in cluster i of stratum j is therefore the production of the two stages selection probabilities:

$$P = P_1 \times P_2$$

Because of the non-proportional allocation of the sample to the different atolls, sampling weights were required in all analysis to ensure the actual representativeness of the sample at the national level and at the atoll level as well. The sampling weight for each household in cluster i of stratum j is the inverse of its overall selection probability:

$$Wi = 1/P$$

Sampling weights were calculated at regional and atoll levels separately. Detail calculations are given in below sheet

Appendix I	Atoll Name	S. No	Island/Ward Name	Population	HH	# Clusters in each Atoll	HH in each cluster	Total HH in Atoll	Selection probability Atoll level	Sampling weight Atoll level	Selection probability region level	Sampling weight region level
North Region	Haa Alif Atoll	1	Baarah	1203	241	10	241	1587	0.08824	11.33214	0.07667	13.04286
		2	Dhidhdhoo	2512	454		454		0.08824	11.33214	0.07667	13.04286
		3	Hoarafushi	2202	374		187		0.08824	11.33214	0.07667	13.04286
		4	Ihavandhoo	2447	305		153		0.08824	11.33214	0.07667	13.04286
		5	Kelaa	1200	262		262		0.08824	11.33214	0.07667	13.04286
		6	Thakandhoo	340	92		92		0.08824	11.33214	0.07667	13.04286
		7	Vashafaru	471	82		82		0.08824	11.33214	0.07667	13.04286
		8	Filladhoo	548	116		116		0.08824	11.33214	0.07667	13.04286
	Haa Dhaal Atoll	9	Kunburudhoo	85	26	12	26	1346	0.12485	8.00952	0.07667	13.04286
		10	Kulhudhuffushi	6998	1123		225		0.12485	8.00952	0.07667	13.04286
		11	Naivaadhoo	375	94		94		0.12485	8.00952	0.07667	13.04286
		12	Nellaidhoo	717	148		148		0.12485	8.00952	0.07667	13.04286
		13	Neykurendhoo	835	180		180		0.12485	8.00952	0.07667	13.04286
		14	Nolhivaramu	1554	291		291		0.12485	8.00952	0.07667	13.04286
		15	Makunudhoo	1045	198		198		0.12485	8.00952	0.07667	13.04286
		16	Vaikaradhoo	923	184		184		0.12485	8.00952	0.07667	13.04286
	Shaviyani Atoll	17	Foakaidhoo	1201	191	8	191	1308	0.08563	11.67857	0.07667	13.04286
		18	Funadhoo	1599	267		267		0.08563	11.67857	0.07667	13.04286
		19	Kanditheemu	1148	191		191		0.08563	11.67857	0.07667	13.04286
		20	Komandoo	1333	248		248		0.08563	11.67857	0.07667	13.04286
		21	Lhaimagu	529	101		101		0.08563	11.67857	0.07667	13.04286
		22	Maaugoodhoo	795	22		22		0.08563	11.67857	0.07667	13.04286
		23	Milandhoo	1637	221		221		0.08563	11.67857	0.07667	13.04286
		24	Narudhoo	426	67		67		0.08563	11.67857	0.07667	13.04286

North Central Region	Noonu Atoll	25	Kedhikolhudhoo	1204	204		204		0.08046	12.42857	0.07684	13.01429
		26	Kudafari	373	72		72		0.08046	12.42857	0.07684	13.01429
		27	Landhoo	582	120		120		0.08046	12.42857	0.07684	13.01429
		28	Manadhoo	1201	200		200		0.08046	12.42857	0.07684	13.01429
		29	Miladhoo	784	143		143		0.08046	12.42857	0.07684	13.01429
		30	Velidhoo	1716	305	6	305	1044	0.08046	12.42857	0.07684	13.01429
	Lhaviyani Atoll	31	Hinnavaru	3017	482		241		0.12395	8.06746	0.07684	13.01429
		32	Kurendhoo	1218	235		235		0.12395	8.06746	0.07684	13.01429
		33	Naifaru	3687	605	6	202	678	0.12395	8.06746	0.07684	13.01429
	Raa Atoll	34	Alifushi	1974	313		313		0.08416	11.88214	0.07684	13.01429
		35	Hulhudhuffaaru	1516	285		285		0.08416	11.88214	0.07684	13.01429
		36	Inguraidhoo	1278	214		214		0.08416	11.88214	0.07684	13.01429
		37	Innamaadhoo	537	113		113		0.08416	11.88214	0.07684	13.01429
		38	Maduvvari	1558	265		133		0.08416	11.88214	0.07684	13.01429
		39	Meedhoo	1736	259		259		0.08416	11.88214	0.07684	13.01429
		40	Rasmaadhoo	487	111		111		0.08416	11.88214	0.07684	13.01429
		41	Ugoofaaru	2988	472	10	236	1664	0.08416	11.88214	0.07684	13.01429
	Baa Atoll	42	Dhonfanu	305	64		64		0.15342	6.51786	0.07684	13.01429
		43	Eydhafushi	2409	363		182		0.15342	6.51786	0.07684	13.01429
		44	Kamadhoo	231	61		61		0.15342	6.51786	0.07684	13.01429
		45	Kendhoo	858	130		130		0.15342	6.51786	0.07684	13.01429
		46	Thulhaadhoo	1759	313		157		0.15342	6.51786	0.07684	13.01429
		47	Dharavandhoo	740	137	8	137	730	0.15342	6.51786	0.07684	13.01429

Central Region	Alif Alif Atoll	48	Himendhoo	515	77		77		0.11991	8.33929	0.14085	7.10000
		49	Mathiveri	483	64		64		0.11991	8.33929	0.14085	7.10000
		50	Thoddoo	1199	183		183		0.11991	8.33929	0.14085	7.10000
		51	Rasdhoo	900	143	4	143	467	0.11991	8.33929	0.14085	7.10000
	Kaafu Atoll	52	Dhiffushi	767	120		120		0.17843	5.60440	0.14085	7.10000
		53	Gaafaru	800	125		125		0.17843	5.60440	0.14085	7.10000
		54	Gulhi	662	105		105		0.17843	5.60440	0.14085	7.10000
		55	Guraidhoo	1220	182	13	91	1020	0.17843	5.60440	0.14085	7.10000

		56	Himmafushi	1007	140		140		0.17843	5.60440	0.14085	7.10000
		57	Kaashidhoo	1696	277		139		0.17843	5.60440	0.14085	7.10000
		58	Maafushi	2000	180		90		0.17843	5.60440	0.14085	7.10000
		59	Thulusdhoo	1148	187		94		0.17843	5.60440	0.14085	7.10000
		60	Huraa	849	117		117		0.17843	5.60440	0.14085	7.10000
	Vaavu Atoll	61	Felidhoo	448	74		74		0.26168	3.82143	0.14085	7.10000
		62	Rakeedhoo	158	33	2	33	107	0.26168	3.82143	0.14085	7.10000
	Alif Dhaal Atoll	63	Dhangethi	624	128		128		0.21543	4.64177	0.14085	7.10000
		64	Dhigurah	420	75		75		0.21543	4.64177	0.14085	7.10000
		65	Fenfushi	560	101		101		0.21543	4.64177	0.14085	7.10000
		66	Hangnaameedhoo	458	82		82		0.21543	4.64177	0.14085	7.10000
		67	Maamigili	1671	247		124		0.21543	4.64177	0.14085	7.10000
		68	Mahibadhoo	1780	205		68		0.21543	4.64177	0.14085	7.10000
		69	Omadhoo	676	88		88		0.21543	4.64177	0.14085	7.10000
		70	Kunburudhoo	322	49	11	49	715	0.21543	4.64177	0.14085	7.10000
South Central Region	Faafu Atoll	71	Biledhdhoo	821	145		145		0.09313	10.73810	0.10053	9.94762
		72	Feeali	741	128	3	128	451	0.09313	10.73810	0.10053	9.94762
		73	Nilandhoo	1303	178		178		0.09313	10.73810	0.10053	9.94762
	Dhaal Atoll	74	Bandidhoo	578	79		79		0.18088	5.52857	0.10053	9.94762
		75	Kudahuvadhoo	1639	272		136		0.18088	5.52857	0.10053	9.94762
		76	Meedhoo	919	125	5	125	387	0.18088	5.52857	0.10053	9.94762
		77	Vaanee	211	47		47		0.18088	5.52857	0.10053	9.94762
	Meemu Atoll	78	Dhiggaru	909	153		153		0.10409	9.60714	0.10053	9.94762
		79	Kolhufushi	811	133		133		0.10409	9.60714	0.10053	9.94762
		80	Mulah	1129	182	4	182	538	0.10409	9.60714	0.10053	9.94762
		81	Naalaafushi	321	70		70		0.10409	9.60714	0.10053	9.94762
	Thaa Atoll	82	Buruni	1130	182		182		0.11405	8.76786	0.10053	9.94762
		83	Guraidhoo	1137	180		90		0.11405	8.76786	0.10053	9.94762
		84	Hirilandhoo	845	136	8	136	982	0.11405	8.76786	0.10053	9.94762
		85	Kibidhoo	808	136		136		0.11405	8.76786	0.10053	9.94762

		86	Madifushi	720	120		120		0.11405	8.76786	0.10053	9.94762
		87	Thimarafushi	1237	222		222		0.11405	8.76786	0.10053	9.94762
		88	Dhiyamigili	452	96		96		0.11405	8.76786	0.10053	9.94762
	Laamu Atoll	89	Dhanbidhoo	537	102	10	102	1258	0.11133	8.98214	0.10053	9.94762
		90	Fonadhoo	1762	274		137		0.11133	8.98214	0.10053	9.94762
		91	Isdhoo	1559	267		267		0.11133	8.98214	0.10053	9.94762
		92	Kunahandhoo	602	98		98		0.11133	8.98214	0.10053	9.94762
		93	Maamendhoo	845	163		163		0.11133	8.98214	0.10053	9.94762
		94	Maavah	1373	242		242		0.11133	8.98214	0.10053	9.94762
		59	Mundhoo	372	49		49		0.11133	8.98214	0.10053	9.94762
		96	Gan	2502	399		200		0.11133	8.98214	0.10053	9.94762
South Region	Gaaf Alif Atoll	97	Dhaandhoo	1113	186	4	186	826	0.06780	14.75000	0.06012	16.63333
		98	Dhevvadhoo	480	105		105		0.06780	14.75000	0.06012	16.63333
		99	Dhiyadhoo	79	25							
		100	Kolamaafushi	1087	189		189		0.06780	14.75000	0.06012	16.63333
		101	Vilingili	1976	346		346		0.06780	14.75000	0.06012	16.63333
		103	Fares Maathoda	936	193		193		0.09153	10.92560	0.06012	16.63333
		104	Gadhdhoo	1439	328		328		0.09153	10.92560	0.06012	16.63333
		105	Hoandedhdhoo	668	140		140		0.09153	10.92560	0.06012	16.63333
		106	Madaveli	1065	198		198		0.09153	10.92560	0.06012	16.63333
		106	Nadallaa	614	122		122		0.09153	10.92560	0.06012	16.63333
		108	Thinadhoo	4442	728		243		0.09153	10.92560	0.06012	16.63333
		109	Fuvammulah	7636	1332		266		0.26316	3.80000	0.06012	16.63333
		110	Feydhoo	2724	511		256		0.11676	8.56476	0.06012	16.63333
		111	Hithadhoo	9465	1493		213		0.11676	8.56476	0.06012	16.63333
		112	Hulhudhoo	1147	257		257		0.11676	8.56476	0.06012	16.63333
		113	Meedhoo	1458	347		347		0.11676	8.56476	0.06012	16.63333
		114	Maradhoo	2043	303		303		0.11676	8.56476	0.06012	16.63333
		115	Maradhoofeydhoo	1025	183		183		0.11676	8.56476	0.06012	16.63333

Male	Male	116	Henveiru	23597	3177	30	454	2635	0.15939	6.27384	0.03067	32.60714
		117	Galolhu	19414	2640		440		0.15939	6.27384	0.03067	32.60714
		118	Maafannu	29964	3983		443		0.15939	6.27384	0.03067	32.60714
		119	Machchangolhi	19580	2623		525		0.15939	6.27384	0.03067	32.60714
		120	Villingili	6956	996		498		0.15939	6.27384	0.03067	32.60714
		121	Hulhumale'	2866	276		276		0.15939	6.27384	0.03067	32.60714

Power Analysis and Precision of estimates

Power of the study has been calculated using national estimates and assumed regional estimates by using below mentioned formula

$$n_1 = DEFF \times \frac{\left[Z_{\alpha/2}\sqrt{(r+1)\bar{p}\bar{q}} - Z_{1-\beta}\sqrt{rp_1q_1 + p_2q_2}\right]^2}{r(p_1 - p_2)^2}$$

Where,

$$\bar{p} = \frac{p_1 + rp_2}{r+1} \text{ and } \bar{q} = 1 - \bar{p}$$

p1 and p2 are national and regional estimates respectively

n1=Regional sample size. (Taken as 420 HH per region)

Design effect =2 Level of significance =95%

$Z_{1-\beta}$ is the z-value corresponding to power of the study.

