NATIONAL NUTRITION AND MICRONUTRIENT SURVEY 2012

ANAEMIA AMONG CHILDREN AGED 6-59 MONTHS AND NUTRITIONAL STATUS OF CHILDREN AND ADULTS

Ministry of Health

unicef

NATIONAL NUTRITION AND MICRONUTRIENT SURVEY

PART I: ANAEMIA AMONG CHILDREN AGED 6-59 MONTHS AND NUTRITIONAL STATUS OF CHILDREN AND ADULTS

Dr. Renuka Jayatissa
Dr. M.M. Gunathilaka
Prof. Dulitha N. Fernando

MESSAGE FROM THE SECRETARY

The National Micronutrient Survey was carried out by the Department of Nutrition of the Medical research Institute in collaboration with the UNICEF. This survey has focused on assessment of four micronutrients, namely iron, vitamin A, Zinc and Calcium, in a national sample of children in the age of 6 months to 5 years. This is the part one of the survey (anaemia in children 6-59 months and nutritional status of children and adults). Part two (iron and zinc) and part three (vitamin A) will be issued subsequently.

Findings of this study highlight the success of our on-going health interventions to prevent and control anaemia at National Level. Though we can thrive our success achieved so far towards controlling iron deficiency as a whole, we see that wide inter district disparity exists and it needs our special attention.

Further we can see from the findings of National Micronutrient Survey, stunting has declined over last three years. It mirrors the unrelenting efforts of the government and other organizations to control under nutrition among children. While appreciating the successful endeavours, I would like to highlight the importance of planning more targeted interventions with the view of upward trend in wasting and emerging problem of overweight.

As we have information on effect of the socioeconomic and other factors on under nutrition and anaemia, this will be a guide to direct policy makers and planners to plan out appropriate interventions aiming to mitigate district levels disparity.

The National Micronutrient Survey is an extensive survey carried out including children from all districts. It is not an easy task and I hereby appreciate the tremendous efforts taken by the staff of Department of Nutrition, Medical Research Institute to bring this survey up to this level. I believe strong leadership, commitment and team work are driving forces of this success story.

I am grateful to UNICEF for being interested in our welfare and investing on this very important venture. Commitment of the UNICEF to uplift the child health in Sri Lanka is further highlighted by this grant.

I take this opportunity to thank every household member who volunteered to participate in this survey, especially allowing haematological investigations in young children. On behalf of Ministry of Health I would like to state that we have no hesitation in providing assistance needed for worthy endeavours like this and I wish staff, Department of Nutrition, MRI will have strength and motivation to continue more and more productive and fruitful surveys.

Dr Nihal Jayathilake,

The Secretary, Ministry of Health.

MESSAGE FROM DDG/ET&R

Research is an essential component in health care planning and policy decision making. Research evidence is essential to ascertain whether our targeted interventions are powerful enough to mitigate the health problems that we try to solve.

The National Micronutrient Survey is one such survey that has furnished us with such a vast amount of information. It was carried out by the Department of Nutrition of the Medical Research Institute in collaboration with the UNICEF. This survey has assessed nearly 7500 households, representing all districts of the country and has yielded lot of information on childhood undernutrition and anaemia.

Childhood undernutition and anaemia are the two major childhood nutrition problems that Sri Lanka has struggled over the years to overcome and many targeted interventions had taken place all over the country. The findings of this survey can be used to assess the effectiveness of those interventions, at national as well as local level. Further it points out how our future resources should be utilized and where we should pay more attention to.

Many prolific surveys have been carried out by the Department of Nutrition of Medical Research Institute so far. I hereby congratulate the survey team of the Department of Nutrition of Medical Research Institute on their success with this survey. I am privileged to be a leader to such a team and would be committed to support all worthwhile accomplishments in future.

Dr Sunil De Alwis,
DDG/ET&R
Ministry of Health

MESSAGE FROM UNICEF

Improving the health and wellbeing of children everywhere is at the heart of what we do at UNICEF. Here in Sri Lanka, we are particularly committed to supporting national efforts to advance children's nutritional status as well as to ensuring that key data and information about children is made available for public consumption and policy planning.

This survey is one of many that UNICEF has supported over the years, and we are very pleased that the country now has an updated nutrition situation analysis as well as disaggregated data that will allow for evidence-based policy making at both the national and decentralised levels.

We congratulate the Government of Sri Lanka for the efforts it has undertaken in the past few years to improve nutrition indicators. It is indeed heartening to note the decline in stunting. According to survey findings, stunting has declined from 19.8% in 2009 to 13.1% in 2012 for children under five years.

We do, however, remain concerned about findings that indicate the wide variation in stunting levels between districts and the increase in the number of severe and acutely malnourished children.

It is imperative that we take speedy and sustainable actions to support targeted and timely interventions for children with severe and acute moderate malnutrition, along with anaemia control measures. It is also important that we scale up proven multi-sectoral nutrition promotion programmes so that communities and families everywhere can reap the benefits of good nutrition.

In doing so, we are confident that we will pave the way forward for a healthier future for all Sri Lankan children.

Reza Hossaini
Country Resident Representative

ACKNOWLEDGEMENTS

We wish to place on record our appreciation of those who assisted us in numerous ways to make this study a success. Many people have contributed to the realization of the study and it is our desire to express our deep gratitude to all, while it is, unfortunately, impossibly to name them all.

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Special thanks go to all the members of the National Nutrition steering committee, Ministry of Health, all the members of the MCN subcommittee for their technical assistance.

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We deeply acknowledge the villagers, families, the mothers, and the children's willingness and openness to cooperate with us.

Many thanks go to the Staff at MRI, Nutrition Department including team of investigators, medical officers, data entry and analysis teams for making this study, a success.

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Executive summary

Micronutrition deficiencies are important public health problems in Sri Lanka. Available data indicate the importance of anaemia and vitamin A deficiency based on which interventions have been implemented. However, recent data on important micronutrient deficiencies are limited except for iodine deficiency. Hence the need for a comprehensive assessment of the micronutrient status of vulnerable groups is a priority. The objective of this assessment was to determine the prevalence of anaemia, iron deficiency, Vitamin A deficiency, calcium, and zinc deficiency among preschool children aged 6-59 months and to determine the district level prevalence of wasting / thinness, stunting, underweight, overweight and obesity among preschool children aged 6-59 months, children aged 5-18 years old, women of 18-59 years, (non-pregnant women) and men 18-59 years old.

Results of some components of the study are presented in this report, which is Part I of the report on findings of the micronutrient assessment, carried out at district level in 2012.

The study was carried out in a representative sample of 7306 households from the 25 districts of Sri Lanka identified using a multi stage sampling procedure. In this component of the study, the study population included were preschool children aged 6 – 59 months resident in the selected households. The field level data collection was carried out using a pre tested interviewer administered questionnaire, taking relevant anthropometric measurements and collecting venous blood samples for the biochemical assessments. All precautions were taken to ensure quality of data and weighted data was used for analysis at national level.

Number of members in a given household ranged from 1–7 with a majority had 4-6 members. Among the mothers, 66.5% were educated up to grades 11–13. Of all households, 50.9% belonged to the upper two wealth quintiles with 28.8% belonging to the lower two quintiles.

Prevalence of stunting, wasting and underweight among children 6–59 months of age were 13.1, 19.6 and 23.5 percent respectively. Stunting was low during the latter half of the first year of life and highest during the second year while the prevalence of wasting was consistently increasing up to 36-47 months and decreased after that. Stunting and wasting was higher among male children. In general, a high prevalence stunting, wasting and underweight was seen among the children of fathers employed in lower occupational categories.

Comparison of prevalence between districts showed that prevalence of stunting ranged from 6.8% in Kalutara to 23.8% in Nuwaraeliya with 17 districts having prevalence at higher levels compared to the ‘national prevalence’. Prevalence of wasting ranged from 14% in Puttalam to 34.9% in Kilinochchi with 16 districts showing higher prevalence figures compared to the ‘national prevalence’. Severe acute malnutrition (SAM) was present in 2.3% of the total sample with the prevalence being 0.4% in Kalutara district an 6.1% in Mullaitivu. Fifteen districts had higher values for SAM prevalence compared to the ‘national prevalence’. Prevalence of underweight ranged from 15.8% in Kalutara district to 40.9% in Killinochchi district with 17 districts showing higher prevalence figures compared to the ‘national prevalence’

Prevalence of overweight children was low, 0.7% with 0% in Polonnaruwa, Mannar, Trincomalee and Kilinochchci and 1.8% in Kalutara districts.

From the total sample, haemoglobin (Hb) estimations were done among 7050 children. Of this group, 15.1 % were anaemic (Hb level <11 gms/dl) and higher in males. Inter district comparisons show the prevalence to range between a low values of 4.9% in Kegalle district to 26.9% in Kilinochchi. There is a consistent decreasing pattern of anaemia with increasing age, showing the highest prevalence of 34% between the age group of 6-11 months.

Results of the study so far, highlights the inter district variations and the influence of socio economic factors relevant to under nutrition and anaemia among children in the age group 6 – 59 months.

Prevalence of low birth weight (17.9%) does not show a major change from those reported in recent studies. There is a decline in the prevalence observed with increasing levels of indicators related to economic status. Among primary school children as well as adolescents, thinness is the predominant nutritional problem, seen along with overweight and obesity present among these groups, even though the prevalence rates are relatively low.

Among non-pregnant adult women show that prevalence of thinness ranged from 14.9% to 36.7%, higher values among younger women. However, prevalence of overweight and obesity especially among the older age groups seem to be emerging nutritional problems. Among the adult males, prevalence of thinness was higher (16.2%) with the prevalence of overweight and obesity lower than the adult females.

It is recommended to address high prevalence of wasting urgently. Appropriate interventions to be implemented to minimise the disparities at district level.

CHAPTER 1

Introduction

1.1. Background

Available data on nutritional status at the community level in Sri Lanka indicate that micronutrient deficiencies (the "hidden hunger") may be a more serious problem to consider than energy deficiency per se.

A survey conducted by MRI in 2009 indicated that acute under nutrition was present in 11.7% of children under 5 years and that this rate has not shown much changes since 1973. The same study reported that chronic under nutrition was present in 19.2% of the children in this age group.[1] Limited data available on the level of iron-deficiency or iron-deficiency anaemia in children and women in the childbearing age in Sri Lanka indicate that anaemia continues to be an important nutritional problem in Sri Lanka. Results of the same study shows that 25.2% of children under five in Sri Lanka were anaemic. Anaemia is associated with impaired physical and cognitive development in children, poor mental and physical performance in adults, increased risks of infectious diseases, and numerous other problems

Data on vitamin A Deficiency are available from two studies, one reported in 1998 and the other in 2006. The earlier study reported that vitamin A deficiency is an important public health problem in Sri Lanka with 36 % of children under five showing serum vitamin A concentration of less than 20 micrograms per decilitre[2]. Results of a study carried out in 20 out of the 25 districts in Sri Lanka among children under five years reported in 2006/07 reported that serum retinol levels of less than 20 micrograms per decilitre were seen among 29% of the children included in the study[3] These observation have to be take into consideration that vitamin A mega dose supplementation at 6 months interval, among the children in this age group was a component of the national child health programme since 2008.

1.2. Rationale

In Sri Lanka, data on micronutrient deficiencies in recent years are limited to those described above. Taking into consideration that there is a paucity of recent data on the micronutrient status of women and children, and the interventions carried out in recent years[4], the need to make a national level assessment of the micronutrient status among these groups in Sri Lanka was identified.

Such data were to be used in controlling micronutrient deficiencies and as a baseline for monitoring on-going nutrition intervention programmes aimed at such control.

1.3. Objective

1. Determine the prevalence of anaemia, iron deficiency, vitamin A deficiencies, and zinc and calcium deficiencies among preschool children aged 6-59 months at national and district levels.

2. To determine the district level prevalence of wasting / thinness, stunting, underweight, overweight and obesity among
   2.1. Preschool children aged 6-59 months
   2.2. Children aged 5-18 years old
   2.3. Women aged 18-59 years old, (non-pregnant women)
   2.4. Men 18-59 years old

CHAPTER 2

Methods

This study was carried out in a representative sample of 7306 households from each of the 25 districts of Sri Lanka. . The study population included were preschool children aged 6–59 months resident in the selected households.

In identifying the study populations the following exclusion criteria were applied: not present in the household on the night before the survey, have a physical disability that would affect either height or weight measurement and those eligible subjects who declined consent or whose guardians/parents have declined consent to any component of the survey, including biological specimen collection

2.1. Sampling

2.1.1. Sample size

The sample size required was based on the estimated prevalence for one of the nutritional status indicators that of zinc deficiency, the desired precision, and an assumed design effect and a non-response of 10% (including refusals) at the individual levels for children 6-59 months of age. The sample size calculated was 300 children in the specified age group from each district, a total of 7,500 children (details in Annex 1).

2.1.2. Sampling procedure

All 25 administrative districts of Sri Lanka were included. A multi stage sampling procedure was used to identify the households to be included.

The sampling frame was the list of Grama Niladari (GN) divisions in each district, obtained from the Census and Statistics Department, Sri Lanka. There were approximately 20,000 GN divisions spread out within the 25 districts. Thus, the GN divisions were the primary sampling units (PSU)

As the first stage, in each of the 25 districts, 30 GN divisions to be included were identified using the population proportion to sampling technique. A total of 750 GN divisions were so identified as clusters.

2.1.3. Identification of households

A household was defined as a group of people who share a common cooking pot. An eligible household was one that had a child in the age group 6 – 59 months.

The following method was used to identify the households to be included in the study.

As the first step, on a transparency sheet, a grid was prepared giving 1 cm squares. From this grid, thirty 'blocks' were selected randomly and they were numbered from 1- 30. This grid was then superimposed on a map of a GN division and the square corresponding to the number allocated to the GN division was identified on the map. This point was considered as the 'starting point' for identification of households to be included in the survey, for a given GN division (a cluster).

As the next step, the investigators continued to walk in a direction selected at random until they were able to identify 10 eligible households. Estimated number of households to be visited in each cluster to identify the eligible households was 30-35.

2.1.4. Selection of Subjects

Children aged 6–59 months in the selected households were identified using the information on the birth certificate or the CHDR by the field investigators on arrival at a selected cluster. Mother or in absence of the mother, the immediate care giver of the eligible child of each selected household was interviewed.