And

Absolute precision of estimates were calculated using

$d=Z_{\alpha/2}*DEFF*pq/n$

Table1: showing approximate power and absolute precision of estimates

Indicator	Assumed regional estimates				
Power of study	96-97%	96-97%	96-98%	95-96%	96-97%
Absolute precision of estimates	3.25%	3.45%	3.71%	3.93%	4.07%
Vitamin A	0.49	0.51	0.53	0.55	0.58
Power of study	86-98%	89-98%	89-98%	89-98%	84-95%
Absolute precision of estimates	4.83%	4.83%	4.82%	4.81%	4.77%
Urinary Iodine	0.36	0.4	0.45	0.49	0.54
Power of study	89-96%	93-98%	93-98%	87-97%	77-95%
Absolute precision of estimates	4.64%	4.73%	4.81%	4.83%	4.81%

AMPLE SIZE FOR BIOCHEMICAL ANALYSIS & OTHER INDICATORS

The Biochemical analysis of Hemoglobin, Hematocrit, Ferritin, CRP, Vitamin A, Folic acid, Vitamin B 12, Zinc and Urinary Iodine along with the stool examination for worm infestation have been major tasks of the survey. The sample size for biochemical analysis has been calculated by using the prevalence data (and ranges) for various micronutrient deficiencies. The sample size calculation has been done on the basis of following assumptions and formula for each micronutrient.

$$n = \frac{1.96^2\, p(1-p)(DEFF)}{d^2}$$

Where:
DEFT = Design effect taken
p= Estimate of the expected proportion of micronutrient deficiency
d=Desired level of absolute precision

We further estimated the expected precision at regional level using the national sample size and the reduction in sample size at regional level by two separate methods. In general precision is proportional to 1/sqrt(n) where n is the sample size. So if the sample size at the regional level is reduced by a factor of the order of 6 (~420 households c.f. a national sample of 2500), the imprecision will be increased by a factor of srt(6) = 2.4. So a precision of +/- 4% would become, roughly, a precision of +/- 10%, which will be sufficient for estimation of trends and analysis of risk factors by region.

The sample size estimation for key indicators is given below;

Indicator	Prevalence Point estimate	Absolute precision at National level	Absolute precision at Regional level	Design effect	Estimated sample size
Exclusive Breastfeeding	23%	4%	10%	2	893
Hemoglobin	51%	4%	10%	2	1103
Urinary Iodine Deficiency	43%	4%	10%	2	1192
Serum Vitamin A	53%	4%	10%	2	1182

We also did a comparison of regional and national estimates for various nutrition indicators using a range of prevalence values and estimated the relevant precision of estimates and the requisite power. There is little information on the prevalence of several biochemical indicators from Maldives, hence we took maximum sample estimate calculated for Iodine i.e. 1192 samples and used that to further correct non-response rates.

ACCOUNTING FOR RESPONSE RATES

Another important issue to consider when calculating a sample size for a survey is to take into account the potential response or compliance of the population to be surveyed. Non-response can occur at many levels, such as;

- None of the household members may be available during the survey (the household is away on a temporary basis)
- The entire household may refuse to participate
- Some individuals within a household may refuse to participate or may not be available during the survey
- Some individuals may partially participate, such as agreeing to answer questions but refusing blood collection
- The volume of blood collected may be insufficient for laboratory analysis

All of these potential reasons for non-participation or non-responsiveness were taken into account and the final sample size was determined by dividing the calculated sample size, by the expected response. For example, if the calculated sample size for Hemoglobin was 1103 and a 95% (i.e., 0.95) response was expected, then the final sample size has been 1103/0.95 = 1161 (always rounded up). By considering 5% non response rate, the final sample size for each indicator has been as follows:

Indicator

	Women Reproductive Age	**Children 6 months to 5 y**	**ears Children 6 – 12 years**
Hemoglobin	1161	1161	
Urinary Iodine	1255	1255	1255
Vitamin A	1244	1244	
Ferritin	1255	1255	
Zinc	1255	1255	
Folic Acid	1255		-
Vitamin B 12	1255		-

Minimum Required Sample size

Appendix B

SPECIMEN COLLECTION, PROCESSING, STORAGE AND HANDLING

The accuracy of any laboratory tests is dependent upon the integrity of specimen on which it is performed. This section has guidelines to follow for collection, processing, storage and transportation of blood and urine specimen. The requirements of specific tests are also mentioned in this section.

Biochemical Analysis

The important and essential bio-chemical assessments for micronutrient deficiencies in women of reproductive age and children

	WRA	**Children**	**Children**
	(15-49 years)	(6months-5 years)	(6-12 years)
Hemoglobin and Haemetocrit Ferritin	1255	1255	-
C-ReactiveProtein	1255	1255	-
Vitamin-A	1255	1255	-
Zinc	1255	1255	-
Urinary Iodine	1255	1255	1255
Folic acid	1255	-	-
Vitamin B12	1255		-

Folic acid and Vitamin B12 assessment is only for women of reproductive age. The urinary iodine will also be performed for children 6 – 12 years of age.

Besides blood and urine specimen, the stool samples of all three groups are also need to be examined to assess the helmintheasis burden.

Stool examination	1255	1255	1255

For laboratory assays that require a large volume of serum and plasma, collection of blood via venipuncture would be necessary.

Drawing Of Blood (Venipuncture Procedure)

The venipuntcure procedure is simple but requires skill to perform. The phlebotomist must have following;

✔	Tourniquet	✔	Appropriate collection tubes
✔	Gauze	✔	Gloves
✔	Alcohol wipes	✔	Sharps container
✔	Stickers	✔	Butterfly 24 gauge
✔	Cotton Balls	✔	Needle Cutter

Several essential steps are required for every successful collection procedure:

- ✔ Identify your subject.
- ✔ Assemble your supplies.
- ✔ Wear gloves.
- ✔ Select a suitable site for venipuncture.
- ✔ Decide which arm you will be drawing from and tie the tourniquet a few centimeters from the arm.
- ✔ If no veins are palpable immediately, have the subject make a fist and clench and release a couple of times.
- ✔ Once a suitable vein is found, disinfect the area with the alcohol wipe.
- ✔ Allow the alcohol on the skin to dry completely.
- ✔ If you need to touch the venipuncture site again, disinfect the fingers you will need to palpate with using an alcohol wipe.
- ✔ Attach 10 cc syringe after removing needle to the butterfly.
- ✔ Anchor the vein using the thumb and finger of the opposite hand, and insert the needle of butterfly.
- ✔ Push the needle of butterfly into vein and check for blood flow.
- ✔ If there is no blood flowing into the tube, rearrange the position of the needle by inserting it further into the subject, bringing the needle slightly back out, or changing the angle of the needle.
- ✔ Allow the syringe to fill.
- ✔ Remove the tourniquet.
- ✔ Have a piece of gauze ready in the opposite (anchoring) hand, remove butterfly, and place gauze on top of the venipuntcure site. Apply pressure.
- ✔ Remove the syringe.
- ✔ Fill appropriate tubes with required amount of blood.
- ✔ Label the tubes.
- ✔ Discard the butterfly in a sharps container.
- ✔ Ensure that the subject has stopped bleeding, and apply tape and gauze, or a bandage to the venipuncture site.
- ✔ Discard waste and put materials away.

✔	Serum Retinol	✔	Hemoglobin & Hematocrit
✔	Serum Ferritin 9	✔	Urinary Iodine
✔	C-ReactiveProtein(CRP)9	✔	VitaminB-12
✔	Plasma Zinc 9	✔	Folic Acid

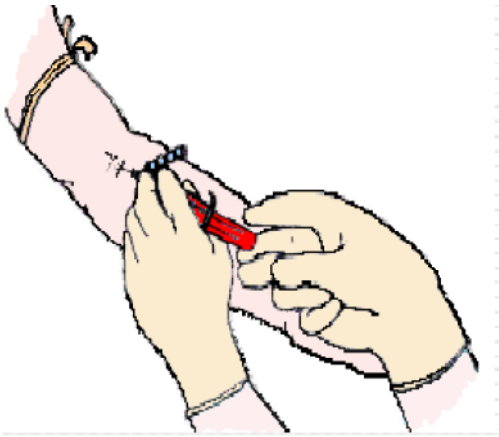
7.5 SPECIMEN SOURCE & VOLUME FOR BIO CHEMICAL TESTS

S.#	Test	Serum	Plasma	Urine	Stool	Volume of whole blood required
1	Serum Retinol	200 µL	-	-	-	2.0 mL
2	Serum Ferritin	200 µL	-	-	-	
3	C-Reactive Protein	200 µL	-	-	-	
4	Zinc	-	1.5 mL	-	-	3.0 mL
5	Hemoglobin	-	-	-	-	By HemoCue
6	Urinary Iodine	-	-	3.0 mL	-	-
7	Stool Examination	-	-	-	100 mg	-
8	Vitamin B -12	1.5 mL	-	-	-	3.0 mL
9	Folic Acid	1.5 mL	-	-	-	3.0 mL
Total Volume Required		**9.0 mL**	**1.5 mL**	**3.0 mL**	**100 mg**	**11.0 mL**



The phlebotomist sets the tourniquet around the upper arm of the subject, searches the proper vein by inspecting and palpating and then sterilizes the injection site. The vein can be anchored by placing the thumb about two centimeters below the vein and pulling gently to make the skin a little taut.





After that, the needle/butterfly, beveled upward, should be pushed smoothly and quickly into the vein, to minimize the possibility of hemolysis as a result of vascular damage. Immediately after the insertion, the tourniquet should be released to minimize the effect of hemoconcentration.

The step-by-step procedures for collecting, labeling, and shipping the urine specimens are provided below;

LAB REQUISITION FORM

A lab requisition form must accompany each sample submitted to the laboratory. This requisition form must contain the proper information in order to process the specimen.
The essential elements of the requisition form are:

- Study Name
- Subject's unique ID number
- Subject's full name, first name, and last
- Subject's date of birth/age and sex
- Date and time of collection
- Initials of phlebotomist/Lab technician
- Indicating the test(s) requested

Requisition form with the essential elements is shown below:

LAB REQUISITION FORM
National Micronutrient Survey 2007
Republic of Maldives

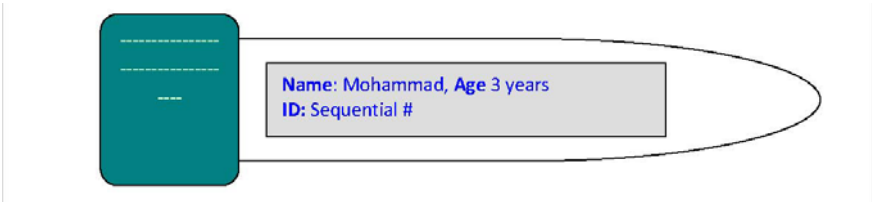
LABELING THE SAMPLES TUBES

A properly labeled sample is essential so that the results of the test will be linked with individual information.
The key elements of labeling are;

- Subject's full name
- Subject's age
- Subject's unique ID number

NOTE: the above identification MUST match with the serum, plasma and urine tube and requisition form
Appropriate and legible labeling of the blood and urine specimen is important. Some alternative methods for labeling are:

Sequentially numbered labels; two/three labels per number; one label will be pasted onto the tubes containing the blood or urine and the other into the form.



Note: The label having similar information has also been on the lab requisition form

COLLECTION TUBES FOR PHLEBOTOMY

Each phlebotomist had following tubes;

Green Top	
Additive	Sodium heparin
Uses	plasma collection (zinc analysis)

Yellow Top	
Additive	Gel (quickly clots blood)
Uses	Serum collection (Retinol, CRP, Ferritin, Vit B12 & Folic Acid)

COLLECTION OF WHOLE BLOOD FOR HEMOGLOBIN & HEMATOCRIT (If Hb/Hct by coulter)

Whole blood was mixed with an anticoagulant already present in the collection tube, and therefore did not clot. Put 1ml whole blood in EDTA tube.

- Whole Blood Preparation Procedures:
- Collect 1.0 ml blood into tube
- To process, invert tube gently 10 to 15 times immediately after draw.
- Leave tube at room temperature.
- Do not centrifuge.
- Keep the specimen at room temperature or store at 4-8oC for few hours until transport to the local laboratory for analysis
- Whole Blood Preparation Errors:
- Failure to invert tube 10 to 15 times to mix anticoagulant immediately after putting blood into tube
- Failure to leave specimen at room temperature

What is Serum & Plasma?

Plasma and serum are both fluid components of the blood. It is the clot that makes the difference between serum and plasma.

Serum: The clear liquid part of the blood that remains after blood cells and clotting proteins has been removed from it. Serum is the clear liquid that can be separated from clotted blood

Plasma: The liquid portion of normal unclotted blood containing the red and white cells and platelets, it comprises approximately 55% (the other 45% is red blood cells) of the total blood volume, and contains salts and ions such as calcium, sodium, potassium, and bicarbonate. It also contains larger molecules such as amino acids, lipids (fats), vitamins, and hormones. Approximately 91-92% of blood plasma is water, 7-8% is protein, and 1-2% is other solutes, such as electrolytes and nutrients.

PROCESSING OF SERUM FOR RETINOL, FERRITIN, CRP, B12, FOLIC ACID

Serum will be obtained from clotted blood that has not been mixed with an anticoagulant (chemical that prevents clotting). Serum is usually collected in (serum separator tubes (7-10 mL SST)/Gel Barrier Tube/ Gel and Clot Activator Tube

Serum Preparation Procedures:

Draw 3 & 8 ml whole blood to yield the required serum volume for children and WRA respectively. The 10 ml gel-barrier red and gray (tiger) top tube will yield approximately 4-5 ml serum after clotting and centrifugation.

Place collection tube upright in rack and allow blood to clot at room temperature (no longer than 30 minutes).

When clot has formed, centrifuge tube for 10 to 15 minutes at 3000 rpm. Caution: Prolonged centrifugation may cause hemolysis. Be sure to use a balance tube of the same size with an equivalent volume of water. The tube stoppers must remain on.

Turn the centrifuge off and let it come to a complete stop without stopping it with your hand or brake. Remove tubes carefully without disturbing the red cells at the bottom.