Information at the household level was collected using an interviewer administered questionnaire.

Once the questionnaire was completed at the household level, the children aged 6-59 months, one child aged 5-18 years residing within the household, adult non pregnant women and adult men between 18-59 years were invited to be present at a given venue for taking anthropometric measurements and for collection of venous blood samples from the children aged 6-59 months. A convenient venue for each cluster was selected to improve participation.

If eligible occupants of a house were not available in the household during the visit, one repeat visit was made. A replacement was made if occupants were not available during both visits.

2.2. Data collection

2.2.1. Survey teams

The field level implementation was carried out by 8 research teams. Each team included 6 members (one medical officer or a nurse, interviewers, measurers, area public health inspector and area public health midwife). A vehicle and a driver were allocated to each team. Each team

had one supervisor (supervising public health inspector). The field co-ordinator (nutrition assistant) performed the overall supervision of the 8 teams and managed the logistics. Each team covered 2 clusters per day.

Activities undertaken by each team included: conducting interviews, collecting venous blood samples, preparing the samples for transport and making arrangements for transporting the samples to the field laboratory. The team was also responsible for carrying out anthropometry.

A convenient place was selected in the district to establish the field laboratory and two laboratory technologists and 3 laboratory orderlies worked round the clock. Haemoglobin and C-reactive protein were analysed on site within 2 hours of the sample collection. Serum was separated and arrangements were made to transport the samples to the MRI laboratory.

Three data editors were placed at central level (MRI) to clean filter and code all the questionnaires. If there were any missing information in questionnaires, households were contacted again and relevant information obtained. This activity was supervised by two medical officers.

On receipt of the samples at the MRI Laboratory, laboratory team at the central level (Consultant Chemical Pathologist, Medical laboratory technologist, laboratory orderlies) started to perform analysis on first on first arrive basis.

All the field and laboratory activities are supervised by the consultant medical nutritionist as the Principle Investigator.

2.2.2. Training of survey teams

An intensive 5 day training workshop was organised to train the field coordinator, team supervisors, field investigators, laboratory team at field and central level, and data editors at central level by the principle investigator. These training workshops focused on, field data collection procedures, and management of other aspects of the survey. The training agenda included inputs on purpose of the study, responsibilities of each member of the research team. Training in interviewing techniques was carried out through detailed explanation of the contents of the questionnaire, mock interviews and checking of data to ensure the completeness of the questionnaire. In addition, guidance was given in handling blood samples and in labeling of samples, separation, storing and transport of samples.

Need to ensure quality of data collected was emphasized throughout the training including conduct of quality checks at the field level.

Detailed information of recruitment and training of staff is given in annex 2.

2.2.3. Field level implementation

Prior to implementation of the survey, the principal investigator and senior staff of the Department of Nutrition, MRI carried out a few planning meetings to prepare the questionnaire and to finalise the sampling techniques with the expert. Sensitization meetings were held with the central, provincial and district level health administrators and the relevant staff.

Community mobilisation activities at the level of each cluster were carried out by the local health staff (public health inspectors and public health midwives).

2.2.4. Data collection at the household level

Administration of the questionnaires was done by the trained field investigators. The questionnaire included several sections, some of which relate to household demographics, and socioeconomic characteristics. Information required in this section was obtained from the mother or in the absence of the mother immediate care taker of the eligible child aged 6-59 months.

A copy of the questionnaire is given in annex 3.

The names of respondents and identification data on the households were kept strictly confidential.

Every attempt was made to conduct interviews in the 10 selected households, and one additional visit was made to ensure that all relevant household members were available during the visit, to minimize possible bias. Those households who refused participation were not included in the sample.

2.2.5. Anthropometry

Height and weight measurements were taken on all children aged 6 to 59 months; children aged 5-18 years, men and non-pregnant women 18-59 years old. Children's age was assessed based on birth date from Child Health Development Record (CHDR) or birth certificate. Ages of the adult men and women were calculated using reported birthdays or self-reporting age.

Anthropometric indicators of length/height-for-age, weight-for-age and weight-for-length/height were determined for the children aged 6 to 59 months using WHO growth standards (2006).

Measurers were specially trained in conducting anthropometry using standardized procedure. They have experience in taking measurements in several nutrition surveys conducted by the MRI for last 10 years. Weight was measured using Seca electronic scale (minimum 50g) and height was measured using stadiometers (minimum 1cm). Weighing instruments were calibrated before

taking measurements, using standard weights. Standard WHO protocol for measuring height and weight of children and women were used.

Heights and weights were recorded in children aged 5-18 years, adult men and non-pregnant women.

The findings from these assessments were recorded in the relevant section of the questionnaire.

2.2.6. Collection of blood samples

During the visit to the household, the field investigators arranged for the participants in the study to be available for collection of venous blood samples, at a given venue on a specific date after obtaining the written consent of the mother or father or immediate caregiver. Consent for extended storage of the blood samples for future testing of additional micronutrient levels was also obtained. Samples were stored at MRI at temperatures below -20^{o}C.

Medical officers or trained nurses attached to each team collected venous blood samples using disposable syringes and needles. Whole blood was collected into two containers. First container was a metal free red top gel tube with non-rubber stopper to separate serum for vitamins and minerals. Second container was an EDTA tube with green top to assess haemoglobin (Hb) levels. Immediately after collection, the blood samples were transported in cool boxes containing frozen gel packs (<8 ^{o}C) to the field laboratory by the nutrition assistant.

Haemoglobin was measured within 2 hours using HICN method in the field laboratory. If the haemoglobin was <11g/dl, balance EDTA sample was send to the haematological laboratory of the MRI to detect any haemoglobinopathies using HPLC method. Additionally, high and low samples were measured in duplicate and quality control samples were analysed with each batch of samples.

In each district, a temporary field laboratory was set up in a central site such as a local hospital, school, pharmacy, health centre or other location which has essential facilities for the technologist to immediately centrifuge the samples brought in from the field and aliquot the serum into appropriate appendorff. All samples were processed within <2 hours of collection. For additional analysis from serum, blood from the red top gel tube with clot activator was utilized. After separation of the serum, one drop was used to analyse the CRP and remaining serum was stored in 2 separate appendorff to assess vitamins and minerals.

Detailed information on the collection of blood samples, their labelling, transport, storage and methods of analysis are given in **annexes 4 a and 4 B.**

Data available from the biochemical assessments were included in the relevant parts of the questionnaire.

In each cluster, the research team visited all selected households and conducted interviews, carried out anthropometric measurements and collection of the biological samples. All interviews, measurements and collection of biological specimens within a cluster were completed before moving to another cluster.

2.2.7. Data Entry

Data was entered by the 3 data entry operators supervised by the Principle Investigator. A unique ID number was used for each household. Data was entered in the EPINFO-6 software package.

2.3. Data Analysis

2.3.1. Descriptive statistics

Distribution of categorical variables was computed and frequencies and percentages were reported along with the means and standard deviations of quantitative variables. For variables with multiple responses, percentage rankings of the most frequent responses are presented. The data analysis was carried out using the software, Statistical Package for Social Sciences (SPSS version 15).

2.3.2. Univariate analysis

In univariate analysis, the association of nutritional status and micronutrient deficiencies with each dependent variable were assessed. Variables were categorized into biologically and socially meaningful categories, wherever required. Weighted data was utilised for making assessments on national level prevalence.

2.4. Ethical Issue

The investigators obtained informed consent from all representatives of the communities involved in this study. In the beginning, the all aspects of the study were discussed with the Provincial and District Director of Health Services and their approval obtained.

Informed consent (written) was obtained from all the participants of the study. The consent form explicitly outlines the aims and objectives of the study along with the strict confidentiality of the participants. Approval was obtained from the ethical review committee, of the MRI, Ministry of Health.

Information on operational procedures is given in annex 5.

CHAPTER 3

Results

3.1. Description of the study population

A total of 7,500 households were included in the study. Using the default settings for flagging records in the ANTHRO software based on extreme Z-score values of -6 and +6 for height/length-for-age (HAZ) and -6 and +5 for weight-for-age (WAZ); and -5 and +5 for weight-for-height/length (WHZ), a total of 194 records were flagged. Upon scrutiny, these flags were due to missing or not tallying of either two of the anthropometry determinants, i.e. Weight, or height, and thus they were excluded in the final analysis. There were no differences in the key socio-economic parameters of children with missing information.

Table 1: Distribution of households by district

Province	District	Number of households	%
Western	Colombo	288	3.9
	Gampaha	286	3.9
	Kalutara	278	3.8
Central	Kandy	287	3.9
	Matale	288	3.9
	Nuwara eliya	286	3.9
southern	Galle	272	3.7
	Matara	294	4.0
	Hambantota	295	4.0
Northern	Jafna	298	4.1
	Mannar	298	4.1
	Vavuniya	292	4.0
	Mullaitivu	295	4.0
	Kilinochchi	298	4.1
Eastern	Batticaloa	297	4.1
	Ampara	300	4.1
	Trincomalee	293	4.0
North western	Kurunegala	296	4.1
	Puttlam	292	4.0
North central	Anuradhapura	297	4.1
	Polonnaruwa	297	4.1
Uva	Badulla	292	4.0
	Moneragala	295	4.0
Sabaragamuwa	Rathnapura	297	4.1
	Kegalle	295	4.0
Sri Lanka		**7306**	**100.0**

The final analysis for the study is based on 7,306 households giving 97.4% of response rate. Number of households from each district was approximately 4% of the sample with the percentages of the population per district ranged from 272 (3.7%) in Galle district to 300 (4.1%) in Ampara district.

3.2. Basic socio demographic information

Table 2: Distribution of households by socio-demographic characteristics

Characteristics	No.	%
No. of residents in household		
≤ 3	1782	24.4
4-6	5065	69.3
.≥7	459	6.3
Mean household no. (SD)	**4.4(1.2)**	
Mother's education level (years)		
No schooling	37	0.5
Primary(1-5)	258	3.5
6-10	1414	19.4
11-13	4861	66.5
Higher	386	5.3
Not mentioned	350	4.8
Mothers employment status		
Managerial executive and management	65	0.9
Professional	220	3.0
Clerical	103	1.4
Sales and related	160	2.2
Agricultural workers	70	1.0
Security forces	11	0.2
Skilled worker	234	3.2
Unskilled worker	106	1.5
Housewife	5786	79.2
Other	217	3.0
Unemployed	334	4.6
Father's employment status		
Managerial	108	1.5
Professional	187	2.6
Clerical	191	2.6
Sales and related	1216	16.6
Agricultural workers	766	10.5
Security forces	526	7.2
Skilled worker	1845	25.2
Unskilled worker	1038	25.2
Other (abroad, retired, unemployed etc.)	1431	19.4
Total	7306	100.0

As shown in table 2, the number of members in the household ranged from 2-11 with the mean number being 4.4. Of them, 69.3% had 4-6 members with only 6.3% having 7 or more members. Of the mothers, 66.5% had been educated up to grades 11 – 13 with the percentage having no schooling being very low 0.5% and those who had studied up to the primary level being 3.5%.

Among the mothers, 79.2% were housewives with only 3.9% were employed in occupations that were categorised as managerial/ professional. Among the fathers, 50.4% belonged to the categories skilled and unskilled workers in equal proportions and only 4.1% were in occupations categories as managerial/professional.

3.3. Income and Wealth Index

Weighted data was utilised for this analysis. Data on two indicators of economic status was collected, household monthly income and wealth index. The 'household wealth index' was developed using 3 sources of information: housing characteristics, household possessions and availability of water and sanitation facilities. Principal component analysis was performed by using information on the ownership of household goods and amenities (assets) to assign weights to each household asset, and obtain wealth scores for each household in the sample. The sample was then divided into five groups of equal size, from the poorest quintile to the richest quintile, based on the wealth scores of households they were living in. The wealth index is assumed to capture the underlying long-term wealth through information on the household assets, and is intended to produce a ranking of households by wealth, from poorest to richest.

Of the total sample, 38.5% of the households reported as belonging to the income category of Rs.20, 000 – 31,999 with 8.8% reporting a monthly income less than Rs.9000/-month. Of the total group, nearly half (50.9%) belonged to the upper two wealth quintiles with 27 % belonged to the richest wealth quintile with 28.8% belonging to the lower two wealth quintiles (Table 3).

Table 3: Distribution of the households according to income, and wealth index

Characteristics	No.	%
Monthly household income		
< 9,000	645	8.8
9,000-13,999	1262	17.3
14,000-19,999	1579	21.6
20,000-31,999	2811	38.5
≥ 32,000	825	11.3
No information	186	2.5
Wealth Index Quintile		
Poorest (Lowest)	764	10.5
Poor (Second)	1336	18.3
Middle	1491	20.4
Rich (Fourth)	1746	23.9
Richest (Highest)	1970	27.0

3.4. Prevalence of malnutrition among children aged 6 – 59 months

The three indices of physical growth that describe the nutritional status of children according to WHO growth standards (WHO, 2006) are: height-for-age, weight-for-height and weight-for-age. Each of the three nutritional status indicators is expressed in terms of standard deviations from the median (Z-scores) of the reference population as given below:

3.4.1. Stunting

A child whose height for age is below -2 SD from the median of the reference population is considered short for his/her age, or "stunted," a condition reflecting the cumulative effect of chronic under nutrition. Those that have height for age values less than -3 SD are considered as 'severely stunted'.

3.4.2. Wasting

A child whose weight for height is below -2 SD from the median of the reference population is considered as "wasted," a condition reflecting the effect of short term under nutrition. Those that have weight for height values less than -3 SD are considered as 'severely wasted'.

3.4.3. Underweight

A child whose weight for age is below -2 SD from the median of the reference population is considered as "underweight". Those that have weight for age values less than -3 SD are considered as 'severely underweight'.

3.4.4. Overweight

A child whose weight for height is above +2 SD from the median of the reference population is considered as "overweight".

As shown in Table 4, among all children in the age group 6–59 months, 13.1 percent were stunted, 19.6 percent wasted**,** 23.5 percent were underweight and 0.7 percent were overweight. Severe stunting was seen among 2.0 percent of the total group, with the comparable figures for severe wasting and severe underweight being 2.3 percent and 3.8 percent respectively.