Hold the tube in upright position and carefully remove the stopper. Transfer serum to a transfer tube with a disposable pipette. Do not disturb the cell layer or allow any cells into the pipette. If cells are disturbed, recentrifuge specimen. Do not pour the serum or invert SST tube. Store at -20 oC until the transportation.

Plasma Preparation Errors:

- Failure to separate plasma from cells
- Hemolysis or damage to red blood cells

PROCESSING OF PLASMA FOR ZINC

Serum will be obtained from clotted blood that has not been mixed with an anticoagulant (chemical that prevents clotting). In most cases, this is a lavender top EDTA Sodium heparin tube. This mixed blood is centrifuged without clotting, yielding plasma.

Plasma Preparation Procedures:

- Collect 3 ml blood in Sodium Heparin tube
- Gently mix the blood by inverting tube six to ten times immediately after collection
- Centrifuge
- Carefully remove the stopper and pipette off the plasma from cells using a disposable pipette
- Transfer plasma to a transfer tube
- Store at -20 oC until the transportation

Plasma Preparation Errors:

- Failure to separate plasma from cells
- Hemolysis or damage to red blood cells

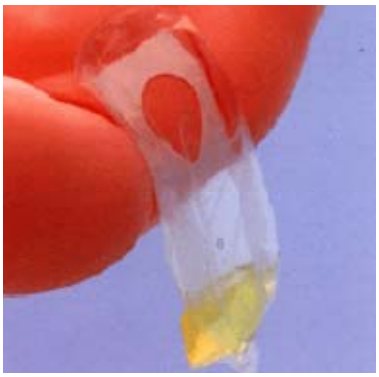
URINE COLLECTION PROCEDURE

- Urine should be collected in sterile plastic bottles or pediatric urine collector
- Do not collect urine during menstruation
- Transfer at least 3 ml urine in green top sample storage tube using a disposable pipette
- Store at -20 oC temperature until the transportation to AKU Karachi
- Urine sample should be mid-stream i.e. the initial small quantity of urine should be discarded and the remaining sample to be collected in the sterile bottle.

The reason for the use of disposable cups and pipettes for urine collection is to prevent contamination from specimen to specimen and the possibility of contamination in cleansing the equipment. Reusable supplies could be used but contamination may bias the results of the urinary iodine concentration tests. Surgical gloves are required to protect survey team members handling urine specimens from the potential of infectious diseases transmitted via urine.

Containers for Urine Samples

Urine Collection Container



Paediatric Urine Collector

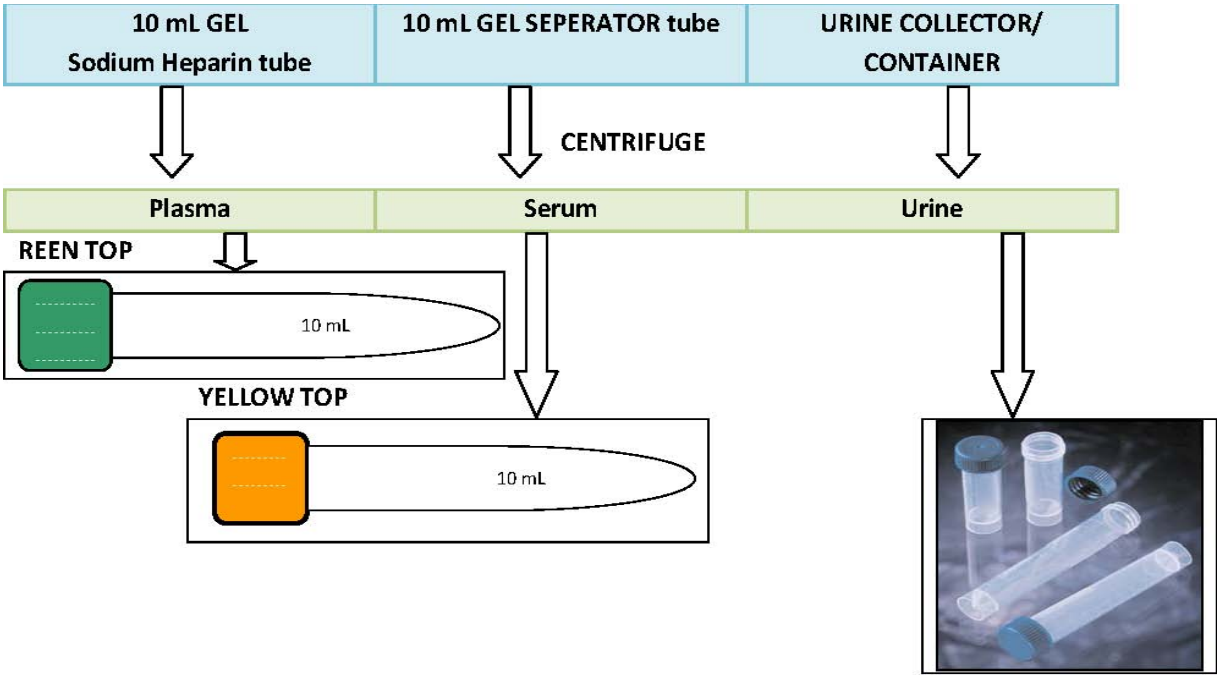
Sample Mailing Tubes

UNACCEPATABLE SPECIMEN

- General criteria for unacceptable specimen:
- Wrong tube selection
- Quantity not sufficient (QNS)
- ID number on tube does not match exactly the number on requisition form
- Sample hemolyzed

SPECIMEN FLOW CHART

A number of supplies were needed for transporting the specimens to the laboratory.



SAFETY AND INFECTION CONTROL

It is important to follow safety and infection control procedures.

- Protect Yourself
- Practice universal precautions:
- Wear gloves and a lab coat or gown when handling blood/body fluids.
- Change gloves after each subject or when get contaminated.
- Wash hands frequently.
- Dispose of items in appropriate containers.
- Dispose of needles immediately upon removal from the subject's vein. Do not break or recap.

If you stick yourself with a contaminated needle:

- Remove your gloves and dispose of them properly.
- Squeeze puncture site to promote bleeding.
- Wash the area well with soap and water.
- Record the subject's name and ID number.
- Follow institutions guidelines regarding treatment and follow-up.

Protect the Subject:

- Place blood collection equipment away from subjects, especially children.
- Practice hygiene for the subject's protection. When wearing gloves, change them between each subject & wash your hands frequently. Always wear a clean lab coat or gown.

BOI-HAZARD WASTE DISPOSAL

How will waste products, such as lancets, needles, syringes, be safely disposed?

In all settings where specimens are collected and prepared for testing, laboratory and healthcare personnel should follow current recommended sterile techniques, including precautions regarding the use of needles, lancets, needles, syringes and other sterile equipment as well as guidelines for the responsible disposal of all biological material and contaminated specimen collection supplies. Some wastes associated with biological materials must be disposed of in special ways because they may have been contaminated with infectious organisms or agents. These wastes include; all sharps, e.g. glass implements, needles, lancets, syringes, blades, etc.

Procedure:

For disposal of these wastes;

- Sterilize or disinfect waste materials infectious to humans (by autoclave or chemical treatment equivalent to 1:10 Hypochlorite solution).
- Place all biohazard wastes, except for sharps, directly into the red bag-lined medical waste boxes.
- Place sharps into labeled sharps containers which when filled are placed into the medical waste box.
- When the medical waste box is filled, seal the bag liner and box and notify assigned staff for pick-up.

SPECIMEN STORAGE & TRANSPORTATION

Step 1: After collecting the specimen (s) whole blood will be transferred to the health facility laboratory or any other allocated area to centrifuge the blood.

Step 2: After centrifugation, transfer the serum and plasma in to appropriate tubes with a disposable pipette,

Step 3: Wrap all serum tubes in aluminum foil to protect form light and seal caps with para film to protect any leakage,

Step 4: Refrigerate specimen at - 4 -8 centigrade for 24 hours or if freezer is available than freeze the specimen at -20 centigrade until transport to Male.

Step 5: Transport the specimen in any close Styrofoam box with ice packs.

Step 6: All serum, plasma and urine will be freeze at -20 o C until transportation to AKU-Karachi

NOTE: Plasma /Serum and Urine specimen (s) can be stored at -20 centigrade up to one year, because specimen stability remain unchanged, Keep all specimens away from bright light.

Exposing a specimen to light causes a breakdown of some analytes, some tests (especially serum retinol) require specimens be wrapped in aluminum foil or be kept in a paper bag to prevent exposure to light.

Step 7: All specimens including serum, plasma, and urine will be transported via DHL in local made special packaging material with dry ice to Nutrition Research Laboratory, Aga Khan University, Pakistan.

Step 8: An assigned person from AKU will collect the samples from the DHL office when intimated by the Survey Focal Person and transfer it to AKU Lab where samples will be processed accordingly.

HAEMOGLOBIN MEASUREMENT BY USING HEMOCUE MACHINE

A. GUIDELINES

- The Lab technician/CHW should explain about the blood test to the subject (WRA & Children) detailing:-
  - What the test is for (to check for anaemia)
  - How it is done (finger prick blood specimen)
  - Why the test is being done (evidence of high local prevalence of anaemia)
  - Implications of anaemia (delay in development, prone to infection)
  - Causes of anaemia (lack of iron in the diet)
- Obtain verbal consent
- Switch on and check the calibration of the Hemocue with the test cuvette
- Health professionals performing the blood drawing procedure are advised to wear gloves

B. PROCEDURE

- The preferred site for collection of capillary blood sample is from the middle or ring finger of children or adults. Infants (less than one year old) who have not begun to walk may have blood collected from the heel. Thumb or big toe can also be used.
- Try to avoid excessive squeezing that might dilute the specimen with tissue fluids and produce a falsely low result
- Avoid fingers with rings for sampling.
- If cold, warm subject fingers with warm water.
- The fingers should be straight but not tense, to avoid stasis.
- Make sure the subject is relaxed and distracted, if child then he/she should be held by the mother
- Ensure that the arm, hand and digit are not held too tight so obstructing blood flow
- Blood obtained by finger stick (lancet) must be free flowing and not forced; do not "milk" the finger to get sufficient blood.
- Wipe away the first and second drop with a clean, dry gauze or lint-free tissue and then collect the third drop of blood for analysis.
- Do not use cotton balls since cotton fibers will interfere with the test.
- Clean site for blood collection with alcohol-soaked gauze or a newly-opened alcohol pack.

- Using your thumb, lightly press the finger from the top knuckle to the tip to stimulate flow of blood to the sampling point.
- For the best blood flow and the least pain, sample at the side of the fingertip, not the center.
- Position the lancet device so that the puncture will be made across the whorls (lines) of the fingerprint. Press the lancet firmly off-center on the fingertip prior to activating the lancet to aid in obtaining a good sample.
- Activate the lancet to puncture the fingertip. Discard the lancet in an approved sharps container.
- Wipe away the first 2 drops of blood without excessive squeezing of the digit to encourage a good flow of blood.
- If necessary, apply light pressure again, until another drop of blood appears. Avoid "milking of the finger".
- Remove a microcuvette from the vial and recap immediately.
- Make sure the **third** drop of blood is big enough to fill the microcuvette completely. Hold the microcuvette at the "wing" end and touch the tip into the middle of the drop of blood from above the finger. Keep the microcuvette in contact with the blood and fill in one continuous process. Do not refill a partially filled microcuvette.
- If obtaining the first specimen has been difficult (due to movement of the child etc), fill a second cuvette from another blood drop.
- Wipe any residual control material from the sides of the microcuvette with a piece of gauze, as if wiping excess butter from a knife. Do not touch the opened end with the gauze since this will draw blood out of the microcuvette.
- Visually inspect for air bubbles in the center of the cuvette eye. If bubbles are present in the cuvette eye, discard the microcuvette and obtain another specimen.
- Load the cuvette into the machine and read result after about 30 seconds. If a second cuvette was filled,then take the higher reading as indicating the true Hb.
- Record the result before removing the microcuvette from the instrument.
- Remove the cuvette and discard it into a biohazardous waste container.
- A record of all subjects screened should be kept in Lab investigation form:
  - Hb test performed or
  - Hb result
- Remove gloves and wash hands.

C. SAFETY

A. Since blood is a primary carrier for hepatitis C virus (HCV), hepatitis B virus (HBV), and human immunodeficiency virus (HIV), standard (universal) precautions are required. Wear appropriate personal protective equipment including gloves and lab coat.

B. Dispose of finger stick devices and microcuvettes in a sharps container.

C. Dispose of all blood soaked items as biohazardous waste.

D. MATERIALS

1. Instruments

1. HemoCue Hb Analyzer
2. HemoCue AC Adapter or 4 AA alkaline batteries

2.Supplies

1. HemoCue Hb- Microcuvettes
2. Gloves
3. Alcohol, lent free tissues, gauze squares, or alcohol pledgets –do not use cotton balls except to apply alcohol as a disinfectant
4. Blood lancet & Biohazard/sharps container
5. Disinfectant

E. STORAGE

1. Microcuvettes: Store the microcuvettes at room temperature (15-30 oC or 59-86 oF) in a dry place.
2. Instrument: Remove the batteries from the HemoCue analyzer if it will be stored for more than a week.

F. MAINTENANCE

- Clean the exterior of the instrument on a daily basis with a clean cloth which has been slightly dampened with mild detergent.
- Clean the interior of the photometer and lens assembly daily (or each day that the instrument is in operation) with a long stem cotton-tipped applicator that has been saturated with water. Squeeze out the excess water and clean the inside of the analyzer until no traces of blood are seen. Alcohol is not to be used in cleaning the interior of the photometer and lens assembly.
- The microcuvette holder should be cleaned daily with soap and water.

G. SOURCES ERROR AND RECOMMENDED ACTION

A. Bubbles in the sample: The quality of the sample has a considerable effect upon the accuracy and precision of this test. Examine the sample drawn into the microcuvette; bubbles of any size in the circular optic window are unacceptable. If bubbles are present, discard the microcuvette and take another sample.

B. Microcuvettes exposed to moisture: Exposure to moisture in room air will inactivate the reagents in the microcuvette, causing a discoloration. Microcuvettes must be used within 5 to 10 minutes of being taken from the canister. After removing microcuvettes from the canister, replace the cap immediately, taking care to assure it is tightly sealed.

C. Microcuvettes used 90 days after opening canister: The cuvettes are stable for 90 days after opening a new canister. Date the canister when opened and write the new expiration date on the label. Discard unused Microcuvettes after 90 days.

D. Microcuvettes exposed to excessive temperatures: Store microcuvettes in their canister at room temperature. Monitor the temperature of the room in order to detect fluctuations of temperature which may have a detrimental impact on the integrity of the microcuvettes.

E. Error Codes: If the analyzer shows "ERROR" and a digit code it may be an occasional fault. Turn off the analyzer and switch it on again after 30 seconds. Take a new cuvette and repeat the measurement.

H. COMPETENCIES FOR STAFFS TO CONDUCT HB SCREENING

Lab technician/CHW should be able to display

- Competence in communicating with mother or care taker about the test
- competence in conducting the bloodletting procedure and in operating the machine

Laboratory Analytical Methods

Detailed description of the analytical methods used for the analysis of each micronutrient with the requisite references and external quality controls is as follows;

1. Serum Retinol

Methodology:

The HPLC consisted of a standard Quaternary pump, a programmable UV/Vis detector. The separation was achieved using a XDB Agilent technologies C-18 Length 25cm, Diameter 4.6mm5-µm. Isocratic mobile phase 100% Methanol was used.

Instrument/Model:

High Performance Liquid Chromatography (HPLC)

- 1200 Series, Agilent Technologies
- 200 Series, PerkinElmer

Standards & Reagents:

- Retinyl Acetate as internal standard
- NIST Standard Reference Material (SRM 968c) for samples calibration
- Calibrated pooled serum

References:

1. J. Chromatogr. 231, (1982), 439-444
2. Biochemistry and Nutrition, ICDDRB, 1986, 1992
3. J. Chromatogr. 311, (1984), 239-248

Reagent Pack:

- IMx Ferritin Reagent Pack. 100 Tests (2219-20)*
- Ferritin Controls (9C01-10)
- MEIA Buffer for IMx

References:

1. U.S. Department of Labor. Occupational Safety and Health Administration, 29 CFR part 1910-1030 Occupational Exposure to Blood borne Pathogen; Final Rule. Federal Register 1991; 56(235);64175-82.
2. U.S. Department of Health and Human Services. Bio safety in Microbiological and Biomedical Laboratories. HHS Publication No. (CDC) 93-8395. Washington, DC: U.S. Government Printing Office, May 1999.
3. World Health Organization. Laboratory Bio safety Manual. Geneva: World Health Organization, 1993.

3. C-Reactive Protein (CRP) In Human Serum

Methodology:
This assay is a reagent system for the quantitative measurement of C - reactive protein in serum samples for clinical assessment of the acute phase response. Measurements obtained are used as indicators of tissue injury, infection, inflammation or malignant neoplasia

Instrument/Model:

Roche/Hitachi 902 Chemistry Automated Analyzer

Kits and Reagents:

- C RPLX , Tina-quant C- Reactive Protein (Latex)
- Preciset Serum Protein
- CRP Control N

References:

1. Henry JB, ed. Clinical Diagnosis and Management by Laboratory Methods, Vol ii.Philadephia, Pa:WB Saunders Co, 1979.
2. Greiling H, Gressner AM, eds. Lehrbuch der Klinischen Chemie und
3. Pathobiochemie, 3rd ed. Stuttgart/New York: Schattauer, 1995:234-236.
4. Use of Anticoagulants in Diagnostics Laboratory Investigations, WHO Publication WHO/DIL/LAB/99.1. Rev.2.Jan.2002
5. Price Cp et al. Development and validation of a particle-enhanced turbidimetric immunoassay for C-reactive protein.

J Immunol
Methods 1987; 99:205-211

4. Zinc in Human Plasma

Methodology:
The method employed is the standard Atomic Absorption Spectrophotometry using a Thermo Elemental SOLLAR M Series atomic absorption spectrometer with Software Package running under Microsoft Windows®, generating the analytical methods and sophisticated database technology stores and retrieves the data. Flame Analytical Method

Instrument/Model:
SOLLAR M-Series Atomic Absorption Spectrophotometer, Thermo Electron Corporation

Calibration & Standards:
Bi-Level Trace Elements Serum Toxicology Control, UTAK Laboratories, Inc Valencia

References:

1. Pra'ad, A. S., Oberleas, D.,ammd Hm1sted, J. A. 1)etermilmntion of zinc jim biological fitmids by atomic absorption spectrophotometry. J. Lab. Cli,,. Med 6. 508 (1965).
2. David, P.1. TIme determination of zinc and other elements immplants by atomic ImlHorptionspectroseopy. Anal y81 83, 655 (1958).
3. Fuwa, K., Pulido, P., McKay, R., and Vahlee, B. L., 1)eterimiimmation of zinc in biological materials by atomic absorption spectrophmotoinetry. Anal. C1IePI. 36, 2406 (1964).
4. Bohing, E. A., A multiple slit burlier for atomic absorptiomi speetroseopy. Spectroehinm. Ada 22, 425 (1966).*weus.Brookfield micro comie.plate viscolneter, Model LVT. Brookfield Enginevrimmg Lal,oratories, Inc., Stoughton, Mass,
5. Thermo electron Corporation Atomic Absorption Method Guide for Zinc blood serum

5. Urinary Iodine

Methodology:
Urine is digested with ammonium per Sulphate. Iodide is the catalyst in the reduction of ceric ammonium Sulphate (yellow) to cerous from (clouourless) and is detected by rate of colour disappearance

Instrument/Model:
Vmax Kinetic Microplate Reader (Molecular Devices)

Reagents:

- Ammonium Persulphate (analyticalgrade) As2O3, NaCl,
- Ce (NH4)4(SO4)4, 2H2O, Deionized H2O, KIO3
- **Solutions:** 10 M, Ammonium Persulphate, Arsenious acid solution n (0.05 mol/L) Ceric ammonium Sulphate solution (0.019mol/L) Standard iodine solution, 1µg iodine/ml (7.9µmol/l)

References:

1. ICCIDD, UNICEF, WHO, Dunn JT et al. Method for measuring iodine in urine. The Netherlands, ICCIDD, 1993.(www.iccidd.org, under about IDD, where the Unrecompensed. Method of Dr. John T. Dunn, jtd@virginia.edu)
2. Clinical Chemistry. 2000; 46: 529-536) C 2000 American Association for Clinical chemistry, Inc.
3. Articles : Simple Microplate Method for the Determination of Urinary Iodine
4. Toshinori Ohashi, Mitsuo Yamaki, Chandrakant S. Pandave, Madhu G, Karmarkar and Minoru Irie.

6. Vitamin - B12

Methodology:
Analytical Internal Standard Method was used to analyze vitamin B12 in human serum. The separation was achieved using a C-18 Supelcosil Column. Isocratic mobile phase 97% Methanol with RO Water was used

Instrument/Model:
200 Series, High Performance Liquid Chromatography (HPLC), PerkinElmer
Reagents, Chemicals and Standards:

- Cyanocobalamin as standard
- Sodium phosphate dibasic
- Trimethylamin
- Perchloric acid
- Ortho-phosphoric acid
- Methanol

References:

1. B-complex; Vitamins; HPLC; Biological fluids; SPE Received: May 26, 2004; revised: July 13, 2004; accepted: July 14, 2004, DOI 10.1002/jssc.200401858
2. I.N. Papadoyannis, HPLC in Clinical Chemistry. Marcel Dekker, New York 1990, Chapter 23, pp. 440–472.
3. S. Albala-Hurtado, M. Teresa Veciana-Nogues, M. Izquierdo-Puliddo, A. Marine-Font, J. Chromatogr. A 1997, 778, 247–253.
4. M.J. Esteve, R. Farre, A. Frigola, J.M. Garcia-Cantabella, J. Chromatogr. A 1998, 795, 383–387.

The conventional normal value ranges for bio-chemical analysis are below:

SERUMRETINOL:µg/dL	
< 10	Deficient
10□<20	Low
20□<30	Marginal
≥30	Adequate

SERUM FERRITIN: ng/mL	
NB:	25-200
1month:	200-600
2-5month:	50-200
6months-15yrs:	7-140
Adult Male:	28-365
Adult Female:	5-148

C-REACTIVE PROTEIN: mg/dL
0 - 6.5

URINARY IODINE: Unit µg/L		
MedianUrinaryIodineConcentration(mcg/L)	**CorrespondingApproximateIodineIntake(mcg/day)**	**Iodine Nutrition**
<20	<30	Severe deficiency
20-49	30-74	Moderate deficiency
50-99	75-149	Mild deficiency
100-199	150-299	Optimal
200-299	300-449	Morethanadequate
>299	>449	Possible excess

PLASMA ZINC: µg/dL
50 -150

VITAMIN B12: ng/mL
0.1-0.35

External quality controls and in-house QC

The clinical laboratories at the Aga Khan University are part of the standard laboratory quality control. For the External Quality Control AKU has collaboration with Bio-Rad Laboratories. The following represents a summary of the existing external and internal quality control measures for other micronutrients.

Vitamin A analysis:
We have recently participated in Vitamin A Laboratory-External Quality Assurance (VITAL-EQA), program with Nutrition Laboratory at the Centers for Disease Control (CDC) and Prevention (CDC) in Atlanta. We are also in the process of settingup external micronutrient measurement quality assurance program of the National Institute of Standards and Technology (NIST) at Gaithersburg, Maryland. Quality Control for Urinary Iodine assessment is being undertaken with the Iodine Resource Laboratory (IRLI) Dept Clinical Chemistry Service Brussels, Belgium.

Additionally, we are using the Bi-Level Trace Elements Control from UTAK Laboratories, INC, Valencia for quality control material for monitoring the accuracy and precision that measures the levels of trace elements in serum.

STOOL EXAMINATION (PROTOCOL FOR STOOL COLLECTION, ANALYSIS & REPORTING)

Stool Analysis has been performed to assess following parameters:

a. To assess the current prevalence rate of infection with

i. Any STH (roundworm, whipworm and hookworm)
ii. Roundworm
iii. Whipworm
iv. Hookworm

b. **To assess the intensity (light or moderate to heavy) level of infection in the community by each type of helmith infection such as**

1. Roundworm
2. Whipworm
3. Hookworm

c. To examine the association of worm infections with other nutritional parameters studied in the main survey

d. To modify the de-worming strategies based on the results of the survey
The above parameters have been assessed for categories pertaining to children 6 months to 5 years and for children 6 months to 12 years.
Methodology
The Kato-Katz technique which is recommended by WHO for assessing the worm burden has been used to assess the prevalence and intensity of STH infections in the community.

A. Training of data collectors and stool analysts
Although a group of both six lab technicians and an equal number of Community Health Workers/Supervisors were trained on Kato-Katz, only the lab technicians performed the microscopic examination of stool and counting of eggs during the survey.

The Community Health Workers/Supervisors who were trained has been effectively used for disseminating messages on the purpose and benefits of stool survey to the community, collecting stool samples from the households, preparation of samples and data recording and record keeping on stool analysis.

B. Collection of samples of stool from the community

Social mobilization as a working strategy has been used to get required support from the community to provide stool samples in the survey.

The households from which we collected the samples were educated about the purpose of study and how to collect the sample of stool from children. Screw-capped Stool collecting bottles were distributed to them in the previous evening or early morning.

Household number/survey identification number was recorded in the container at the time of its collection.

C. Analysis of collected samples

Kato-Katz technique as described below has been used for laboratory analysis of stool.

Materials required:

For analyzing specimens:

a)	Kato-Katz kits provided in the kit (the plastic templates and spatulas will be reused)	
b)	Personal protection items such as face masks	
c)	microscopes* (Objectives 10x)	5 -6
d)	microscope slides 1	per subject
e)	glycerine	200 cc
f)	forceps	1 per team
g)	scissors	1 per team
h)	disposable gloves non sterile	1 box
i)	glass jar (500 ml – 1ltr size)	1

For cleaning:

j)	brush	1
k)	heavy-duty rubber gloves	2 pairs
l)	bucket	1
n)	owder soap	
o)	Sodium hypochlorite (Bleach)	¼ litres per team

For data registration:

p)	pencil	1

Preparation for laboratory testing

I. Put glycerine into a small jar (the amount depends on the number of tests to be performed next day but usually 50 –100 ml s will be adequate)

II. Add a few drops of methylene blue into the solution and stir well.

III. Cut an adequate number (about 10% more of the next day's sample) of cellophane from the roll provided in the Kat-Katz kit into 3.5 cm-slip-size pieces. Put them into the above prepared glycerine jar and mix them. Close the lid and keep them for use in the testing next day.