The prevalence of stunting (height for age <-2 SD) was relatively low during the first year of life and was highest in the second year and showing marginally lower prevalence values in the ages up to five years. There was an increasing pattern seen in the prevalence of wasting (weight for height <-2 SD) with age up to 4 years and showed a decline in the fifth year 21.7%.

Prevalence of underweight was relatively low during the first year thereafter; an increase in the prevalence is seen with age and a marginally lower prevalence in the fifth year of life. The percentage of children with stunting and wasting were higher among males compared to females, with the reverse seen in the prevalence of underweight.

Prevalence of stunting was highest in the children of mothers with the lowest level of education and this percentage decreased as the level of education of the mother increased. Prevalence of wasting was highest among the mothers with primary schooling and after that there was a consistent decreasing pattern of wasting was observed with increasing education. However, no consistent pattern was seen in the prevalence of underweight when comparisons were made with the levels of maternal education.

Prevalence of stunting and underweight was highest in the households with 7 or more members. However, the prevalence of wasting was highest in the households with 4-6 members.

The percentage of overweight children was only 0.7% in the total sample with male children having a higher prevalence than females. There was no consistent age pattern seen. The prevalence was high among the children of mothers with a higher level of education and among those from households with ≤ 3 members.

Table 4: Prevalence of under nutrition: stunting, wasting, overweight among children aged 6-59 months, by basic demographic characteristics.

Background characteristic	Height-for- age (%)		Weight-for-height (%)			Weight-for-age (%)		Total No of Children
	<-3SD severe	<-2SD stunting	<-3SD SAM	<-2SD wasting	≥+2SD Overwt	<-3SD severe	<-2SD underwt	
Age of the child								
6-11	0.8	7.5	2.0	10.5	0.9	1.9	12.2	579
12-23	2.1	14.8	2.2	16.6	0.4	3.4	22.2	1713
24-35	2.5	12.7	2.0	20.0	0.5	4.3	23.4	1727
36-47	1.8	13.7	2.9	23.1	0.9	4.4	26.7	1621
48-59	1.8	13.1	2.3	21.7	0.8	3.8	25.6	1667
Sex of the child								
Male	2.1	13.4	2.5	20.1	0.8	3.3	22.8	3666
Female	1.8	12.7	2.1	19.0	0.5	4.3	24.2	3641
Mother's education								
No schooling	2.9	22.2	2.7	20.7	0.0	4.6	27.1	37
1-5	2.8	19.5	1.7	21.6	0.3	7.1	32.3	258
6-10	2.2	15.8	3.4	21.1	0.5	5.1	27.5	1414
11-13	1.9	12.1	2.0	19.7	0.7	3.4	22.5	4861
Higher	1.4	8.7	1.7	11.7	2.6	1.6	16.1	386
No information	1.6	14.4	2.5	18.4	0.3	3.6	22.6	350
No of members in household								
≤ 3	1.9	11.2	2.4	17.9	1.3	3.4	19.5	1782
4-6	1.9	13.5	2.2	20.1	0.5	3.9	24.8	5065
≥7	2.3	15.9	2.8	19.7	0.0	4.4	24.7	459
Sri Lanka	**2.0**	**13.1**	**2.3**	**19.6**	**0.7**	**3.8**	**23.5**	**7306**

As shown in table 5, in general, a declining trend was seen in the prevalence of stunting, wasting and underweight with increasing monthly household income and wealth quintiles. The prevalence of severe wasting was highest with children from the lowest quintiles and lowest in the richest quintile. However, there was no consistent trend in the prevalence of wasting with household income though the rates in the income group of <9000 was higher than the ≥ 32,000 income group.

Table 5: Prevalence of under nutrition: stunting, wasting, overweight among children aged 6-59 months, by socio economic characteristics

Background characteristic	Height-for- age (%)		Weight-for-height (%)			Weight-for-age (%)		Total No of Children
	<-3SD severe	<-2SD stunting	<-3SD SAM	<-2SD wasting	≥+2SD Over weight	<-3SD severe	<-2SD Under weight	
Father's employment								
Managerial	0.0	2.3	1.3	12.5	0.0	0.9	10.2	108
Professional	2.9	9.6	3.0	20.5	0.0	1.9	21.1	187
Clerical	1.2	8.5	0.5	20.1	1.2	1.2	19.9	191
Sales and related	2.1	12.0	2.0	17.5	0.8	3.0	19.1	1216
Agricultural workers	2.1	16.1	3.0	21.5	0.4	5.5	30.3	766
Security forces	2.0	10.8	2.1	17.4	1.1	2.0	19.5	526
Skilled workers	1.4	12.9	2.1	19.7	0.7	3.6	23.7	1845
Unskilled worker	2.3	15.3	2.1	23.3	0.3	4.3	32.5	1038
Other	2.3	13.8	3.1	18.4	1.0	4.1	22.6	1431
Monthly household income								
<9,000	2.6	18.9	4.8	27.0	0.3	7.7	34.5	645
9,000-13,999	2.6	15.2	2.8	23.0	0.3	5.9	28.2	1262
14,000-19,999	1.8	13.7	2.5	18.2	0.4	3.3	22.7	1579
20,000-31,999	1.8	12.0	1.6	18.7	1.0	2.8	21.5	2811
≥ 32,000	0.8	7.2	1.5	13.1	1.1	1.4	14.9	825
Wealth index quintile								
Lowest	2.9	19.3	4.2	25.4	0.2	8.2	33.4	764
Second	2.5	15.6	3.1	20.8	0.1	5.1	28.4	1336
Middle	1.5	14.1	2.1	20.3	0.7	3.1	25.0	1491
Forth	1.7	11.6	2.1	19.2	1.2	2.9	20.4	1746
highest	1.8	9.6	1.4	16.2	0.8	2.6	17.9	1970
Sri Lanka	**2.0**	**13.1**	**2.3**	**19.6**	**0.7**	**3.8**	**23.5**	**7306**

There were marked differences in the prevalence of the nutritional status indicators, between occupational categories of fathers. Prevalence of stunting was comparatively higher among the children of fathers belonging to sales and related work, agricultural workers, skilled workers and unskilled workers. A similar pattern was seen in relation to wasting. The prevalence of

underweight was much higher among children of fathers belonging to the occupational categories, unskilled workers, agricultural workers and skilled workers.

However, it must be noted that the prevalence among children of unskilled workers was relatively high.

Inter district differentials in the prevalence of under nutrition are presented in table 6.

Table 6: Prevalence of under nutrition: stunting, wasting, underweight, overweight among children aged 6-59 months, by districts

Background characteristic	Height-for- age (%)		Weight-for-height (%)			Weight-for-age (%)		Total No of Children
	<-3SD severe	<-2SD stunting	<-3SD SAM	<-2SD Wasting	≥+2SD Over weight	<-3SD severe	<-2SD underwt	
Colombo	1.7	8.0	0.7	17.0	1.0	2.4	16.3	288
Gampaha	1.0	9.4	1.0	18.5	0.3	0.7	21.7	286
Kalutara	1.4	**6.8**	0.4	15.8	**1.8**	1.8	**15.8**	278
Kandy	2.1	15.7	1.7	20.2	0.3	3.5	24.7	287
Matale	2.1	14.9	3.1	22.2	0.3	5.9	28.5	288
NuwaraEliya	**4.9**	**23.8**	1.4	16.4	0.3	7.0	26.6	286
Galle	2.6	13.6	2.9	18.8	0.7	3.7	22.4	272
Matara	0.7	13.6	3.1	20.4	1.0	3.1	25.2	294
Hambantota	1.4	9.5	3.1	24.4	0.3	4.4	20.3	295
Jafna	1.0	10.1	2.3	18.8	0.7	4.0	19.8	298
Mannar	3.0	17.4	4.7	22.1	0.0	5.4	28.2	298
Vavuniya	2.4	19.9	1.4	21.9	0.3	6.8	28.4	292
Mullaitivu	2.4	17.6	6.1	27.8	0.7	7.8	35.6	295
Kilinochchi	2.3	18.1	**5.0**	**34.9**	0.0	**8.1**	**40.9**	298
Batticaloa	2.7	14.5	4.7	20.2	1.3	5.7	27.9	297
Ampara	4.3	19.3	5.3	20.7	0.7	7.3	28.7	300
Trincomalee	2.0	18.8	5.8	25.6	0.0	7.5	32.8	293
Kurunegala	2.7	14.5	2.0	20.6	0.7	4.4	24.7	296
Puttlam	1.4	11.3	1.4	**14.0**	0.7	2.7	18.8	292
Anuradhapura	0.7	10.4	3.4	18.5	0.7	4.7	22.2	297
Polonnaruwa	0.3	14.8	4.4	25.9	0.0	5.1	30.6	297
Badulla	3.4	22.3	2.1	16.4	0.7	5.1	26.7	292
Moneragala	2.0	14.2	3.7	28.8	0.3	4.4	30.2	295
Rathnapura	1.3	13.8	2.7	21.5	0.3	2.7	28.3	297
Kegalle	2.0	12.5	3.4	20.3	1.0	5.8	25.8	295
Sri Lanka*	**2.0**	**13.1**	**2.3**	**19.6**	**0.7**	**3.8**	**23.5**	**7306**

For Sri Lanka, the prevalence of stunting was 13.1%, wasting 19.6% and underweight 23.5%. The prevalence of stunting ranged from a low value of 6.8% in Puttalam district to a high value of 23.8% in Nuwara Eliya district (Table 6 and Figure 1).

Figure 1: Prevalence of stunting in children aged 6-59 months of age by District (n=7306)

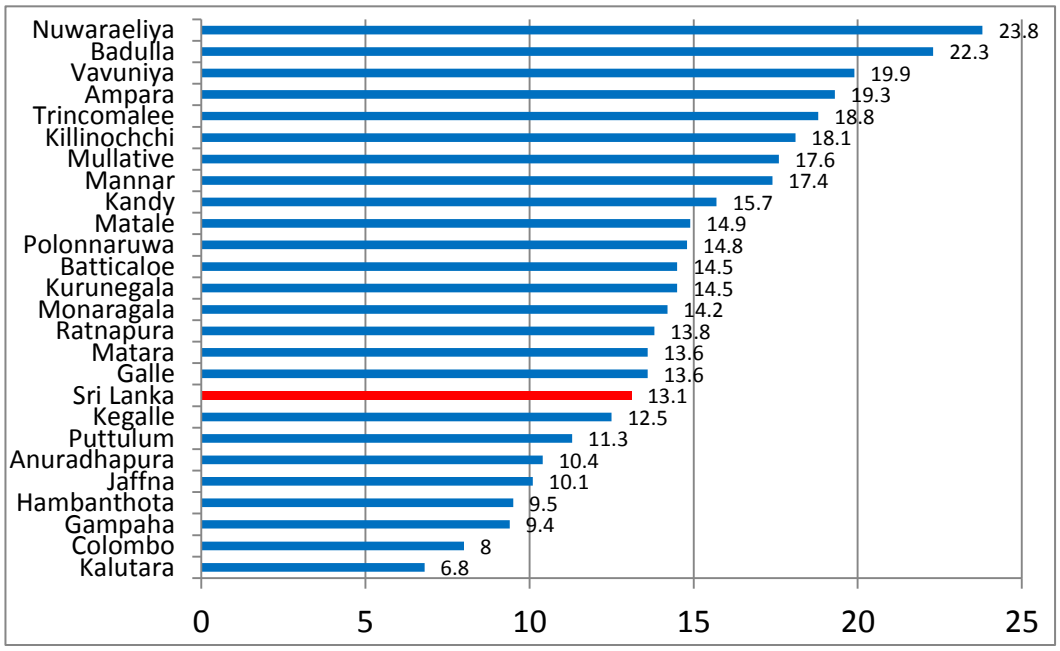


Figure 2: Map showing prevalence of stunting in children aged 6-59 months of age by District

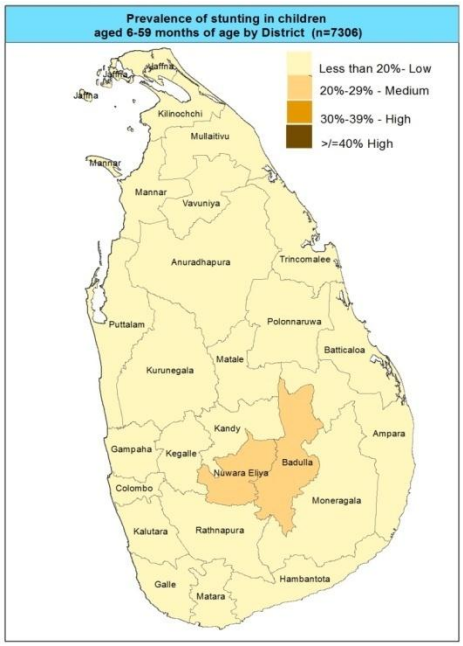


Figure 1 shows that 17 out of the 25 districts showed higher prevalence of stunting compared to the national average (Kandy, Matale, Nuwara Eliya, Mannar, Vavuniya, Mullaitivu, Kilinochchci, Kurunegala, Ratnapura, Trincomalee, Batticalo, Ampara, Polonnaruwa, Monaragala, Galle, Matara and Badulla).

According to the cut-off values specified by WHOM, for prevalence of stunting as being of public health significance, stunting is a low public health problem in all districts except in Badulla and Nuwaraeliya. (Figure 2).