Laboratory analysis of stool

IV. Mark the child's number (survey code) correctly in the stool container, child's survey form, and the glass slide. (have an adequate number of glass slides – e.g. 1 each per study subject)

V. Place the plastic template provided in Kato-Katz kit that has a rounded hole in the middle on the numbered slide and centre it on the slide

VI. Take 2-3 grams of collected stool from the container onto a piece of newspaper/toilet paper. Place a piece of filter paper provided in the Kato-Katz kit after cutting it into an adequate size (5 cm length) over the sample of stool. Scrape stool through the filter paper using the plastic spatula provided in the Kato-Katz kit

VII. Fill with the filtered stool on the middle hole of the plastic template over the slide and take the plate away after leveling the stool contents over the plate. This should leave approximately 41.7 mgs of stool on the slide

VIII. Place the glycerine soaked cellophane cover-slip over the stool patch and carefully spread it evenly underneath the cover-slip by pressing the cellophane cover-slip by using another slide. Allow about 45-60 minutes before reading the slide to have a clear visibility. For hookworm eggs read before one hour and leave other worms to be read after 45 –60 minutes**.**

IX. Identify and start counting eggs using the low power of microscope. Higher magnification may be used for egg type identification but counting is recommended under usual magnification. The whole field should be viewed and eggs counted in a systematic manner.

X. It is important that the sample and slide have the same coding number as in the data collection sheet (many stool analysts tend to forget the importance of record keeping) This need to have been included in the overall study methodology and the information on coding should be available at the time of training.

XI. Team leader should check at least 10% of the samples tested by each technician. Errors must be identified and corrected and if the laboratory technician is consistently off the mark his slides must be redistributed among the other consistent lab technicians.

Appendix C

GENERALPHYSICALEXAMINATION

6.1 CYANOSIS

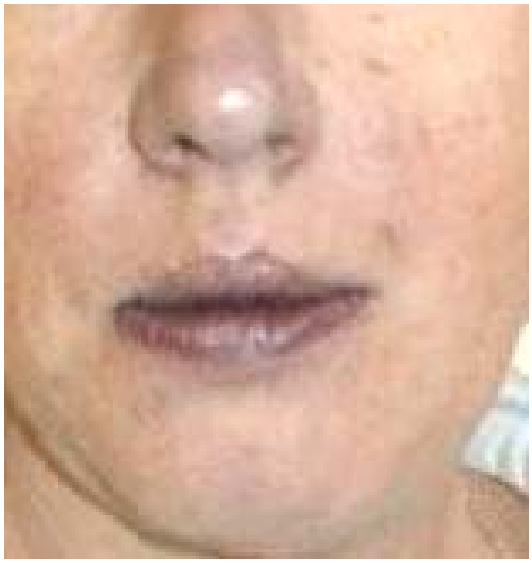
Skin coloration is determined by the amount of pigment in the skin and the blood flowing through it. Blood that is saturated with oxygen is bright red. Blood that has lost its oxygen is dark bluish-red. Cyanosis is defined a bluish or bluish black discoloration of the skin and mucous membranes (inner lining of mouth), cyanosis results from lack of oxygen in the blood. It can be classified as central or peripheral, although the two types may coexist.

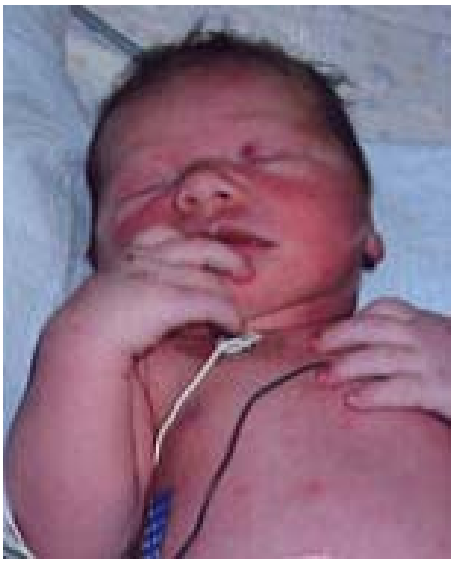
Central cyanosis it may occur anywhere on the skin and also on the mucous membranes of the mouth, lips, and conjunctivae.

Peripheral cyanosis It may be widespread or may affect only one extremity (leg or arm); however, it doesn't affect mucous membranes. Typically, peripheral cyanosis appears on exposed areas, such as the fingers, nail beds, feet, nose, and ears.

Severe cyanosis is quite obvious, whereas mild cyanosis is more difficult to detect, even in natural bright light. In dark-skinned subjects, cyanosis is most apparent in the mucous membranes and nail beds.

CULTURAL CUE: The lips of some black people have a bluish hue making it difficult to assess cyanosis. Establishing a baseline color of the subject's skin and mucous membranes will help you detect color changes.



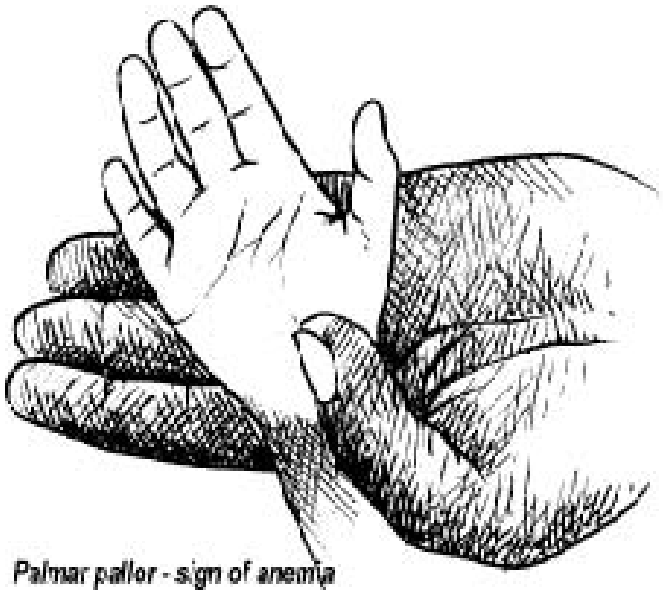


6.2 PALLOR

Pallor is the sign of reduced amount blood in the body; it may be by anemia and other illnesses. It is a useful indicator of anemia.

Pallor is not usually clinically significant unless pale lips, tongue, palms of the hands, inside of the mouth, and lining of the eyes, accompany it.

Pallor can be assessed on conjunctivae of eyes and other sites i.e. palm, nail bed, tongue and buccal mucosa.



PalmarPallor

Look for palmar pallor. Look at the palms. Hold the child or woman palm open by grasping it gently from the side. Do not stretch the fingers backward as this could cause pallor by blocking the blood supply. Compare the color of the subject palm with your own palm or with some on else who is not suffering from anemia. If the skin of the palm is very pale or so pale that it looks white, the subject has s palmar pallor and may have anemia.

Conjunctival Pallor

Ask the child or woman to look upward and gently pull her lower eye downward. See the interior of the lower eyelid. If conjunctiva is pale then mark it on the questionnaire.

6.3 JAUNDICE

Jaundice consists of a yellow discoloration of the skin, mucus membranes (tissue including that which lines the mouth), and whites of the eyes. It is a symptom that often occurs with liver and gallbladder disorders. It may also be present in certain blood disorders.

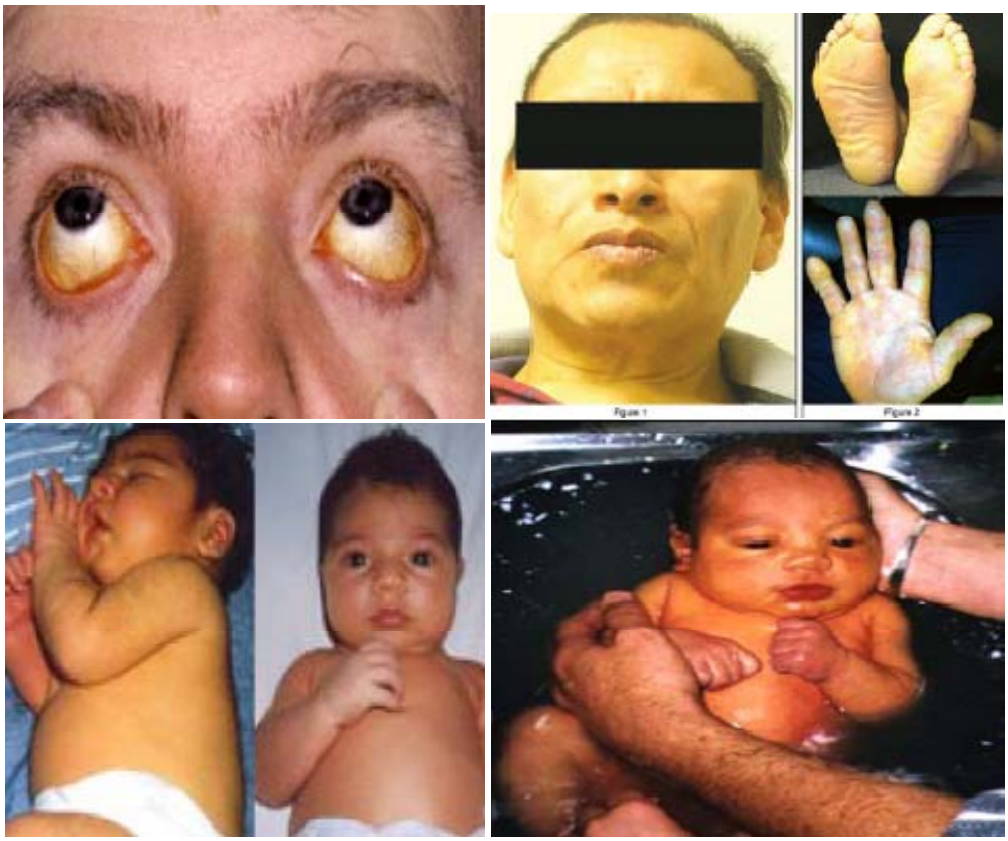
Jaundice occurs when excess bilirubin builds up in the blood. Bilirubin is a yellow-brown colored substance in the bile that is formed during the body's normal process of breaking down red blood cells. Bile is a liquid that carries waste products (including bilirubin) away from the liver.

How to check for jaundice and what to do

It is best to check for jaundice during the day using natural light. Hold the baby near a door or window.

- Starting from the face, use your finger to gently but firmly press on the skin and quickly let go.
- If the area that you pressed looks yellow the subject has jaundice
- Work your way down from the face to the legs.

Examine the subject skin and whites of eyes for yellow discoloration in sun light.If the face and body are yellow, then the jaundice is quite high. You must take your baby back to the hospital immediately.



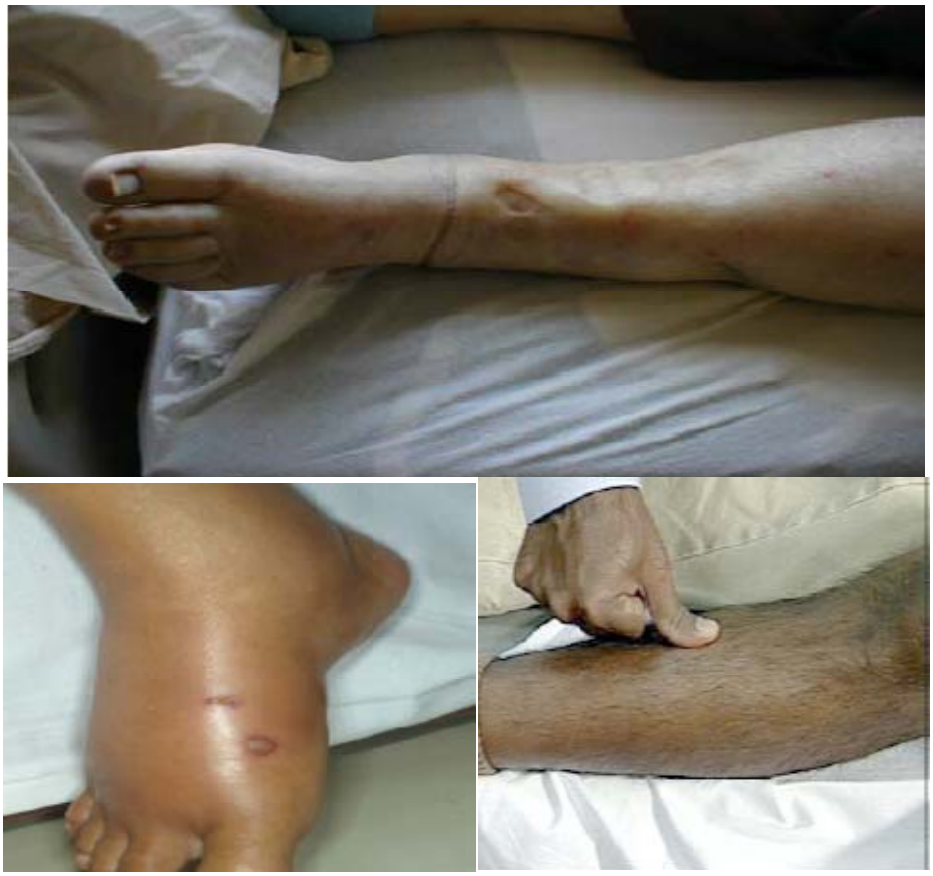
6.4 EDEMA

Edema is swelling from a buildup of extra fluid. Edema most often occurs in the feet, ankles, and legs, but any part ofthe body may develop edema.

To check for edema that is not obvious,

Observeforedema.

Gently compress the subject's soft tissue with thumb by applying slow, steady pressure over both shins for a fewminutes.Observe for indentation where pressure applied.



6.5 GOITER(NECKSWELLING,THYROIDGLAND)

Goiter is an enlargement of thyroid gland — a small, butterfly-shaped gland weighing less than an ounce, located just below Adam's apple. Hormones produced by thyroid gland regulate all aspects of your metabolism, from the rate at which your heart beats to the speed at which you burn calories. The possible causes are numerous; the most common cause of goiter was a deficiency of iodine.

Examination of Goiter
Inspection: Examine the neck for local or general enlargement of thyroid gland. Ask the child to swallow, the thyroid will move upward.