Figure 3: Prevalence of wasting in children aged 6-59 months of age by Districts (n=7306)

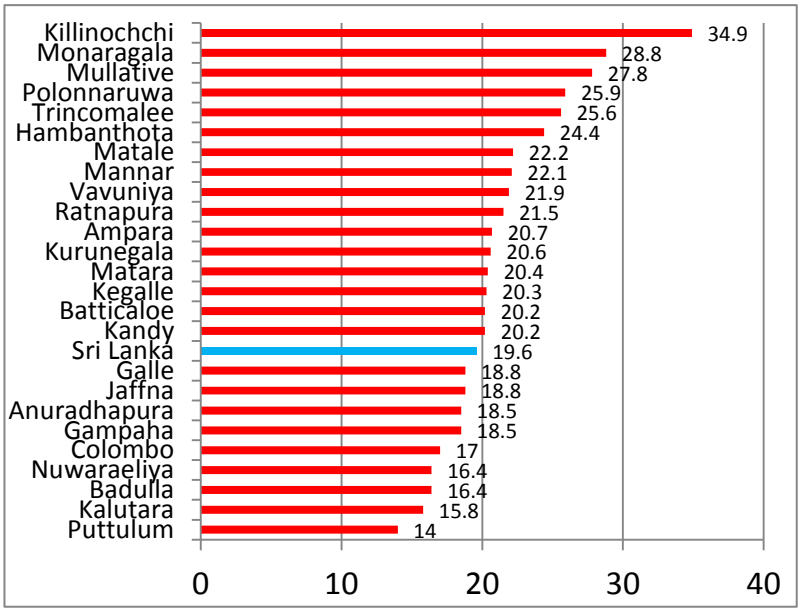
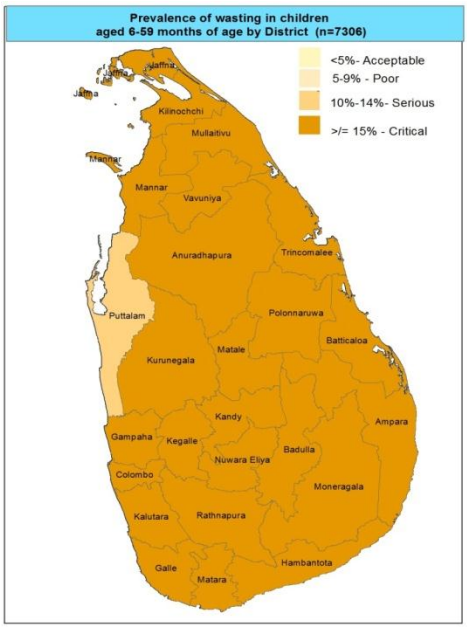


Figure 4: Map showing prevalence of wasting in children aged 6-59 months of age by District

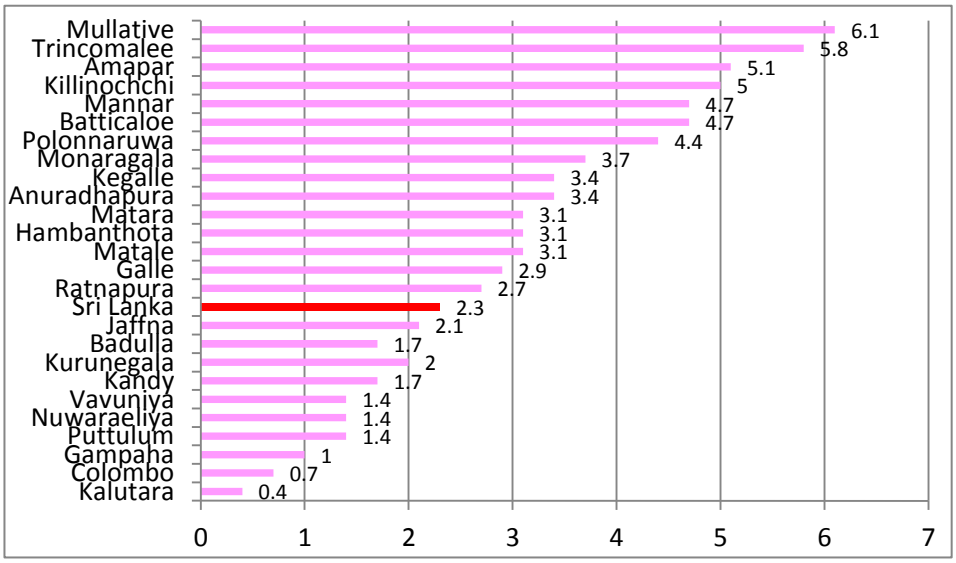


Considering the prevalence of wasting, the prevalence ranged from 14% in Puttalam to 34.9% in Kilinochchi. Nine districts showed lower prevalence than national and they were Puttulum, Kalutara, Badulla, Nuwareliya, Colombo, Gampaha, Anuradapura, Jaffna and Galle. All other districts showed prevalence higher that the value shown for national level (Figure 3).

According to the cut-off values in the prevalence of wasting that identified this problem as of public health significance (specified by the WHO), wasting is a critical public health problem in all districts except in Puttalam district indicating the need for implementing effective interventions on a priority basis. (Figure 4).

Overall prevalence of severe acute malnutrition (SAM as indicated by weight for height <-3SD) was reported as 2.3%, this figure varying between 0.4% in Colombo district to a high value of 6.1% in Mullativu district. Comparing the prevalence figures with that for national prevalence rates, it was seen that 15 districts had higher prevalence figures as shown in Figure 5.

Figure 5: Prevalence of severe acute malnutrition (SAM) in children aged 6-59 months of age by Districts (n=7306)



Underweight children comprised of 23.5% of the total sample with the highest prevalence figures being reported from Kilinochchi district (40.9%) and lowest 15.8% from Kalutara district. Eight districts showing lower prevalence and 17 districts showing higher values, three among them show marginally higher values (Figure 6).

Figure 6: Prevalence of underweight in children aged 6-59 months of age by Districts (n=7306)

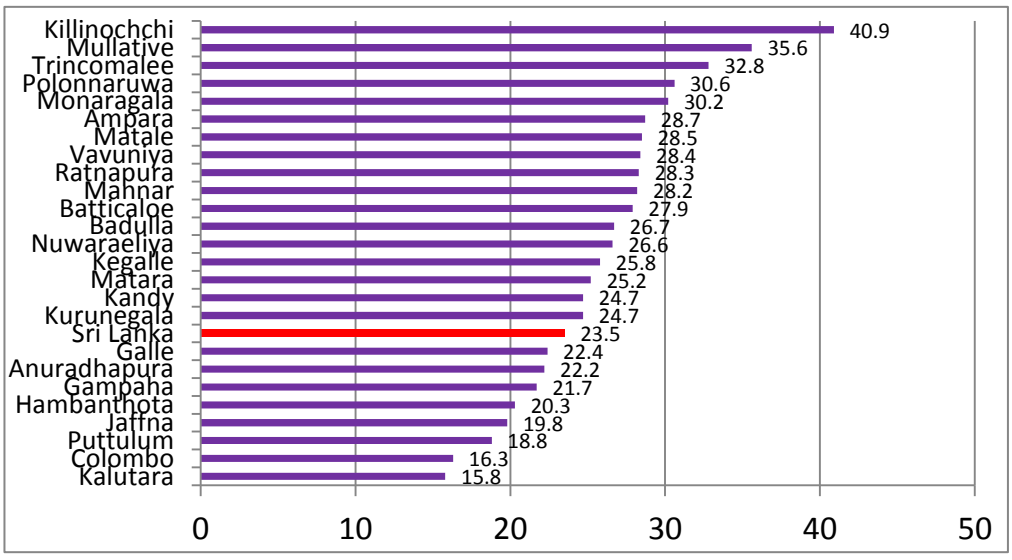
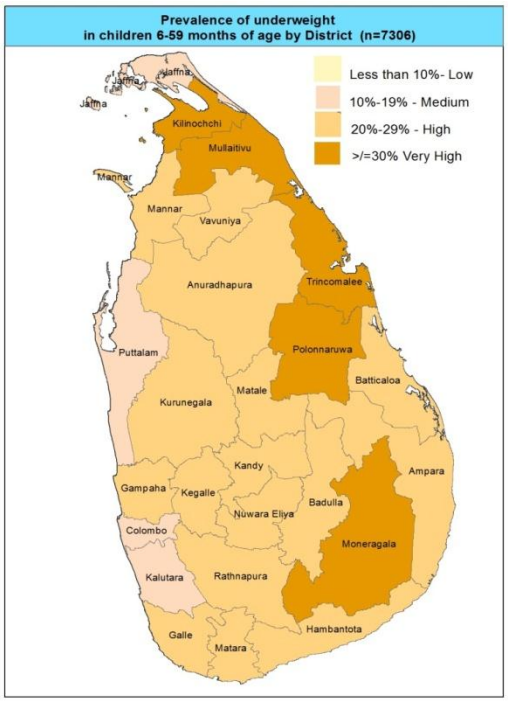


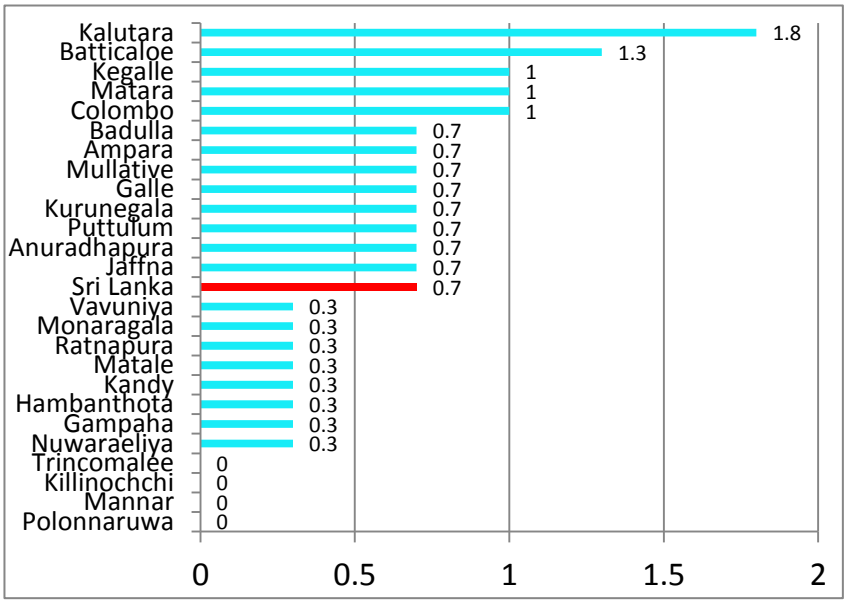
Figure 7: Map showing prevalence of underweight in children aged 6-59 months of age by Districts (n=7306)



According to the prevalence figures that identify underweight as a problem of public health significance as specified by the WHO, underweight is a very high public health problem in the districts of Monaragala, Polonnaruwa, Trincomale, Mullativu and Killinochchci districts. Puttulum, Kalutara and colombo district data showed that in these districts, the level of public health significance to be of a 'moderate' degree. All the other districts indicate underweight as a high public health problem (Figure 7).

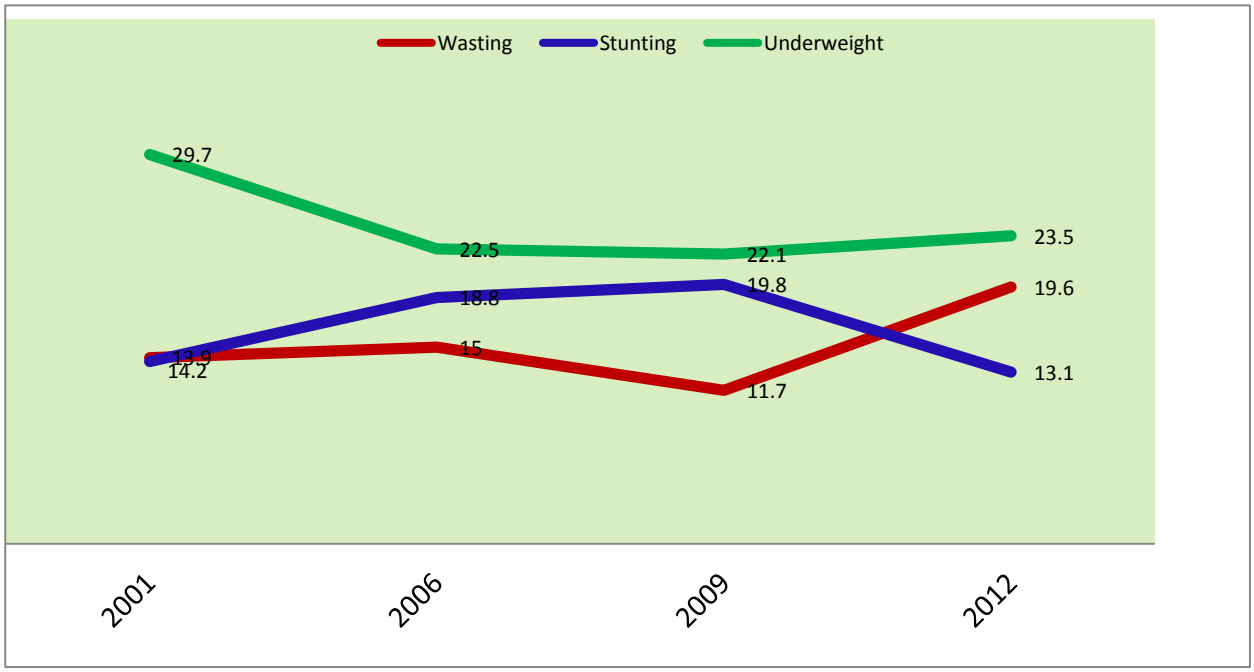
Prevalence of overweight for the total sample was low 0.7% ranging from 0% in Polonnaruwa, Mannar, Kilinochchci and Trincomalee districts to 1.8% in Kalutara district (Figure 8).

Figure 8: Prevalence of overweight in children aged 6-59 months of age by Districts (n=7306)



Trends in the prevalence of wasting, stunting and underweight in children aged between 6–59 months based on available data (WHO standards) over the period 2001–2012 are shown in Figure 9.

Figure 9: Trends in the prevalence of wasting, stunting and underweight in children age 6-59 months from 2001-2012 (WHO standards)



3.5. Prevalence of anaemia in children aged 6 – 59 months

The haemoglobin levels of 7050 children in the age group 6–59 months were assessed using the HICN method (cut off point - Hb <11.0 gms % and adjusted for altitudes). The response rate was 94%.

As shown in Table 7, the prevalence of anaemia in this group was 15.1 percent, with the highest percentage during the latter half of infancy (34.0 %), and declining with increasing age, with the 48–59 months age group showing the lowest prevalence (6.9%). Male children showed a higher prevalence than females.

There was a decline in the prevalence of anaemia with increasing household income levels and higher wealth quintiles. However, there was no clear pattern seen with levels of maternal education and number of members in the household.

Similar to the observations related to nutritional status, the occupational category in which the father was employed in had an influence on the occurrence of anaemia. High prevalence were

seen in children of fathers belonging to occupational categories, security forces, agricultural workers and professionals, with a high value being observed among the children whose father's occupation was categorised as 'other' which include father dead, unemployed, separated etc.

Table 7: Prevalence of anaemia among children aged 6-59 months, by background characteristics

Background characteristic	% of Children with Anaemia (Hb<11.0g/dl)*	Total No of Children investigated
Age of the child		
6-11	34.0	535
12-23	24.1	1642
24-35	13.1	1657
36-47	9.9	1582
48-59	6.9	1633
Sex of the child		
Male	17.1	3528
Female	13.1	3522
Mother's education		
No schooling	14.7	37
Primary	17.9	249
Secondary	15.7	1370
Passed O' Level	15.0	4677
Higher education	11.5	371
No information	16.4	347
Father's employment		
Managerial	8.1	102
Professional	14.7	179
Clerical	9.5	187
Sales and related	14.5	1181
Agricultural worker	16.0	738
Security forces	24.5	509
Skilled worker	13.1	1770
Unskilled worker	14.7	1001
Other	15.7	1382
No of members in household		
≤ 3	16.2	1721
4-6	14.7	4883
≥7	15.4	446
Monthly household income		
<9000	17.5	624
9000-13999	15.7	1217
14000-19999	15.8	1520
20000-31,999	14.1	2715
≥ 32,000	13.8	797
No information	17.6	177
Wealth index quintile		
Lowest	18.2	741
Second	17.6	1285
Middle	15.7	1444
Fourth	13.8	1688
Highest	12.9	1892
Sri Lanka	**15.1**	**7050**

Table 8: Prevalence of anaemia among children aged 6-59 months, by district

District	% of Children with Anaemia (Hb<11.0g/dl)*	Total No of Children investigated
Colombo	17.1	275
Gampaha	15.8	272
Kalutara	14.7	273
Kandy	16.9	278
Matale	12.9	279
Nuwara Eliya	13.3	271
Galle	8.9	259
Matara	10.0	279
Hambantota	9.7	290
Jafna	18.6	291
Mannar	15.4	279
Vavuniya	18.1	281
Mullaitiv	14.3	280
Killinochchi	26.9	283
Batticaloa	15.3	295
Ampara	13.6	295
Trincomalee	23.1	290
Kurunegala	16.0	288
Puttlam	20.3	286
Anuradhapura	16.2	291
Polonnaruwa	21.5	288
Badulla	15.9	289
Moneragala	25.6	281
Rathnapura	11.1	280
Kegalle	4.9	283
Sri Lanka	**15.1**	**7050**

Inter district comparisons show the prevalence to range between a low values of 4.9% in Kegalle district to 26.9% in Kilinochchi (Table 8).

Among the 25 districts that have prevalence below the average for national level were Kegalle, Galle, Hambantota, Matara, Rathnapura, Matale, Nuwaraeliya, mpara, Mullative and Kalutara. The other districts reported prevalence figures higher than that for national level (Figure 10).

Figure 10: Prevalence of anaemia in children aged 6-59 months of age by Districts (n=7050)

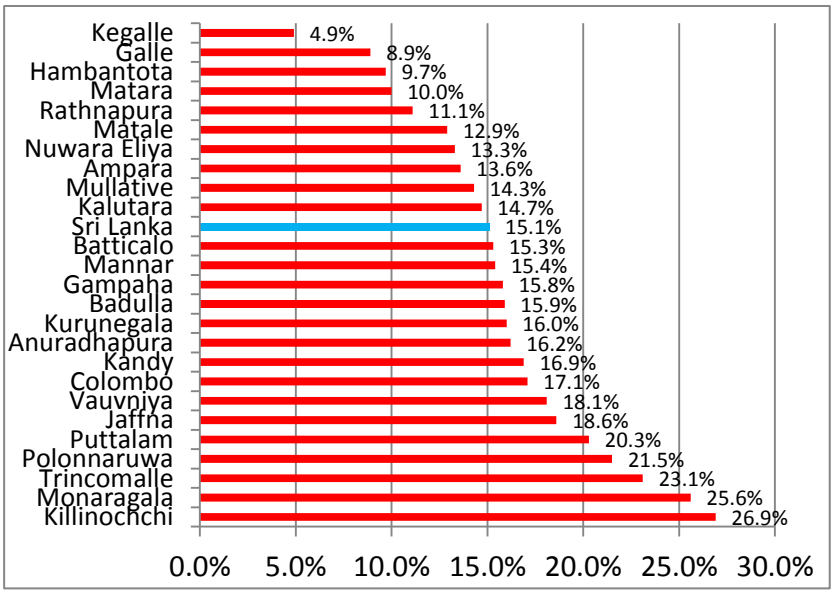
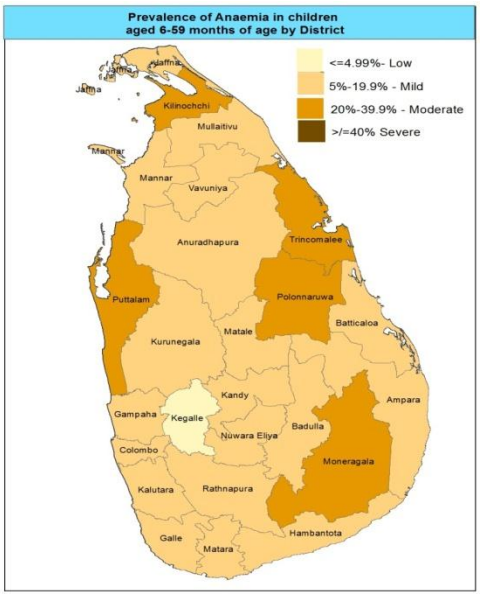


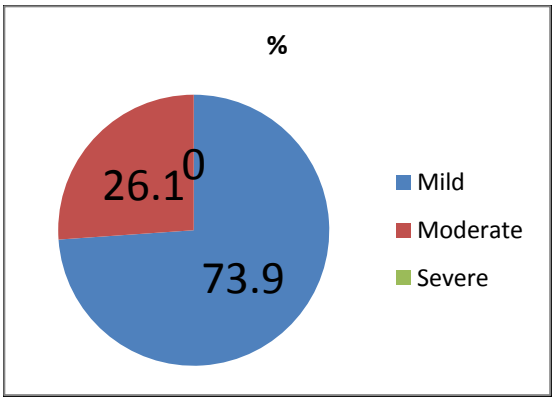
Figure 11: Map showing prevalence of anaemia in children aged 6-59 months of age by districts (n=7050)



According to the prevalence values that identify anaemia as a problem of public health significance as specified by the WHO, the findings of this study shows that anaemia is of public health significance at a 'moderate' level, in Putatalam, Monaragala, Polonnaruwa, Trincomale, and Killinochchci districts. Kegalle district showed a low public health problem. All the other districts indicate anaemia as a mild public health problem (Figure 11).

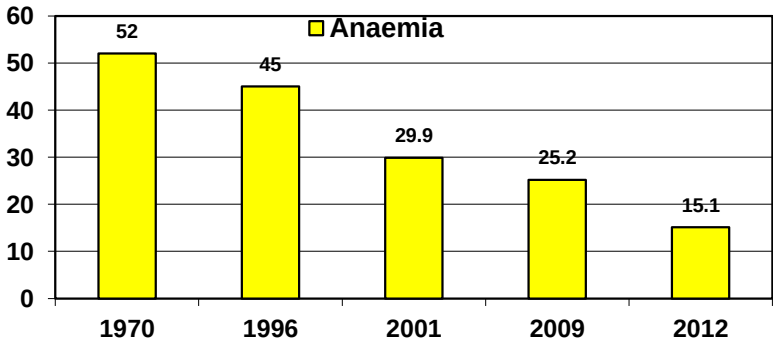
Additional information available shows that 73.9% of the children who were identified as anaemic had anaemia of a mild degree with 26.1% having a 'moderate' level of anaemia (Figure 12).

Figure 12: Degree of anaemia in children aged 6-59 months of age (n=7050)



For comparison purposes, Figure 13 shows data available from 1970 to 2012, showing the trends in the prevalence of anaemia.

Figure 13: Trends in the prevalence of anaemia in children age 6-59 months from 1970-2012



3.6. Prevalence of low birth weight

As shown in table 11, mean birth weight of the study sample was 2.9 (1.24) kg and prevalence of low birth weight as given by the percentage of newborns with birth weights less that 2.5 kg was 17.9%. The study group included children from different birth cohorts and the prevalence varied between the different age groups, between 15.2% to 19.8%. The highest prevalence was seen among the cohort of children aged 48–59.9 months at the time of the study. The prevalence among female children was higher compared to males. There is some indication that the prevalence reduced with increasing level of maternal education though there is no consistent pattern. This observation has to be interpreted with caution as relevant data were not available from 19.5% of the mothers. Considering father's employment too, there is no clear pattern seen. However, there is a declining trend in the prevalence seen with increasing levels of monthly household income and with increasing wealth quintiles.

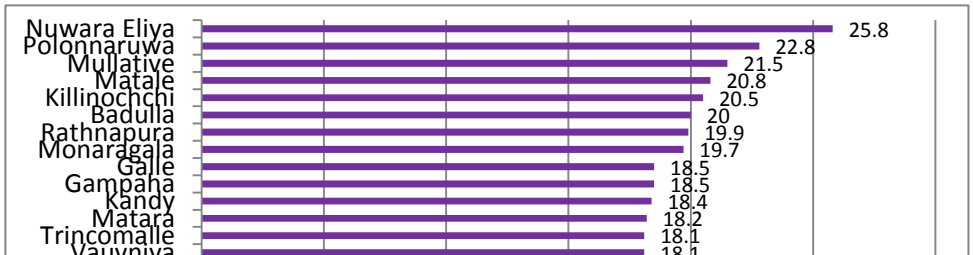
Table 9: Prevalence of low birth weight (LBW) among children aged 6-59 months, by background characteristics

Background characteristic	% of Children with LBW	Total No of Children

	(Birthweight<2.5kg)	investigated
Age of the child		
6-11	15.2	579
12-23	17.9	1713
24-35	16.6	1727
36-47	18.4	1621
48-59 9	19.8	1667
Sex of the child		
Male	15.3	3666
Female	20.6	3641
Mother's education		
No schooling	21.8	37
Primary	23.9	258
Secondary	20.1	1414
Passed O' Level	17.1	4861
Higher education	14.6	386
No information	19.5	350
Father's employment		
Managerial	6.0	108
Professional	18.4	187
Clerical	10.8	191
Sales and related	16.4	1216
Agricultural worker	20.6	766
Security forces	18.8	526
Skilled worker	17.2	1845
Unskilled worker	20.7	1038
Other	17.3	1431
Monthly household income		
<9000	26.5	645
9000-13999	20.3	1262
14000-19999	15.7	1579
20000-31,999	17.6	2811
≥ 32,000	12.2	825
No information	21.6	186
Wealth index quintile		
Lowest	22.8	764
Second	21.5	1336
Middle	17.7	1491
Fourth	17.0	1746
Highest	14.6	1970
Sri Lanka	**17.9**	**7306**

Prevalence of low birth weight by districts is shown in Figure 14.These values ranged from a low value of 14.1% in Hambantota district to the highest, 25.8% in Nuwara Eliya district. Fourteen out of the 25 districts had values higher than that reported at national level (17.9%).

Figure 14: Prevalence of LBW in children aged 6-59 months of age by District



3.7. Nutritional status of primary schoolchildren

Anthropometry was carried out among the primary school children (n=1135) resident in the households included in the study. Prevalence of stunting was approximately 9% in all age groups with that of thinness ranging from a value 29.6% in the 7-9.9 age group to 26.6% in the age group 5-6.9 years. Prevalence of overweight also differed between the age groups with the percentage being lowest (2.2%)in the youngest age group (5 -6.9 years) and highest in the 7 – 9.9 year age group, 4.1%. with no difference in the prevalence of obesity (Figure 14).

Figure 15: Prevalence of Stunting, Thinness and Obesity among children 5-9.9 years of age (n=1135)

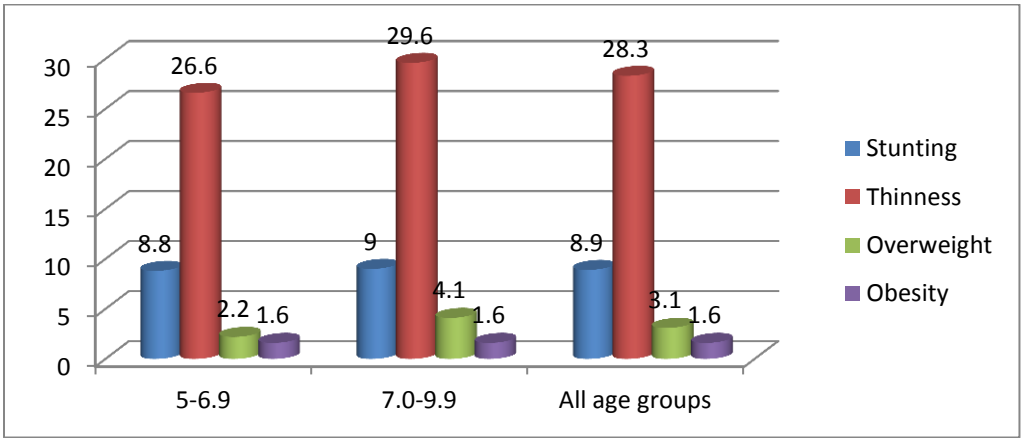
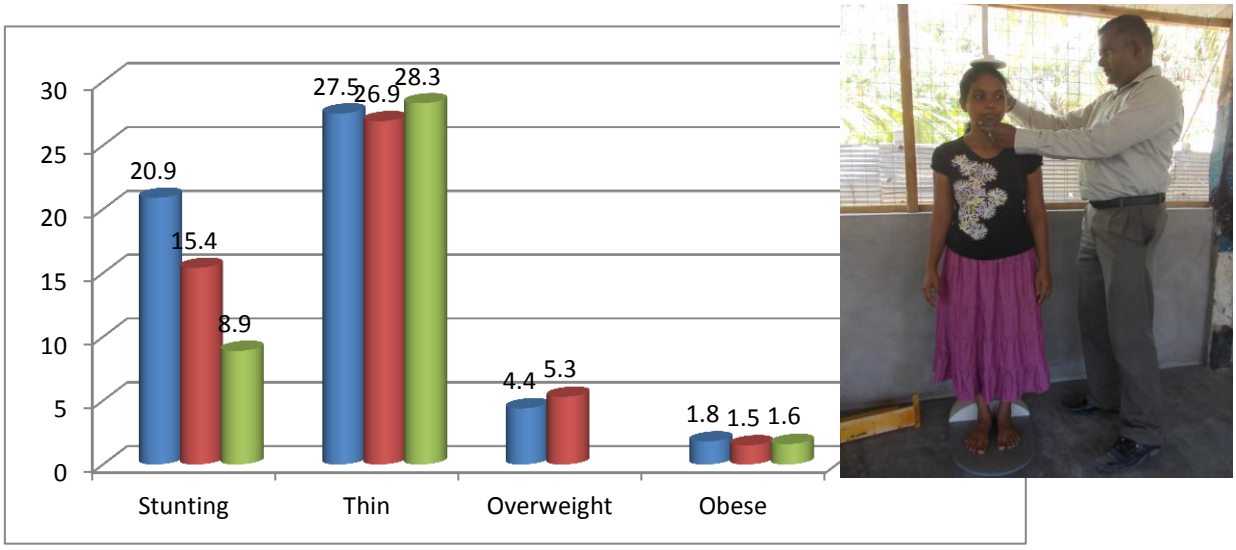