The goiter was assessed by palpation method, which was conducted as below: -

Palpation method: -

The examiner should stand or sit facing the subject, placed his two thumbs on either side of the subject's windpipe several centimeters below the notch of thyroid cartilage (the "Adam's Apple") and roll his thumb gently over the thyroid, which lies next to windpipe.

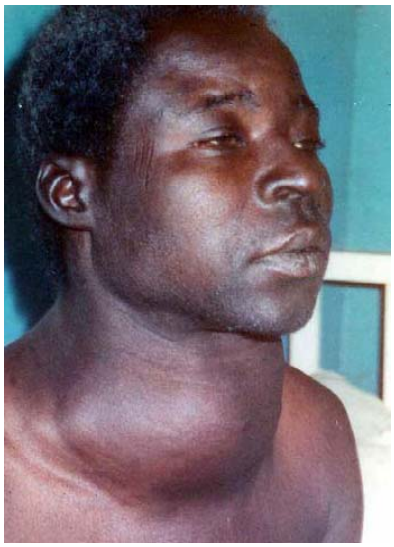
If each lobe of the thyroid is smaller than the part of the subject's thumb beyond the last joint ("terminal phalanx"), then no goiter. If each lobe is larger than the ("terminal phalanx") of the subject's then, he or she has goiter.

Classification of Goiter

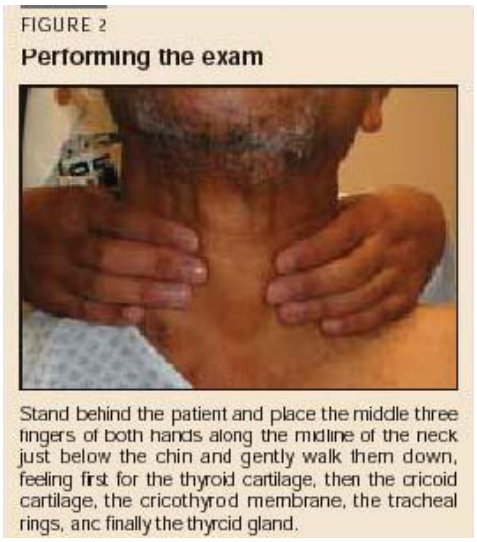
Grade 0: No palpable or visible goiter

Grade 1: A mass in the neck that is consistent with an enlarged thyroid that is palpable but not visible when the neck is in the normal position. It moves upward in the neck as the subject swallows. Nodular alteration(s) can occur even when the thyroid is not enlarged.

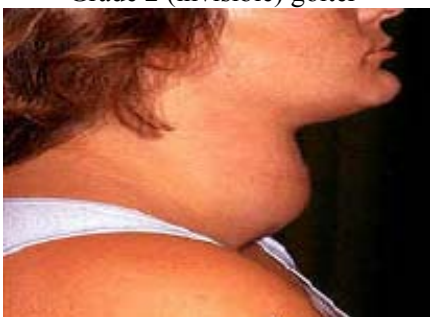
Grade 2: Aswelling in the neck that is visible when the neck is in a normal position and is consistent with an enlarged thyroid when the neck is palpated

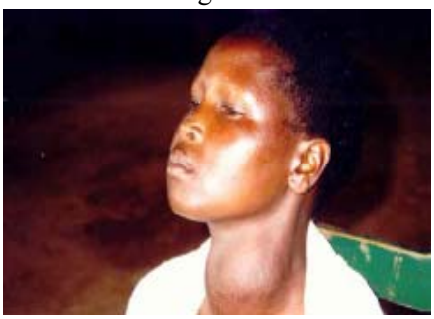


Grade 2 (invisible) goiter



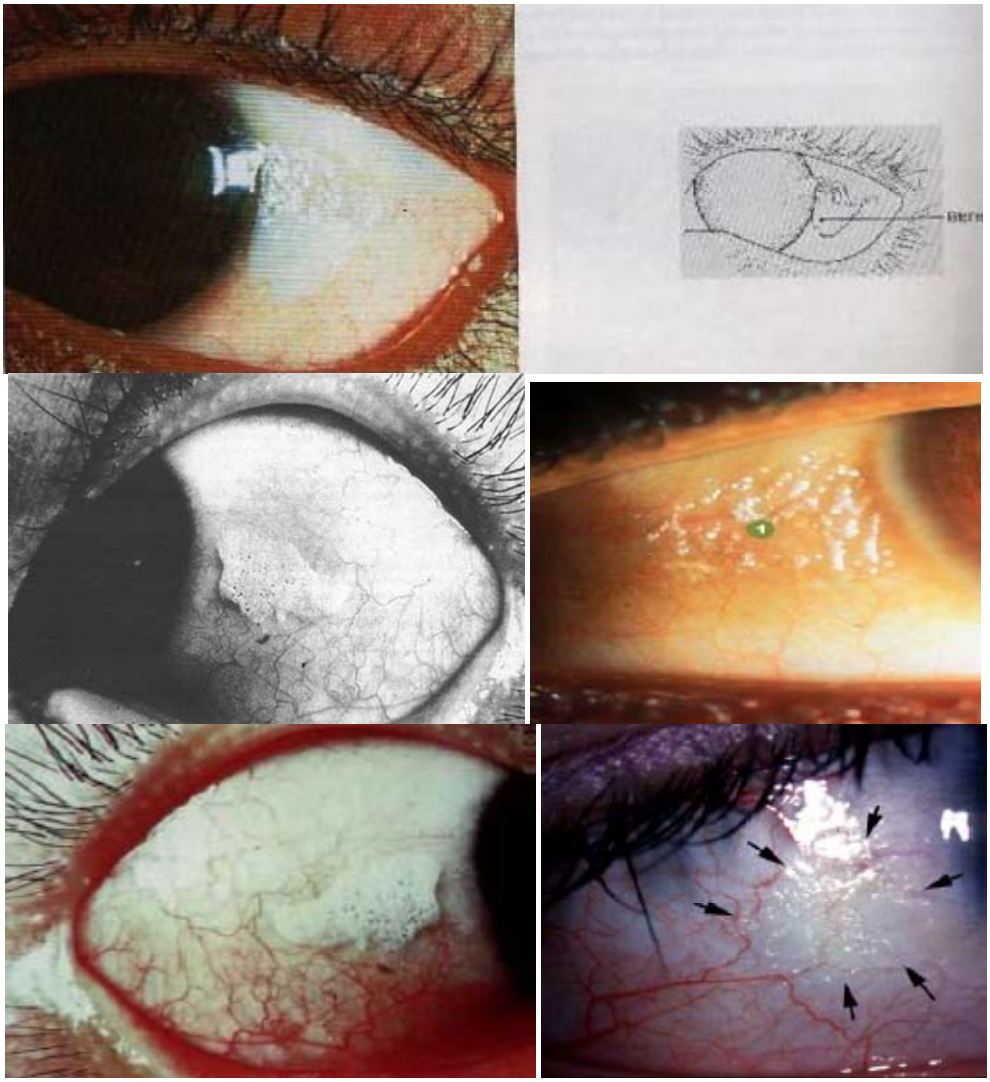
Examination for goiter





6.6 BITOT'SSPOT

Bitot's spot is white silvery spots on the Bulbar Conjunctiva near the limbus on the temporal side of eye. It is due to vitamin "A" deficiency. Below are the pictures showing Bitot's spots.



6.7 HAIR PLUCKING

The easy plucking is the sign of Zinc deficiency. Gently open your fingers and place them inside the hairs of the child, close the fingers and pull out gently the hairs with the help of closed fingers. Now examine the finger, if there are hairs between the fingers.

Region		Atoll		Island/Ward			Cluster		Form #		Subject #	

NATIONAL MICRONUTRIENT SURVEY 2007

Republic of Maldives

Survey Household Questionnaire

Modules of Questionnaire

Household Information (for every household): Module A to B

KAP regarding micronutrients (complete for all categories): Module C

Women of Reproductive Age: Module D to F

Children (6 months to 5 years of age): Module G to I

Children (6-12 years of age): Module J,K

Identification Information

Region	Atoll	Island/Ward	Cluster #	HH Name	HH #

MODULE A:

HOUSEHOLD SCREENING

Note: The respondent for the child questionnaire should be mother/care taker of the child & Women of reproductive age should be the respondent for women questionnaire Text in italic is instructions for the enumerators

1:

a.	Date of visit			b. Duration of Interview		
	DD	MM	YY	Start Time	End Time	
c.	Data collector Name				d. Code _____	
e.	Respondent Name					
f.	Head of Household Name			g. Sex		
				Male = 1	Female = 2	

A. 2: Who lives in this household including anyone who lives here since last one year? (Indicate number of household members within each age category)

a. Total Family Members	b. Female age 15-49 years	c. Children up to 12 years of age	
		c.1. Children age 0-5 years	c.2 Children aged 6-12 years
Number ____	Number ___	Number _____	Number _____

A. 3: Information of eligible Subjects (Please use the codes where applicable in following columns)

AgeGroup	Sr #	A) Name of eligible Subjects	B) Mother S.No	C) Marital status Married [1] Unmarried [2] Others [3]	D) Sex Male 1 Female 2	E) Current pregnancy status Yes = 1 No = 2	F) Age				
							Date of birth				Age
							DD	MM	YY	YY	MM
A. Women 15-49 years	1.										
	2.										
	3.										
	4.										
	5.										
B. Children 0-5 years	6.										
	7.										
	8.										
	9.										
	10.										
C. Children 6-12 years	11.										
	12.										
	13.										
	14.										
	15.										

MODULE B:

SOCIO_ECONOMIC & DEMOGRAPHIC DATA

S.No.	Question		Responses	Remarks
	What is the primary construction material used to build the house? (By observation) (mark the mostly used material)	Walls:	With bricks, cement and lime ----------[1] With bricks and unplastered----------[2] Durable wood or wooden sheets----------[3] Ordinary thin plywood and wood slides-------[4] Thatch and sticks ----------[5] Gulvanized tin sheets----------[6] Other (Specify)----------[7]	
B.1		Roof:	Gulvanized tin sheets----------[1] Thatch ----------[2] Roofing tiles----------[3] Concrete sheets ----------[4] Wood ----------[5] Other (Specify)----------[6]	
		Floor:	Cement/Slake lime ----------[1] Tiles ----------[2] Durable wood ----------[3] Concrete sheets ----------[4] Sand ----------[5] Other (Specify)----------[6]	
B.2	What is the ownership status of your house? (Read the responses)		Owned----------[1] Rented----------[2] Living without paying rent ----------[3] Other (specify) ----------[4]	
B.3	How many rooms in this household are used for sleeping?			
B.4	Does the household have? (Please ask about each individual item)		Electricity----------[1] Radio ----------[2] Television----------[3] Mobile phone----------[4] Land phone ----------[5] Refrigerator ----------[6] Motorbike ----------[7] Sewing machine ----------[8] Washing machine ----------[9] Computer ----------[10] Fishing boat ----------[11] Any other boat ----------[12] Other (specify) ----------[13]	
B.5	What type of fuel does your household mainly use for cooking?		Firewood ----------[1] Gas ----------[2] Oil ----------[3] Other (specify) ----------[4]	

B.6	What is the main source of drinking water for member of your household?	Rain water ----------[1] Well water ----------[2] Desalinated water ----------[3] Mineral Water ----------[4] Other (specify) ----------[5]	
B.7	What do you usually do to the water to make it safer to drink?	Boiling ----------[1] Chlorinating ----------[2] Filtering ----------[3] Without any treatment ----------[4] Cleaning the roof ----------[5] Other (specify) ----------[6]	
B.8	What is the main source of water used by your household for cooking	Rain water ----------[1] Well water ----------[2] Desalinated water ----------[3] Mineral Water ----------[4] Other (specify) ----------[5]	
B.9	What is the main source of water used by your household for hand washing?	Rain water ----------[1] Well water ----------[2] Desalinated water ----------[3] Mineral Water ----------[4] Other (specify) ----------[5]	
B.10	What kind of toilet facility do members of your household usually use?	No toilet----------[1] Toilet connected to sea----------[2] Toilet connected to septic tank----------[3] Reserved compound of house(Gifili) ----------[4] Other (specify)---------- [5]	
B.11	How do you dispose of household waste?	Garbage compound ----------[1] Sea site ----------[2] Land reclamation ----------[3] Throwing it into bushes----------[4] Buried in living area. ----------[5] Burning of garbage ----------[6] Other (Specify)----------[7]	
B.12	How frequently, do you wash hands with soap after defecation?	Always ----------[1] Sometime ----------[2] Never---------- [3] Other (Specify) ----------[4]	

MODULE C:

KAP REGARDING MICRONUTRIENTS

(This module has to be completed for all groups. The mother or the caretaker is the respondent for children)

S. No.	Question	Responses	Remarks
C.1	Have you heard of Iron?	Yes----------[1] No----------[2] Don't know ----------[99]	
C.2	What foods contain Iron? (Don't prompt but ask if anything else and list all the responses)	Liver ---------- [1] Beef ---------- [2] Mutton ---------- [3] Chicken ---------- [4] Egg yolk ---------- [5] Green leafy vegetables ----------[6] Lentils ---------- [7] Beans ----------[8] Other (Specify)----------[9] Don't know ----------[99]	
C.3	What kind of health problems can occur due to Iron deficiency? (Don't prompt but ask if anything else and list all the responses)	Behavioural problems (specify)---------- [1] Repeated infections---------- [2] Loss of appetite ----------[3] Lethargy ----------[4] Breathlessness ----------[5] Increased sweating ---------- [6] Strange 'food' cravings (pica) ----------[7] Failure to grow at the expected rate----------[8] Abortions in pregnant women ----------[9] Still Births ----------[10] Growth retardation of foetus ---------- [11] Anaemia ----------[12] Other (Specify)----------[13] Don't know ----------[99]	
C.4	Do you drink tea or coffee?	Yes----------[1] No----------[2] Don't know ----------[99]	If no go to Q. C. 7
C.5	Do you drink tea or coffee, how often?	Usually, every day----------[1] Usually 1 – 6 times/week---------- [2] Usually around once per week---------- [3] Less than once per week ----------[4] Don't know----------[99]	
C.6	When you drink tea or coffee, do you usually drink it immediately after (while having) meal?	Yes----------[1] No----------[2] Don't know ----------[99]	