Figure 16: Trends of Stunting, Thinness and Obesity among children 5-9.9 years of age

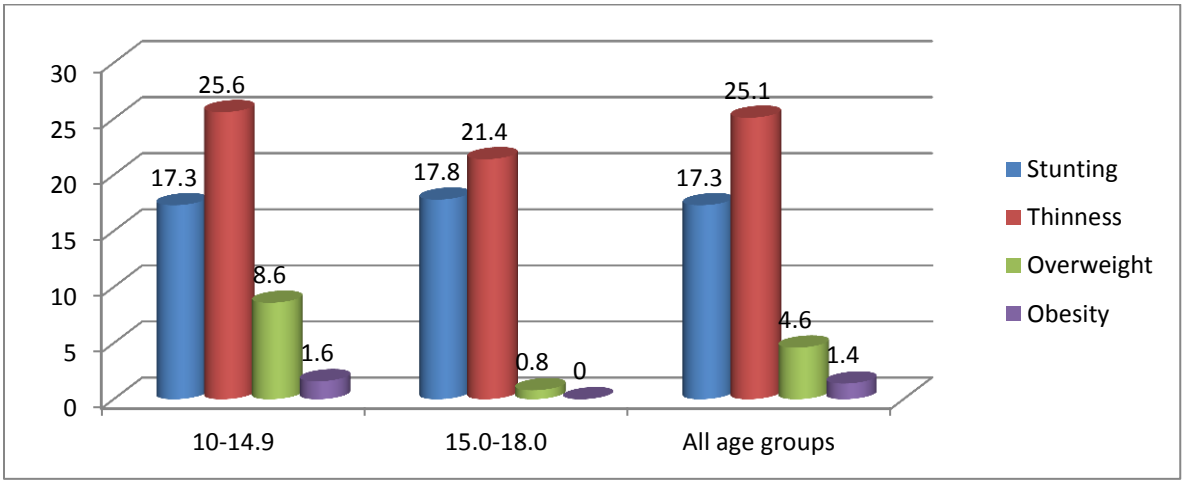


Comparison with the prevalence data reported in 2002 and 2010, there is a marked decline in the prevalence of stunting and an increase in the prevalence of thinness and overweight (Figure 17).

3.8. Nutritional status of Adolescents aged 10-18 years

Anthropmetry was carried out among 405 adolescents who were residents in the households included in the study. Their nutritional status was assessed using BMI for age and sex.Among this group, 17.3% were stunted, 25.1% were thin, and 4.6% were overweight and 1.4% obese.

Figure 17: Prevalence of Stunting, Thinness and Obesity among adolescents aged 10-18 years of age (n=405)

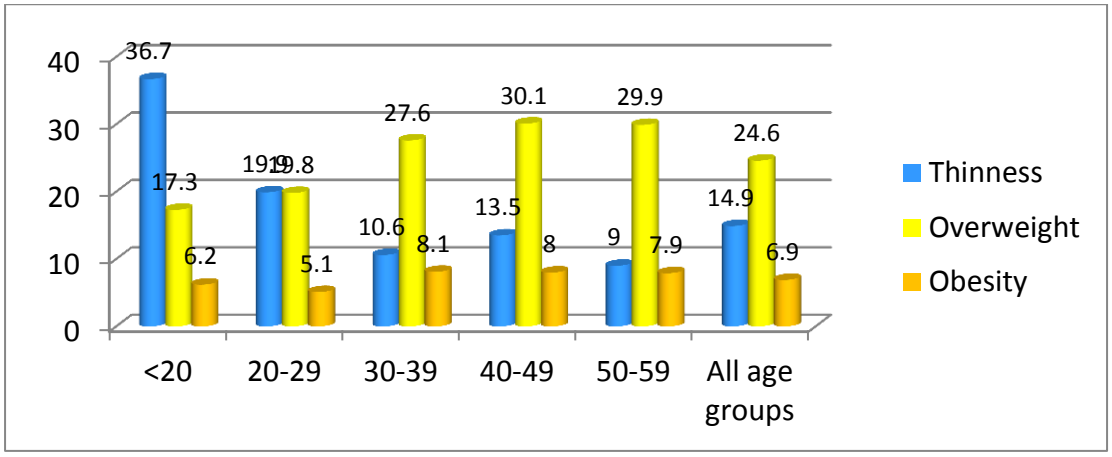


3.9. Nutritional status of non-pregnant women aged 18-59 years

Heights and weights of all non-pregnant women (n=3019) resident in the selected households were measured and body mass index (BMI) was used to assess their nutritional status. As shown in Figure 18, prevalence of thinness among the total group was 14.9% with the highest value

(36.7%) seen among the less than 20 year age group. The prevalence of overweight for the total sample was 24.6% ranging from a low value of 17.3% in the <20 year age group to 30.1% in the age group 40-49 years, showing a general increase in the prevalence with age, though not consistent.

Figure 18: Prevalence of Thinness, overweight and Obesity among women 18-59 years of age (n=3019)



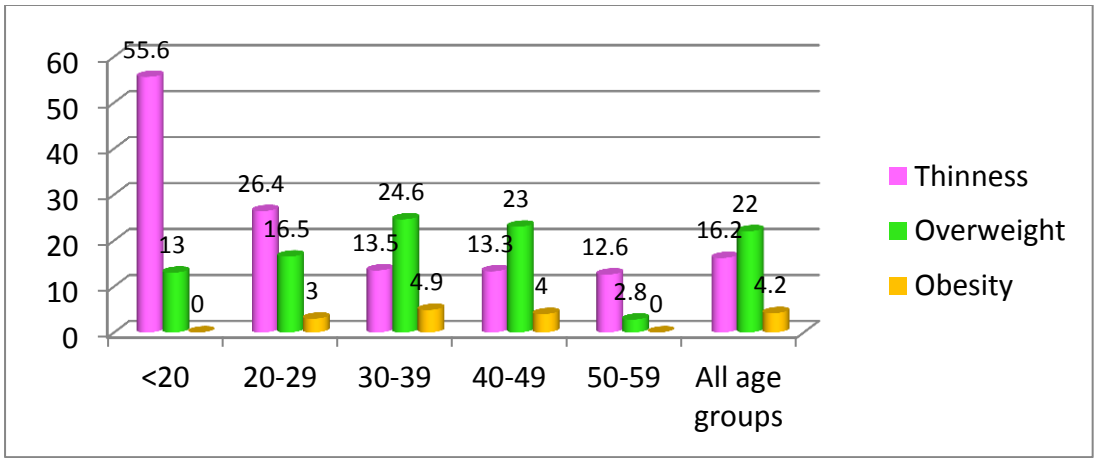
3.10. Nutritional status of men aged 18-59 years

Anthropometric measurements of a total of 3019 men in the age group 18 – 59 years who were resident in the households included in the study were carried out and their nutritional status assessed using BMI.

As shown in Figure 19, prevalence of thinness among the total group was 16.2% with the highest value (55.6%) among the less than 20 year age group. The prevalence of overweight for the total sample was 22% ranging from a low value of 13.0% in the <20 year age group to 24.6% in the age group 30-39 years. There is no consistent pattern observed in the prevalence of overweight with age.

Prevalence of obesity in the total group was 4.2% with the highest prevalence (4.9%) being observed in the 30-39 year age group.

Figure 19: Prevalence of Thinness, overweight and Obesity among men 18-59 years of age (n=3019)


60
50
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55.6
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26.4
16.5
3
13.5
24.6
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13.3
23
4
12.6
2.8
0
16.2
22
4.2
<20
20-29
30-39
40-49
50-59
All age groups
Thinness
Overweight
Obesity

CHAPTER 4

Conclusions and recommendations

4.1. Conclusions

1. The assessment of anthropometric indicators among 7306 children in the age group 6–59 months showed that 13.1% of them were stunted, 19.6% were wasted and 23.5% were underweight. Among this group of children, 15.1% were anaemic and 2.3% were severely acute malnourished (SAM). Inter district variation of SAM ranged from 0.4 to 6.1%. These findings indicate the undernutrition and anaemia continue to be problems among children in this age group in Sri Lanka.

   Compared to the reported prevalence figures in the NFSS carried out in 2009, there is a decline in the prevalence of stunting (NFSS-19.2%) and anaemia (NFSS-25.2%), an increase in the prevalence of wasting from 11.7 % in the in 2009 to 19.1% in the present study and an increase in underweight. This increase was observed in almost all the districts.

2. Prevalence of anaemia in the 6-59 month age group shows a decline from 25.2% in 2009 to 15.1% in 2012 with marked inter-district variations.

3. Association of indicators of low economic status, lower levels of occupation with a higher prevalence of under nutrition is an important observation that highlights the multi-factorial causes of under nutrition and anaemia.

   Substantial inter district variations seen is another important finding in the present study highlighting the need for more in depth assessments of the contributory factors to under nutrition at district level and planning of appropriate interventions at that level.

5. Pattern of inter district variations indicating high prevalence rates in all indicators of nutritional status and of anaemia as in some districts (e.g Kilinochchi).

6. Prevalence of low birth weight (17.9%) does not show a major change from those reported in recent studies. There is a decline in the prevalence observed with increasing levels of indictors related to economic status.

7. Among primary school children as well as adolescents, thinness is the predominant nutritional problem, seen along with overweight and obesity. Even though the prevalence rates are relatively low. However, comparison with available data shows that stunting among primary schoolchildren has shown a decline in recent years.

8. Assessment of nutritional status among non pregnant adult women show that prevalence of thinness among the group ranged from 14.9% to 36.7%, the high prevalence seen among the younger women. However, prevalence of overweight and obesity especially among the older age groups seem to be emerging nutritional problems. Among the adult males, prevalence of thinness was higher (16.2%) with the prevalence of overweight and obesity lower than among the adult females.

4.2. Recommendations

1. It is necessary to immediately address the high prevalence of wasting throughout the country as a short term programme.

2. Interventions to be implemented in the districts with high prevalence of SAM need to target all sectors in the health service with emphasis on the curative sector.

3. The study identified the multi-sectoral issues that are relevant to the problems of under nutrition and anaemia highlighting the need for a cohesive sustainable multi-sectoral programme to prevent these public health problems which continue to be of importance in Sri Lanka.

4. Marked difference between districts indicate the need to develop interventions targeted at the district level taking into consideration the relevant factors pertaining to each district.

5. Monitoring the on-going interventions aimed at prevention of under nutrition and anaemia has to be an important component of the child welfare programmes at all levels, with the focus on appropriate targeting.

6. Interventions aimed at improvement of nutritional status among other population groups, school age children, adolescents, adult men and women also needs to be considered with emphasis on multiple factors that influence nutritional status and the long term sustainability of such interventions.

7. Appropriate interventions at district level need to be planned and implemented through stakeholder participation at all levels including the poverty alleviation programmes.

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Annexes

Annex 1: Sample sizes for each target group

Population group	Age Group	Indicator	Prevalence estimate	Precision	Design Effect	Response rate	Total sample size	Total number of HH	Estimat. Number of eligible people per district	Mean HH size	Target group as % of the total Population	Samples to be taken per individual
Preschool Children	6-59 Mons	Zinc	40%	7.0%	1.5	90%	300	974	10 per cluster 30 GN areas	4.5	8.5%	Weight and height Blood 5ml
School Children	5-18 years	Thinness	30%	7.0%	1.5	90%	269	492	9 per cluster 30 GN areas	4.5	15%	Weight and height
Non-Pregnant Women	18-60 years	Thinness	20%	7.0%	1.5	90%	205	187	7 per cluster 30 GN areas	4.5	30%	Weight and height
Men	18-60 years	Thinness	20%	7.0%	1.5	90%	205	187	7 per cluster 30 GN areas	4.5	30%	Weight and height

ANNEX 2: Training of staff

1. Training of laboratory Staff:

An intensive one week training was organized to train the MLTs in the laboratory of National Institute of Nutrition, Hydrabad, India under the supervision of Dr. Longvah, head of the micronutrient laboratory. The training agenda covered the following points:

a) Collection of blood samples
b) Separation of serum
c) Transport of samples
d) Storage of samples
e) Sample preparations for analysis
f) Analysis of blood for zinc, calcium using Atomic Absorption Spectrophotometer
g) Analysis of blood for Vitamin A, D using High Performance Liquid Chromatography
h) Preparation of standards
i) Quality control measures
j) Practice in the laboratory
k) Critique of field practice

2. Training of field Staff:

An intensive 5 day training workshop was organized to train the field investigators (Team supervisors, measurers, phlebotomists, Enumerators etc.). These training workshops were focused on the conceptual clarity of the instrument, field data and blood sample collection procedures, and management of other aspects of the project. The training agenda covered the following points:

l) Purpose of the Project
m) Responsibilities
n) Interviewing techniques
o) Definition and technical aspects of different methodologies and terminologies
p) Enumeration procedures and use of interview tools
q) Explanation of the questionnaires, question by question
r) Practice using simulated interviews
s) Field practices (mock interviews)
t) Critique of field practice
u) How to handle blood samples and refusals
v) On the field quality checks
w) Questionnaire review for completeness
x) Quality Control and Quality Assurance
y) On the field quality checks
z) How to handle final data