C.7	Have you heard of Iodine?	*Yes*----------*[1]* *No*----------*[2]* *Don't know* ----------*[99]*	
C.8	What foods contain Iodine? (Don't prompt but ask if anything else and list all the responses)	*Liver* ---------- *[1]* *Meat products* ---------- *[2]* *Dairy Products* ---------- *[3]* *Vegetables* ---------- *[4]* *ish/Reef fish* ---------- *[5]* *Iodized Salt* ---------- *.[6]* *Other (Specify)*---------- *[7]* *Don't know* ----------*[99]*	
C.9	What health problems can occur due to iodine deficiency? (Don't prompt but ask if anything else and list all the responses)	*Goitre* ---------- *[1]* *Cretinism* ---------- *[2]* *Mental retardation/IQ loss* ---------- *[3]* *Brain damage* ---------- *[4]* *Impairs growth/development* ----------*[5]* *Defects of speech & hearing* ---------- *[6]* *Abortions in pregnant women* ---------- *[7]* *Still births* ---------- *[8]* *Congenital anomalies* ---------- *[9]* *Growth retardation of Foetus* ---------- *[10]* *Other (Specify)* ---------- *[11]* *Don't know* ---------- *[99]*	
C.10	Have you ever heard about iodized salt?	*Yes*----------*[1]* *No*----------*[2]* *Don't know* ----------*[99]*	
C.11	Are you using Iodized salt for cooking?	*Yes*----------*[1]* *No*----------*[2]* *Don't know* ----------*[99]*	If Yes Go to C.13
C.12	If non-Iodized salt user, ask: Why are you not using Iodized salt?	*Expensive* ---------- *[1]* *Not available* ----------*[2]* *Bad taste* ----------*[3]* *Impairs reproductive ability* ---------- *[4]* *Birth control (Family planning)* ----------*[5]* *Ill effects on health* ----------*[6]* *Others (specify)* ----------*[7]* *Don't know* ----------*[99]*	
C.13	Have you heard of Vitamin A?	*Yes*----------*[1]* *No*----------*[2]* *Don't know* ----------*[99]*	
C.14	What foods contain vitamin A? (Please list all the spontaneous responses, don't probe)	*Liver* ---------- *[1]* *Meat product*---------- *[2]* *Egg yolk* ---------- *[3]* *Vegetables* ---------- *[4]* *Lentils* ----------*[5]* *Beans* ----------*[6]* *Fruits* ----------*[7]* *Drumstick leaves*----------*.[8]* *Others (Specify)* ----------*[9]* *Don't know* ----------*[99]*	

C.15	What health problems can occur due to Vitamin A deficiency? (Don't prompt but ask if anything else and list all the responses)	*Abortions in pregnant women---------- [1]* *Still Births ---------- [2]* *Growth retardation of foetus ---------- [3]* *Night Blindness ----------[4]* *Rough and Dry Skin ----------[5]* *Vulnerable to infections ----------[6]* *Growth retardation ----------[7]* *Others (specify)---------- [8]* *Don't know ----------[99]*	
C.16	We would like to check whether the salt used in your house hold is iodized, May I see the sample of salt used to cook the main meal eaten by members of your household last night? (Once you have examined the salt, circle # that correspond to test outcome)	*Not iodized (0PPM)----------[1]* *7 PPM---------- [2]* *15 PPM----------[3]* *30 PPM ----------[4]* *No Salt in home ----------[5]* *Salt not tested ----------[6]*	

MODULE D

HEALTH STATUS

Women Reproductive age

S. No.	Question	Responses	Remarks
D.1	Are you suffering from any of these symptoms currently? (Please probe for each listed symptoms)	Flu ----------[1] Fever ----------[2] Cough ----------[3] Difficulty in breathing ----------[4] Diarrhea/Dysentery ----------[5] Vomitin ----------[6] Abdominal pain ----------[7] Constipation ----------[8] Skin rash/Boils ----------[9] Difficulty at micturation ----------[10] Hypertension ---------- [11] Headache ----------[12] Weakness [13] Others (specify) ----------[14] None ----------[15]	
D.2	Have you been diagnosed for worm infestation in the last one year?	Yes ----------[1] No ----------[2] Don't know ----------[99]	If No or Don't know go to D4
D.3	Did you take de-worming medicine in the last one year??	Yes ----------[1] No ---------- [2] Don't know ----------[99]	
D.4	Did you suffer from any illness in the past one year for which you had to be hospitalized? (Note the information for the last hospitalization if hospitalized more than one time during last one year)	Yes ----------[1] No ----------[2] Don't know ----------[99]	If No or Don't know, Go to Module E
D.5	If yes, specify illness (List the illnesses if more than one)	1---------- 2---------- 3----------	

MODULE E:

REPRODUCTIVE HISTORY

Only to be filled for women with child

S. No.	Question	Responses	Remarks
E.1	Are you currently married? (if currently not married probe for getting other options)	Currently married ----------[1] Widow ----------[2] Divorced ----------[3] Others (specify----------[4]	If currently not married go Q E.3
E.2	Are you currently living with your husband? (if not living with husband, probe for getting other options)	Living with husband ----------[1] Living separately in different household -------[2] Husband working in other Island----------[3] Others (specify----------[4]	
E.2	Are you currently living with your husband? (if not living with husband, probe for getting other options)	Living with husband ----------[1] Living separately in different household -------[2] Husband working in other Island----------[3] Others (specify----------[4]	
	a. Miscarriages (if less than 7 months of pregnancy)	b. Still births (after 7 months of pregnancy)	c. Live Births(if mother has doubt live birth, what the birth attendant informed her)
	☐☐	☐☐	☐☐
E.4	Did any of your children die? (explain to mother that this of the live births)	Yes ----------[1] No ----------[2]	If No go to E6
	Details of deceased children (ask mother the age of the child at death and put the count in the respective category)		
	a. Early neonatal deaths (0-7 days)	b. Late neonatal deaths (8-28 days)	c. Post neonatal deaths (29-364 days)	d. Child deaths (12-59 months)	e. Child deaths (5-15 years)
	☐☐	☐☐	☐☐	☐☐	☐☐
E. 6	Did you see any one for antenatal care during your last pregnancy?	Yes ----------[1] No ----------[2] Don't know ----------[99]	If No or don't know, go to Q E.12
E.7	If yes, whom did you see? (Probe for the type of person seen and circle)	Gyencologist ----------[1] Other Doctor ---------- [2] Nurse ----------[3] CHW ----------[4] FHW ----------[5] Traditional Birth attendant (Foolhuma) -[6] Others Specify ----------[7]	

E.8	How many months pregnant were you when you first received ANC during your last pregnancy? (if gestation less than one month then write the weeks) and if more than one month, then write months of pregnancy)	----------weeks ----------months Don't know ----------[99]	
E.9	How many times did you receive ANC during your last pregnancy?	Once ----------[1] Two times ----------[2] Three times ----------[3] Four times ----------[4] More than four times ----------[5] Don't know----------[99]	
E.10	As part of your ANC, Were any of following done at least once? (Ask about each option and circle positive response. Multiple response is allowed)	Were you weighed ----------[1] Was your BP measured ----------[2] Did you give urine sample ----------[3] Did you give blood sample ----------[4] Ultrasound (scan) ----------[5] Other (Specify) ----------[6]	
E.11	During any of the ANC visit, were you given any information or counselled about following? (Circle the appropriate response)	Eating more nutritious food ---------- [1] Exclusive breast feeding ---------- [2] Smoking & drug use ----------[3] Extra rest ----------[4] Other (specify) ----------[5] None (If none of the above circle this option) [6]	
E.12	Do you feel, you had night blindness (difficulty in seeing clearly in dusk) during your last pregnancy? (explain to mother as in the instruction manual, what night blindness)	Yes ----------[1] No ----------[2] Don't know ----------[99]	E.12
E.13	During your last pregnancy, did you take Iron/Folate tablets or syrup? (Show tablets or syrup)	Yes ----------[1] No ----------[2] Don't know ----------[99]	
E.14	Do you have a health record card? May I see it? (Please see the health record card and note the Iron/Folate supplement received)	Health Record Card not available ---------[1] Card available and recorded ----------[2] No card and no record)----------[3]	
E.15	During your last pregnancy, did you take any drug for intestinal worms?	Yes ----------[1] No ----------[2] Don't know ----------[99]	

MODULE F:

Women of Reproductive Age

PHYSICAL EXAMINATION

Physical examination Women of Reproductive Age will be performed by community health worker

S. No.	Question	Responses	Remarks
F.1	General Physical Assessment (Women reproductive age) (Circle only positive sign)	Cyanosis ----------[1] Edema ----------[2] Jaundice ----------[5] Pallor ----------[6] Neck Swelling (Thyroid Gland)----------[7] Bitot's spot----------[8] Others Specify----------[9]	
F.2	Goitre Examination	Grade 0---------- --[1] Grade 1---------- --------[2] Grade 2---------- ----------[3]	

LAB INVESTIGATIONS

S. No.	Question	Responses	Remarks
F.3	Was the blood sample taken?	Yes----------[1] No----------[2]	
F.4	If yes, write the volume of blood taken	ml ---------- ☐☐	
F.5	Was urine for iodine collected?	Yes----------[1] No----------[2]	
F.6	Was stool sample taken?	Yes----------[1] No----------[2]	
F.7	Was stool test performed?	Yes----------[1] No----------[2]	
F.8	Was Hemoglobin test performed by using Hemocue machine?	Yes----------[1] No----------[2]	
F.9	If yes, what was the result?		

RESULT OF STOOL EXAMINATION

Worm infection		Yes = 1 No = 2	# of eggs per slide	Egg/gram	Light intensity	Moderate – Heavy intensity
1.	Any infection(RW, WW, HW)					
2.	Round worm					
3.	Whip worm					
4.	Hook worm					

MODULE G:

FEEDING BEHAVIOURS AND PRACTICES

Children (6 months to 5 years of age)(The respondent should be mother or care taker of the child)

S. No.	Question	Responses	Remarks
G.1	Did you ever breast fed (name of child)?	Yes ----------[1] No ----------[2] Don't know ----------[99]	If no don't konw go to Q.G.5
G.2	How long after birth did you first put (name of child) to the breast? (If less than one hour, record immediately If less than more than one hour and less than 24 hours, records hours Otherwise, record days)	Immediately after birth (first hour) ------[1] Hours after birth----------[2] _____ days after birth ----------[3] Never ----------[8] Don't know ----------[99]	
G.3	Until what age (in months) did (name of child) breast feed "Exclusively"? "Exclusively" mean no other intake except for the breast milk, not even water	Age in Days----------Age in months Never exclusively breastfed----------[1]	
G.4	Until what age (in months) did you breastfeed (name of child)?	Months ---------- Still being breast feed----------[2] Don't know ----------[99]	
G.5	What was the first thing the child was fed directly after birth?	Honey----------[1] Plain water ----------[2] Glucose water ----------[3] Tea----------[4] Packet milk ----------[5] Formula milk ----------[6] Breast milk (BM)---------- [7] Others (specify) ----------[8] Don't know ----------[99]	If option 7 (BM), then go to G.7
G.6	Why was the child not breastfed directly after birth? (Multiple responses, Circle appropriate responses)	Maternal illness ----------[1] Child's illness ----------[2] Colostrums is harmful for child ----------[3] Cultural reasons ----------[4] Religious reasons ----------[5] Others (specify) ----------[6] Don't know ----------[99]	
G.7	Has (name of child) been given any Formula milk?	Yes ----------[1] No ----------[2] Don't know ----------[99]	If No or don't know go to G.10
G.8	What type of Formula milk is presently being used? (Circle appropriate response)	Infant Formula ---------- [1] Powdered milk ---------- [2] Other (Specify) ---------- [3]	
G.9	How old was (name of child), when this milk was introduced?	Months ----------☐☐ Days ----------☐☐	
G.10	At what age did you give (name of child) liquids (Juice, Tea, etc) other than breast milk for the first time?	Months----------☐☐ Baby is only being breastfeed ----------[2] Don't know ----------[99]	If only breastfed go to G16

G.11	At what age did you feed (name of child) his/her first solid or semi solid food?	_____months ----------[1] Don't know ----------[99]	
G.12	What was food or preparation that you first give to (name of child)? (Record all responses)	Fruit ----------[1] Vegetable ----------[2] Cereals ----------[3] Egg ----------[4] Rice ----------[5] Chicken ----------[6] Beef ----------[7] Fish----------[8] Biscuits ----------[9] Yogurt ----------[10] Commercial Baby food----------[11] Not Applicable(Baby is only being breastfeed ----------[12] Other (Specify) ---------- [13]	
G.13	On whose advice did you start the complementary foods? (Don't prompt, Record most spontaneous response)	Mother ----------[1] Mother-in-law's ----------[2] Relative's ----------[3] Neighbour's ----------[4] Own experience---------- [5] Doctor---------- [6] CHW ----------[7] TV / Radio ----------[8] Other (Specify) ----------[9] Not Applicable (Baby is only being breastfeed ----------[10]	
G.14	How many times did you feed (name of child) in last 24 hours?	----------_____times Don't know ----------[99]	
G.15	Do you prepare FOOD separately for (name of child)? (Don't prompt, Record most spontaneous response)	Always ----------[1] Sometimes ----------[2] When time permits ----------[3] Never ----------[4] NA (Baby is only being breastfeed ------[5] (Not Applicable)	
G.16	In your opinion, what kinds of food should be used as complementary food? (Don't prompt but ask if anything else)	1 ---------- 2 ---------- 3 ----------	
G.17	How many times complementary food should be given to children in 24 hours?	A) UNDER 1 year: Times_____ B) OVER 1 year?: Times_____	
G.18	Do you know what micronutrient supplement is? If no, explain briefly (mineral/vitamin supplement)	Yes ----------[1] No ----------[2] Don't----------[99]	
G.19	Is there any advantage of giving the child micronutrient supplement?	Yes ----------[1] No ----------[2] Don't know ----------[99]	If No or Don't know go to module H
G.20	What are the advantages of micronutrient supplements?	Physical strength ----------[1] Mental strength ----------[2] Other (specify) ----------[3] Don't know ----------[99]	

SECTION H:
CHILD HEALTH STATUS

Children (6 months to 5 years of age)

(The respondent should be mother or care taker of the child)

Please make sure that the child is present for the physical examination conducted by the community health worker.