Annex 3: Survey Questionnaire

To be used only for research purposes **Identification Number** | | | | | | |

Date of the Interview | | | | | | |

National Micronutrient Survey – Sri Lanka 2012

Executed by Ministry of Health in collaboration with UNICEF

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This survey is being conducted to know about current micronutrient deficiency status and food consumption information about household members of your area. As per result of the survey, Ministry of Health and donor agencies would like to take a decision about what sort of intervention would be necessary to help people in Sri Lanka to reduce micronutrient deficiencies.

ióCIKh wdriN lsrSug fmr

When starting the interview of the mother, make sure -

ióCIKhfha wruqk meyeos,s lroqkafkao Has the objectives of the survey been explained?	☐
wikakg hk m%YaKj, iajNdjh úia;r lf,ao Has the type of questions to be used been explained?	☐
f;dr;=rej, ryIHNdjh wdrCIdlrk nj m%;spdrlg oekajQfhao Has the respondent been informed that the data will be kept confidential?	☐
m%;spdrlf.a leue;a; ,nd .;af;ao? Has the permission of the respondent sought?	☐

Section 01

01. Area Identification (write original name and code)**:**	
A) Province ☐☐	B) District ☐☐
C) DS division ☐☐	D) 1. Urban/ 2. Rural/ 3. Estate ☐
E) Cluster(GN Division) ☐☐☐☐	F) Household No. ☐☐☐☐

02. Name of the Respondent:			
Complete Address:			
Telephone No: Home:		Mobile:	

	Interviewer (PHI)	Supervisor (SPHI/D)	Q.C.O(MRI)
Name:			**Complete 1** **Partially complete 2**
Signature/Date:			

Section 1 - Basic information

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20 úfoaY/lshd 21 fjk;a ----------

Household Characteristics			
No	Questions and filters	Response options ms<s;=rg wod, wxlh rjqï lrkak	Code
HC1	oekg mjqf,a cSj;ajk idudcsl ixLHdj Total number of members currently living in the family?	2 3 4 5 6 7 8 9 10 11 12 …	☐
HC2	Tn ksjfia fmd<j ilia lr we;af;a fudkjdhskao Type of floor of your house?	1. f.du$ueá Mud/cow dung 2. ,S Wood 3. isfuka;s Cement 4. ms.ka .fvd,a$fgrdfida Tile/Terrazzo 5. fjk;a Other	☐
HC3	Tn ksjfia jy,h ilia lr we;af;a fudkjdhskao Type of roof of your house?	1. fmd,aq w;= b,qla msoqre Cadjan/ 2. glrka $;dr ISÜ Corrugated sheet/Tar sheet 3. weianeiagia Asbestos 4. W¿ Tile 5. fldkal%SÜ Concrete 6 Tent 7. fjk;a Other …….	☐
HC4	Tn ksjfia ì;a;s ilia lr we;af;a fudkjdhskao Type of wall of your house?	1. fmd,q w;= Cadjan/ 2. ueá Mud 3. ,S Wood 4. Hard boards 5. lfndla $ .fvd,a Brick/Cabok 6. isfuka;s íf,dla .,a Cement blocks 7Tent 8. fjk;a Other……..	☐

HC5	Tn ksjfia my; i\yka lrk foaj,a ;sfnkjdo Do you have following items in your household? A. Trf,daiqjla Clock B. úoq,sn,h Electricity C. iQ¾h fldaI Solar power D. .=jka úoq,s hka;%hla Radio E. rEmjdyskS hka;%hla Television F. cx.u oqrl:khla Mobile phone G. .Dyia; oqrl;khla ^Land/CDMA phone) H. nhsisl,hla Push bicycle I. h;=re meoshla Motorcycle J. ;%sfrdao r:hla Three wheeler K. w;a g%elagrhla$g%elagrhla Tractor/ land master L. ld¾$jEka $ nia $ f,drs Car/Van/Bus/Lori M. fudag¾ fndaÜgq Motor boat N. YS; lrkh Refrigerator O uyk ueIska Sewing machine P. fros fidaok hka;%h Wasing Machine Q. mrs>Klh Computer R. wdNrk Jewellary	ksjfia we;s whs;uhkag ysñ wCIrh rjqï lrkak A B C D E F G H I J K L M N O P Q R	A. …… B. …… C. …… D. …… E. …… F. …… G. …… H. …… I. …… J. …… K. …… L. …… M. …… N. …… O. ……. P. ……. Q. ……. R. …….

Section 2 - Use of fortified food/ Food supplementation

FF1	Tn whäka fhoQ ,qKq mdúÉÑ lrkafkao Do you use iodized salt?	1. Tõ Yes 2. ke; No 9. fkdokS NK ☐
FF2	Tn ksjfia uilg fldmuK ,qKq m%udKhla mrsfNdackh lrkfkao How much salt do you use at the household per month?	lsf,da ☐
FF3	miq.sh udih ;=, Tn mjqf,a ldg fyda mrsmQrl wdydr fyda wdydr wdOdr lsisjla ,enqkdo Has the family received any Food supplementation / Aid.? during the last one month?	1. ;sfí Yes 2. ke; No **(If No, go to Section 4)** ☐
	,enqkd kï fudkjdo lsh,d úia;r lrkak mq,qjkao? Could you describe the Food supplementation /Aid Package?	
FF4.1	A. wdydr i,dlh WFP/GA General food distribution from WFP/GA	1 i;shg jrla 2 i;s follg jrla 3 uilg jrla 4 udi fol ;=klg jrla 5 l,d;=rlska 6 ke;

FF4.2	B. iuDê uqoaor Samurdhi ration	1 uilg jrla 2 udi fol ;=klg jrla 3 l,d;=rlska 4 ke;
FF4.3	C. iuDê fmdaIK u,a, Samurdhi Posanamalla	1 uilg jrla 2 udi fol ;=klg jrla 3 l,d;=rlska 4 ke;
FF4.4	D. mdi,a $fmr mdi,a osjd wdydrh School feeding/Pre-school feeding	1 i;sfha osk 5u 2 i;shg osk 2 - 3 3 i;shg jrla 4 l,d;=rlska 5 ke;
FF4.5	E. ìialÜ BP100 Biscuits BP100	1 i;shg jrla 2 i;s follg jrla 3 uilg jrla 4 udi fol ;=klg jrla 5 l,d;=rlska 6 ke;
FF4.6	F. Y%uh i|yd ,enqk wdydr wdOdr Food for work/training	1 i;shg jrla 2 i;s follg jrla 3 uilg jrla 4 udi fol ;=klg jrla 5 l,d;=rlska 6 ke;
FF4.7	G. fjk;a NGO úh,s wdydr wdOdr NGO/Community basic food aid (*dry ration equivalent to WFP*)	1 i;shg jrla 2 i;s follg jrla 3 uilg jrla 4 udi fol ;=klg jrla 5 l,d;=rlska 6 ke;
FF4.8	H. brs.= fidahd ñY%Kh (CSB) Corn Soya Blend (CSB)	1 uilg jrla 2 udi fol ;=klg jrla 3 l,d;=rlska 4 ke;
FF4.9	I. ;%sfmdaI Thriposha	1 uilg jrla 2 udi fol ;=klg jrla 3 l,d;=rlska 4 ke;

Section 3 - Children less than 5 years

Infant and Young Child Feeding

.Dy idudcsl ,hsia;=fõ we;s kï ,hsia;=fjka wjq 5g wvq orejka f.ka tla wfhl= wyUq f,i f;dard tu orejdf.a ku mjiñka my; m%YaK wikak

Breastfeeding (to be completed for all children aged 0 – 59 months)

fma, s wxlh	QUESTION	RESPONSE OPTION	CODE
IY1	fuu orejdg ^ku& g ljodl fyda uõlsrsoS ;sfnkjdo Has your child ever been breastfed?	1. Yes 2. No 9. NK	☐
IY2	fuu orejdg ^ku & g uq,skau uõlsrs oqkafka bmoS fldmuK fj,djlska miqjo When did you introduce breast milk to your first baby?	1. mehlg wvqld,hloS Less than one hour 2. oskla;=, Within one day 3. osklg jeäld,hlg miq More than one day	☐
IY3	Bfha oj,ald,fha fyda rd;%S ld,fha fuu orejdg uõlsrs oqkakdo Was your child breastfed yesterday during the day or at night?	1. Tõ Yes 2. ke; No 9. fkdokS NK	☐

Complementary feeding (to be completed for all children aged 0 – 59 months)

	Line number from BI 1:		
CF1	fuu orejdg Bfha osjd ld,fha fyda rd;%S ld,fha iQmamqjlaa iys; fnda;,hlska fudkjd fyda îug oqkakdo Did your child drink anything from a bottle with a nipple yesterday during the day or at night?	1. Tõ Yes 2. ke; No 9. fkdokS NK	☐
CF2	fuu orejdg Bfha osjd ld,fha fyda rd;%S ld,fha oshruh wdydrj,g wu;rj >K fyda w¾O >K wdydr lSjdrhla oqkakdo How many times did your child eat solid, semi-solid, or soft foods other than liquids yesterday during the day or at night?	jdr .kk 1 2 3 4 5fyda Bg jeä fkdokS 9	☐

CF3	fuu orejdg uia lEug fokjdo Do you give your child any Meat?	1.Tõ Yes 2.ke; No	☐
CF4	fuu orejdg ud¿ lEug fokjdo Do you give your child fish?	1.Tõ Yes 2.ke; No	☐
CF5	fuu orejdg ì;a;r lEug fokjdo Do you give your child eggs?	1.Tõ Yes 2.ke; No	☐
CF6	fuu orejd f;a fyda fldams fndkjdo Does (name) drink tea or coffee?	1. Tõ Yes 2. ke; **No If No go to 4.6** 9. fkdokS NK	☐
CF7	idudkHfhka fldmuK jdr .kkla f;a	1. osklg tlajrla 2. osklg fojrla	☐

	fyda fldams fndkjdo How often does (name) drink tea or coffee?	3. osklg 3ka jrla fyda Bg jeä 4. i;shlg osk fol ;=kla 5. l,d;=rlska 6. fndkafkau ke;	
CF8	orejd f;a fldams fndkafkal=uK fj,d jlo	1 m%Odk wdydr fù,a .kakd w;r 2 m%Odk wdydr fù,g miq 3 m%Odk wdydr fù,a folla w;r	

Complementary feeding (to be completed for all children aged 0 – 59 months)			
	Tfí orejdg Bfha osjd ld,fha fyda rd;%S ld,fha ksjfia oS fyda ksjiska msg; oS my; i|yka wdydr j¾. lsisjla oqkakd oehs lreKdlr mjikak **^udi 0 isg 59 olajd orejka i|yd &** Please describe anything that your child ate yesterday during the day or at night, whether at home or outside the home (Children between 0 to 59 months of age).		
	Line number from BI 1:		
CF 9	n;a, iy,a msá ksIamdok, mdka, mdkamsá ksIamdok, brs.= n;a le| fyda ;,m Bread, rice, or other foods made from grains?	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 10	jÜglald lerÜ ly n;, jeks ly meye;s t<j¿ fyda w, j¾. Carrots, squash, or sweet potatoes that are yellow or orange inside?	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 11	u[af[dlald, n;, , w,j¾., w¾;dm,a, fyda w, j¾. j,ska ieoQ wdydr yd fldia ,fo,a White potatoes, white yams, manioc, cassava, or any other foods made from roots?	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 12	;o fld, meye;s m,d j¾. Any dark green leafy vegetables such as kana kung, etc? ……	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 13	boqkq mefmd,a fyda wT Ripe mangoes or ripe papayas?	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 14	fjk;a t<j¿ fyda m<;=re Any other fruits or vegetables such as banana, grapes, apples, oranges, tomato? ……	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 15	mSl=oq yd i;aj wjhj Liver, kidney, heart or other organ meats?	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 16	l=l=,a uia Any chicken?	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 17	yrla uia W!reuia t¿uia wdoS uia j¾. Any meat, such as beef, pork, lamb, goat, or duck?	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 18	ì;a;r Eggs?	1. Tõ Yes 2. ke; No 9. fkdokS NK	

CF 19	ud¿ lrj, yd,aueiaika yd ákaud¿ Fresh or dried fish, shellfish, or seafood?	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 20	lõms uqx weg Woq mrsmamq fidahd fidahd óÜ jeks rks, wdydr j¾. Any foods made from beans, peas, lentils, or nuts?	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 21	rglcq fyda fjk;a f;,a iys; weg j¾. Any peanuts, or other nuts? ……	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 22	fmd,a fmd,alsrs Coconut	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 23	Öia fhda.Ü fyda fjk;a lsrs wdydr j¾. Cheese, curd, or other milk products?	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 24	oshr lsrs fyda lsrs msá Milk liquid /powder	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 25	f;,a fïo ng¾ fyda tajd fhoQ wdydr Any oil, fats, or butter, or foods made with any of these?	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 26	fpdl,Ü fgdmS flala ìialÜ yd meksri wdydr Any sugary foods such as chocolates, sweets, candies, pastries, cakes, or biscuits?	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 27	;%sfmdaI firs,ela iufmdaI *d¾,sia jeks in, lrk ,o wdydr Any fortified, commercially available infant and young child food" [e.g. Cerelac, thrispora]? …….	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 28	nosk ,o wdydr Any fried foods?	1. Tõ Yes 2. ke; No 9. fkdokS NK	
CF 29	fuys i|yka fkdjQ wdydrhla i|yka lf,akï th ,shkak Please write down any other foods in the box that respondent mentioned but are not in the list below.		