S. No.	Question	Responses	Remarks
H.1	In the past two weeks did (name of child) have cough?	Yes ----------[1] No----------[2] Don't know ----------[99]	
H.2	In the past two weeks did (name of child) had difficulty in breathing?	Yes ----------[1] No----------[2] Don't know ----------[99]	
H.3	Is (name of child) currently suffering from cough?	Yes ----------[1] No----------[2] Don't know ----------[99]	
H.4	Has (name of child) currently having difficulty in breathing?	Yes ----------[1] No----------[2] Don't know ----------[99]	
H.5	Observe, if the child has cough or difficulty in breathing? (See the instructions in the manual)	Cough ----------[1] Difficulty in breathing ----------[2] Both----------[3] None ----------[4]	
H.6	Does (name of child) have chest indrawing?	Yes ----------[1] No----------[2] Don't know ----------[99]	
H.7	Observe, if the child has chest indrawing? (See the instructions in the manual)	Yes ----------[1] No----------[2]	
H.8	In the past two weeks did (name of child) have diarrhoea? Diarrhoea is determined as perceived by mother or caretaker or as three or more loose or watery stools per day, or blood in stool	Yes ----------[1] No----------[2] Don't know ----------[99]	
H.9	Does (name of child) have diarrhoea currently?	Yes ----------[1] No----------[2] Don't know ----------[99]	
H.10	In the dusk, when your child enters dark room of your house, do your (name of child) have difficulty seeing clearly? Recognizing food articles in the plate, recognize faces, sitting against furniture (Explain to mother what night blindness is as per the instructions in the manual)	Yes ---------- [1] No---------- [2] Don't know ---------- [99]	
H.11	Is (name of child) suffering from any of these symptoms currently?	Flu ---------- [1] Fever----------[2] Dysentery ----------[3] Vomiting ----------[4] Abdominal pain ----------[5] Constipation----------[6] Skin rash/Boils ----------[7] Crying at micturation----------[8] Others (Specify) ---------- [9] None ----------[10]	

H.12	Is (name of child) using any medicines currently?	Yes----------[1] No ---------- [2] Don't know ----------[99]	If no or don't know go to H14
H.13	If yes, specify thename (s) of medicine (pls . ask the mother to bring the medicines, note both the names including the generic name)	1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ----------	
H.14	Did (name of child) suffer from any illness in the past six months for which he/she had to be hospitalized?	Yes----------[1] No ----------[2] Don't know ----------[99]	If No or Don't know go to H16
H.15	If yes, specify the illness (Please note more than one illness. Write what the respondents says	1 ---------- 2 ----------	
H.16	Was (name of child) diagnosed for worm infestation in the last six months?	Yes ----------[1] No ----------[2] Don't know ----------[99]	
H.17	Did (name of child) de-worming medicine in the last six months?	Yes ----------[1] No ----------[2] None ----------[3]	
H.18	Does your child currently have worm infestation?	Yes----------[1] No----------[2] Don't know ----------[99]	
H.19	Has (name of child) ever received Vitamin A capsule supplement) like this one? Show capsule are dispenser for different doses_ 100,000 IU (Blue) for 6 – 11 months old 200,000 IU (Red) for 12 – 59 months old	Yes ----------[1] No----------[2] Don't know ----------[99]	If 'Yes Go to Q 21 go to H23
H.20	If no, why (name of child) have not received the Vitamin A drops?	---------- ----------	End Module H
H.21	How many months ago did (name of child) take the last dose? (Skip in case of women don't have child)	----------_____months ago Don't know ----------[99]	
H.22	Does (name of child) have a health record card? May I see it? (Please see the health record card and note the Vitamin A supplement receive)	Health Record Card not available --------[1] Received Vitamin A supplement ---------[2] Did not receive Vitamin A supplement - [3]	If Option 3 then skip Q. H. 22
H.23	Where did (name of child) get the last dose?	Routine visit to health facility ----------[1] Sick child visit to health facility ----------[2] School ----------[3] Growth monitoring/Immunization day -- [4] Others (Specify) ----------[5]	

MODULE I:

Children (6 months to 5 years of age)

PHYSICAL EXAMINATION

Physical examination of the child to be conducted by the community health worker

S. No.	Question	Responses	Remarks
I.1	Child General Physical Examination (Circle only positive sign)	Edema----------[1] Jaundice ----------[2] Pallor ----------[3] Neck Swelling (Thyroid Gland) ----------[4] Bitot's spot ----------[5] Others ----------[6]	
I.2	Goiter Examination	Grade 0----------[1] Grade 1----------[2] Grade 2----------[3]	
I.3	Child Hair Examination	Plucking easily ----------[1]	

LAB INVESTIGATIONS

S. No.	Question	Responses	Remarks
I.5	Was the blood sample taken?	Yes----------[1] No----------[2]	
I.6	If yes, write the volume of blood taken	ml ---------- ☐☐	
I.7	Was urine for iodine collected?	Yes----------[1] No----------[2]	
I.8	Was stool sample taken?	Yes----------[1] No----------[2]	
I.9	Was stool test performed?	Yes----------[1] No----------[2]	
I.10	Was Hemoglobin test performed by using Hemocue machine?	Yes----------[1] No----------[2]	If yes, then ask Q F.9
I.11	If yes, What was the result?	----------	

RESULT OF STOOL EXAMINATION

Worm infection		Yes = 1 No = 2	# of eggs per slide	Egg/gram	Light intensity	Moderate – Heavy intensity
1.	Any infection (RW, WW, HW)					
2.	Round worm					
3.	Whip worm					
4.	Hook worm					

Module J:

CHILD HEALTH STATUS

(Children (6 to 12 years of age)
The respondent should be mother or care taker of the child)Please make sure that the child is present for the physical examination conducted by the community health worker.

S. No.	Question	Responses	Remarks
J.1	In the past two weeks did (name of child) have cough?	Yes ----------[1] No----------[2] Don't know ----------[99]	
J.2	In the past two weeks did (name of child) had difficulty in breathing?	Yes ----------[1] No----------[2] Don't know ----------[99]	
J.3	Is (name of child) currently suffering from cough?	Yes ----------[1] No----------[2] Don't know ----------[99]	
J.4	Has (name of child) currently having difficulty in breathing?	Yes ----------[1] No----------[2] Don't know ----------[99]	
J.5	Observe, if the child has cough or difficulty in breathing? (follow the instructions in the manual)	Cough ----------[1] Difficulty in breathing? ----------[2] Both----------[3] None----------[4]	
J.6	Does (name of child) have lower chest indrawing? (explain the signs of chest indrawing to mother)	Yes ----------[1] No----------[2] Don't know ----------[99]	
J.7	Observe, if the child has chest indrawing? (follow the instructions in the manual)	Yes ----------[1] No----------[2]	
J.8	In the past two weeks did (name of child) have diarrhoea?	Yes ----------[1] No----------[2] Don't know ----------[99]	
J.9	Does (name of child) have diarrhoea currently?	Yes ----------[1] No----------[2] Don't know ----------[99]	
J.10	In the dusk, when your child enters dark room of your house, do your (name of child) have difficulty seeing clearly? Recognizing food articles in the plate, recognize faces, sitting against furniture (follow the instructions in the manual to explain nightblindness to mother)	Yes ----------[1] No----------[2] Don't know ----------[99]	

J.11	Is (name of child) suffering from any of these symptoms currently?	Flu ----------[1] Fever----------[2] Dysentery ----------[3] Vomiting ----------[4] Abdominal pain ----------[5] Constipation ----------[6] Skin rash/Boils ----------[7] Crying at micturation----------[8] Others (Specify) ----------[9] None ----------[10]	
J.12	Is (name of child) using any medicines currently?	Yes----------[1] No----------[2] Don't know ----------[99]	If yes, ask Q J 13, otherwise skip
J.13	If yes, specify	1 ---------- 2 ----------	
J.14	Did (name of child) suffer from any illness in the past six months for which he/she had to be hospitalized?	Yes----------[1] No----------[2] Don't know ----------[99]	If yes, ask Q J.15 otherwise skip
J.15	If yes, specify the illness Please note if more than one illness	1 ---------- 2 ----------	
J.16	Did (name of child) have worm infestation in the last six months?	Yes----------[1] No----------[2] Don't know ----------[99]	
J.17	Did (name of child) de-worming medicine in the last six months?	Yes----------[1] No----------[2] Don't know ----------[99]	
J.18	Does your child currently have worm infestation?	Yes----------[1] No----------[2] Don't know ----------[99]	

MODULE K:

PHYSICAL EXAMINATION

S. No.	Question	Responses	Remarks
K.1	Child General Physical Examination (Circle only positive sign)	Edema----------[1] Jaundice ----------[2] Pallor ----------[3] Neck Swelling (Thyroid Gland) ----------[4] Bitot's spot ----------[5] Others ----------[6]	
K.2	Goiter Examination	Grade 0----------[1] Grade 1----------[2] Grade 2----------[3]	

Physical examination of the child age 6 – 12 years to be conducted by the community health worker

LAB INVESTIGATIONS

S. No.	Question	Responses	Remarks
K.3	Was urine for iodine collected?	Yes----------[1] No----------[2]	
K.4	Was stool sample taken?	Yes----------[1] No----------[2]	
K.5	Was stool test performed?	Yes----------[1] No----------[2]	

RESULT OF STOOL EXAMINATION

Worm infection		Yes = 1 No = 2	# of eggs per slide	Egg/gram	Light intensity	Moderate – Heavy intensity
1.	Any infection(RW, HW, WW					
2.	Round worm					
3.	Whip worm					
4.	Hook worm					

VALIDATION

Responsible Person	Name	Signature	Date
1st Reviewer			☐☐ ☐☐ ☐☐☐☐
2nd Reviewer			☐☐ ☐☐ ☐☐☐☐

24-HOUR FOOD PRACTICES

ID

Region		Atoll		Island/Ward			Cluster		Form #		Subject #	

Write same ID as in household questionnaire, so data can be linked.

Identification Information

Make sure the same ID MUST be assigned to 24 hours food practices questionnaire as assigned to child questionnaire. This is very important to link the data

Region	Atoll	Island/Ward	Cluster	HH Name	HH #

A. Would you like to tell me what (name of child) had to eat or drink in last 24 hours?

Probe for the following timings?

- *What did the child eat when he/she wake up in the morning?*
- *What was fed to child at breakfast?*
- *What was fed to the child between breakfast and lunch?*
- *What was given to child at Lunch?*
- *What was given to child between the lunch and dinner?*
- *What was given to child at the time of dinner?*
- *What was given to child after the dinner?*

S. #	Time	Food or Drink	Amount Taken
	The time of the food/drink taken. (Probe for each)	In this column record the type of the drink or food taken by the child.	In this column record the amount of the food or drink taken. The example of the amount taken can be half a glass of milk.
01	Wake up in the morning?		
02	Breakfast?		
03	Between breakfast and lunch?		
04	Lunch?		
05	Between the lunch and dinner?		
06	Dinner?		
07	After the dinner?		

How often do you feed your child the following foods?

The purpose of this question is to know the frequency of following food items given to the child. Ask about each food item listed in the following table given to the child per day as well as per week. After you complete the list ask mother/care taker if any other food item was given to the child, if yes record all information in blank space in the end of form.

S. No	Food Items	Times per day					Times per week				
		Never	1	2	3	> 3	Never	1 -2	3 -4	5 -6	>6
01	Breast milk										
02	Infant formula (Less than six										
03	Follow-up infant formula (6 – 12										
04	Powdered/Packet milk										
05	Condensed milk										
06	Yogurt										
07	Cheese										
08	Fresh vegetables										
09	Starchy vegetables (e.g. potato)										
10	Canned / packed vegetables										
11	Canned / packed fruits										
12	Fresh fruit										
13	Fresh fruit juice										
14	Packed fruit juice										
15	Juice concentrate (Water has to be										
16	Coconut water										
17	Biscuits										
18	Packed food in jars (e.g. Purity)										
19	Packed food (e.g. Purity, Heinz)										
20	Tuna / reef fish										
21	Chicken										
22	Beef										
23	Rice										
24	Liver										
25	Pulses (e.g. dhal, peas)										
26	Green leaves										
27	Noodles / pasta										
28	Garudhiya										
29	Rihaakuru										
30	Roti										
31	Short-eats										
32	Curry										
33	Egg										
34	Bread / buns										
35	Packed chips										
36	Dhiyaa hakuru										
37	Chocolate										
38	Ice-cream										
39	Jelly										
40	Sweet										
41	Fizzy drinks										
42	Rice water										
43	Other (please specify)										
44											
45											