Child Food Frequancy

^udi 0 isg 59 olajd orejka i|yd &

Tfí orejdg miq.sh osk yf;a lSojila ksjfia oS fyda ksjiska msg; oS my; i|yka

wdydr j¾. lsisjla oqkakd oehs lreKdlr mjikak ^wOd,osk .kk rjqï lrkak ,ndoS ke;akï 0 rjqï lrkak&

Please describe any thing that your child ate during last 7 days whether at home or outside the home (Children between 0 to 59 months of age).

	wdydr j¾.h		miq.sh i;sfhaos k lShla oqkafkao
CF30	n;a, iy,a msá ksIamdok, mdka, mdkamsá ksIamdok, brs.= n;a le| fyda ;,m Bread, rice, or other foods made from grains?	0 1 2 3 4 5 6 7	☐
CF31	kQâ,aia	0 1 2 3 4 5 6 7	☐
CF32	jÜglald Pumkin that are yellow or orange inside?	0 1 2 3 4 5 6 7	☐
CF33	lerÜ Carrot	0 1 2 3 4 5 6 7	☐
CF34	ly n;, sweet potatoes that are yellow or orange inside?	0 1 2 3 4 5 6 7	☐
CF35	lxl=ka	0 1 2 3 4 5 6 7	☐
CF36	ksú;s	0 1 2 3 4 5 6 7	☐
CF37	f.dgq fld<	0 1 2 3 4 5 6 7	☐
CF38	l;=reuqrex.d	0 1 2 3 4 5 6 7	☐
CF39	fjk;a ;o fld, meye;s m,d j¾. uql=kq jekak jeks Any dark green leafy vegetables such as etc? ……	0 1 2 3 4 5 6 7	☐
CF40	boqkq mefmd,a Ripe papayas?	0 1 2 3 4 5 6 7	☐
CF41	wT Ripe mangoes	0 1 2 3 4 5 6 7	☐
CF42	meIka *DÜ Passion fruit	0 1 2 3 4 5 6 7	☐
CF43	mSl=oq Liver?	0 1 2 3 4 5 6 7	☐
CF44	l=l=,a uia Any chicken?	0 1 2 3 4 5 6 7	☐
CF45	yrla uia W!reuia t¿uia wdoS uia j¾. Any meat, such as beef, pork, lamb, goat, or duck?	0 1 2 3 4 5 6 7	☐
CF46	ì;a;r ly uoh iu. Eggs?	0 1 2 3 4 5 6 7	☐
CF47	l=vd ud¿	0 1 2 3 4 5 6 7	☐
CF48	ud¿ lrj, yd,aueiaika yd ákaud¿ Fresh or dried fish, shellfish, or seafood?	0 1 2 3 4 5 6 7	☐
CF49	lõms uqx weg Woq mrsmamq fidahd fidahd óÜ jeks rks, wdydr j¾. Any foods made from beans, peas, lentils, or nuts?	0 1 2 3 4 5 6 7	☐
CF50	rglcq fyda fjk;a f;,a iys; weg j¾.	0 1 2 3 4 5 6 7	☐

	Any peanuts, or other nuts? ……		
CF51	fmd,a fmd,alsrs Coconut	0 1 2 3 4 5 6 7	
CF52	oshr lsrs fyda lsrs msá Milk (liquid or powdered)	0 1 2 3 4 5 6 7	
CF53	ng¾ butter	0 1 2 3 4 5 6 7	
CF54	ud.rSka	0 1 2 3 4 5 6 7	
CF55	fmd,a f;,a, t<j¿ f;,a, fïo fyda tajd fhoQ wdydr Any oil, fats, or foods made with any of these?	0 1 2 3 4 5 6 7	
CF56	fudar f;,a Cod liver oil	0 1 2 3 4 5 6 7	
CF57	;%sfmdaI firs,ela iufmdaI *d¾,sia jeks in, lrk ,o wdydr Any fortified, commercially available infant and young child food" [e.g. Cerelac, thrispora]? ……	0 1 2 3 4 5 6 7	
CF58	nosk ,o wdydr Any fried foods?	0 1 2 3 4 5 6 7	
CF59	ñrsia ;=kmy fhoQ wdydr	0 1 2 3 4 5 6 7	

Health

H1	myq.sh iqudk fol we;=,; ^ku&…..g *mdpkh je,oqkdo* mdpkh hkq osklg ;=kajdrhlg jvd nqre,g fyda oshruh jYfhka fyda reêrh iu. u,my msgùuhs Has (*NAME*) had diarrhoea in the last two weeks, that is, since (*DAY OF THE WEEK*) of the week before last? Diarrhoea is determined as perceived by mother or caretaker, or as three or more loose or watery stools per day, or blood in stool.	1. Tõ Yes 2. ke; No 9. fkdokS NK	
H2	myq.sh iqudk fol we;=,; ^ku&…..g *leiai iu. hïlsis frda.hla je,oqkdo* Has (*NAME*) had an illness with a cough at any time in the last two weeks, that is, since (*DAY OF THE WEEK*) of the week before last?	1. Tõ Yes 2. ke; No 9. fkdokS NK	
H3	myq.sh iqudk fol we;=,; ^ku&…..g *Wk je,oqkdo* In the last two weeks, including today, has (name) had a fever?	1. Tõ Yes 2. ke; No 9. fkdokS NK	

Vitamin A and Micronutrient Supplementation			
MS1	^ku& g ljod fyda fï jdf.a lr,la ta lshkafka úgñka tA wêud;%dj ,eì,;sfhkjo Has (*name*) ever received a vitamin A capsule (supplement) like this one? **(If No, go to H10)**	1. Tõ Yes 2. ke; No	
MS2	if yes, udi 6 oS Check with the CHDR	1. Tõ Yes 2. ke; No 8.wod, ke; NA 9. fkdokS DK	
MS3	udi 12 oS at 12 month	1. Tõ Yes 2. ke; No 8.wod, ke; NA 9. fkdokS DK	
MS4	udi 18 oS at 18 month	1. Tõ Yes 2. ke; No 8.wod, ke; NA 9. fkdokS DK	
MS5	udi 24 oS at 24 month	1. Tõ Yes 2. ke; No 8.wod, ke; NA 9. fkdokS DK	
MS6	udi 36 oS at 36 month	1. Tõ Yes 2. ke; No 8.wod, ke; NA 9. fkdokS DK	
MS7	udi 48 oS at 48 month	1. Tõ Yes 2. ke; No 8.wod, ke; NA 9. fkdokS DK	
MS8	udi 60 oS at 60 month	1. Tõ Yes 2. ke; No 8.wod, ke; NA 9. fkdokS DK	
MS9	Tfí orejdg CIø fmdaIl mõv¾ ,eî we;ao ^ CIø fmdaIl mõv¾ melÜ tl fmkajd úuikak&	1. Tõ Yes 2. ke; No 9. fkdokS NK	
MS10	,enqfkakï jhi lSfha oSo	1 udi 6 - 12 w;r 2 udi 13 - 18 w;r 3 udi 19 - 24 w;r	
MS11	orejdg tu CIø fmdaIl mõv¾ ,nd oqkafka flfiao	1 oskm;d 2 ojila yer ojila 3 i;shg jrla 4 boysg 5 ke;	

Use of micronutrient supplementations			
MS12	Tfí orejdg úgñka fm;s lr,a fyda isrma lsisjla,nd fokjdo Do you give any multivitamin syrup or tablets or capsules to the child?	1. Tõ Yes 2. ke; No **if no skip to WT1**	
MS13	,nd fokafkakï tajdfha we;s CIqø fmdaIl fudkjdo ^weiqreu mrSCIdlr n,kak& If yes, What are the micronutrients in the supplementation.(show the tablets/bottle to the interviewer)	1.Vit. A 2.Iron 3.Zin 4.Calcium 5. Folate 6.Others	**1** **2** **3** **4** **5** **6**
MS14	fïjd ,nd oSug fya;=j Reason to give it	1. ffjoH kshufhka Prescribed by a doctor 2. idhkfhka ,nd fok ,os Given at the clinic 3. ;uka úiskau Giving on own 4. Other (specify).	

MS14 Tfí orejdg ;%sfmdaI ,enqfkao

1. Tõ Yes
2. ke; No

MS15 melÜ 1 2 3 4

;%sfmdaI ,enqfka kï jrlg ,enqk m%udKh

MS16 **udi**

uq,skau ;%sfmdaI ,enqfka jhi lSfhaoSo

MS17 **jdr**

fï olajd lS j;djla ;%sfmdaI ,eî we;ao

MS18 **osk**

;%sfmdaI melÜ tlla orejdg osk lShla ,nd fokjdo

MS19 **1 Tõ 2 ke;**

fuu ;%sfmdaI wfkl=;a orejka yd fnod .kakjdo

Worm Treatment			
WT1	miq.sh udi 6 ;=, orejdg mkq m%;sldr ,nd oS we;ao Did the child take worm treatment during past 6 month?	1. Tõ Yes 2. ke; No 9. fkdokS NK	

Anthropometric measurements of children under 5 years			
No.	Questions and filters	Response options	
	Line number from the HH list:		
AM1	Date of measurment	dd/mm/yyyy	

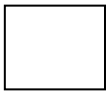
AM2	Date of birth of the Child	dd/mm/yyyy	
AM3	Gender	1= Male 2= Female	
AM4	Birth weight -	Kg	
AM5	Type of measurement	1= Length 2= Height	
AM6	Child's height/Length	In cm	
AM7	Child's weight	In kg	
AM8	Odema	1 = present 2=absent	

Instrument Number	Team Number	
Height Board / Rod**:**	Editor/Coder**:**	Name: ……
Electronic Seca Scale**:**	Entrier**:**	Name: ……
	Checker**:**	Name: ……

Biochemical measurements of children under 5 years			
No.	Questions and filters	Response options	
	Line number from the HH list:		
BM1	Hb		
BM2	Vitamin A		
BM3	Zinc		
BM4	Calcium		
BM 5	C reactive protein		
BM 6	Ferritin		
BM 7	Haemoglobinopathy		

BM 7
Status of blood collection

1 Collected Enough
2 Collected insuficint
3 Couldn't collect
4 Refused
5 Absent



ANNEX 4: Collection, labeling, transfer, storage of blood samples

Children:
From all children 6-59 months of age, 5 ml of blood was drawn using disposable syringe and needles. The 5 ml of blood was distributed among the two gel tubes as follows: 1 ml of blood to the tube containing a separator gel (red top) and was free from metals, 2 ml for analysis of serum retinol, ferritin, C –reactive protein and serum calcium and 2 ml to a vacutainer containing EDTA (green top) to be used for the assessment of haemoglobin and haemoglobinopathies.

The blood collected in the gel tubes were centrifuged in the field lab site. C - reactive protein was analysed in the field using kits. The serum was aliquoted into appropriately labelled appendorff. The EDTA and appendorffs were labelled with appropriate subjects' ID numbers and stored at -20^{o}C until transported to the MRI lab for further processing and analysis of serum zinc, retinol, and ferritin. The packed blood cells remaining in the EDTA after centrifugation was stored at **-20^{o} C** when the Hb is below 11g/dl until analysed for haemoglobinopathies.

A. Transportation of blood from household to temporary field lab:
Immediately after collection, the blood samples were transported in cool boxes containing frozen gel packs (<8 ^{o}C) to the field lab site by the laboratory technician.

In each cluster, a temporary field lab will be set up in a central site such as a school, pharmacy, health centre or other location for the technologist to immediately centrifuge the samples brought in from the field and aliquot the serum into appropriate cryovials. All samples were processed within <2 hours of collection.

B. Analysis of the blood samples

Iron status was assed using haemoglobin and serum ferritin that reflect different stages of iron deficiency using the Enzyme-Linked Immunosorbent Assay (ELISA) technique. C- reactive protein (CRP) was done to identify the presence of infection because ferritin is elevated when there is an infection. Therefore, subjects who have high CRP, the cut-off level was taken at 30ug/dl as indicated by the World Health Organization recommendations.

Vitamin A
Serum retinol was also assessed using the high-performance liquid chromatography (HPLC) technique. Serum retinol is the recommended biomarker by the World Health Organization as a valid measure of vitamin A status within a population. Circulating serum retinol is reduced in the presence of inflammation and as a consequence results in an overestimation of the prevalence of vitamin A deficiency. Therefore according to the WHO, subjects who are found to have an elevated acute phase protein should be excluded from the analysis.

Zinc was measured by serum zinc, which is the recommended biomarker to estimate zinc prevalence in populations. Seasonal variation, age and sex influence serum Zn concentrations. All samples were measured using atomic absorption spectrophotometry (AAS) (IZiNCG, 2004). Low and high values of samples was measured in duplicate and an internal control sample was analysed with each batch of samples.

Additional indicators
Anaemia was assessed by measuring haemoglobin protein in red blood cells, using a HICN method.

Infection
Acute Phase Proteins:C-reactive protein was measured to control for inflammation when interpreting biomarkers. These measures were assessed using the Enzyme Linked Immunosorbent Assay (ELISA) technique (21).

ANNEX 5: Operational Procedures

The following is a general description of opretional procedures of activities.

i. Development of Study operating Protocol:

The Principle Investigator at Medical Research Institute (MRI) was responsible for preparation of detailed study operational protocol in the study. The protocol was based on comments provided by Consultants Prof. Dulitha Fernando, Emeritus Professor, members of the Nutrition steering committee, Ministry of health and Dr. Moazzem Hossain, Chief health and nutrition, UNICEF. Final protocol was shared with the members of the MCN sub Committee for their comments.

ii. Development of Instruments:

Principle Investigator was responsible to develop the data collection instruments with the steering committee members. The instruments was provided to the Consultant for comments and clarifications and it was the responsibility of MRI to take all comments suggestions into consideration and respond to prepare the final questionnaire.

iii. Liaisons with Health officials:

Principle Investigator was responsible for making liaison and building rapport with the district health officials (PDHS, RDHS, MOHs, PHIs, and PHMs). This action was taken with the aim of smooth conducting of the study activities at field level.

Iv. Data Collection, Monitoring and Validation:

The data was collected by trained interviewers at field level and at house hold level; Children, women and Men was screened and selected at household level. The whole activity of the data collection was supervised and monitored by the survey coordinator (nutrition assistant) and Public Health Inspectors (PHI) of the Nutrition Department who have more than 5 years experience in participating national surveys to supervise this task. Measurers and doctors or nurses was with the data collectors all the time and was performed all anthropometric measurements and collection of blood samples. Survey coordinator performed the overall supervision of the data collection and measurements. All data collectors and team leaders attend the morning meeting being conducted by the survey coordinator, they then went to the field to collect and enumerate the data. 8 teams were operated and one team was supervised by one team leader. After completing their work each day, team leader checked their work and submitted it to survey coordinator. Enumerator checked the entire filled questionnaire for completeness.

v. Monitoring:

Supervisor will have to re-check a random sample of 5% of the total filled questionnaires on daily basis. If any errors and inconsistencies are identified the forms will be given back to the data collectors for correction from the field. Effective supervision and monitoring is a key to the success of any study. This study will be regularly monitored. Overall project monitoring will be conducted by survey. Moreover, regular monitoring visits conducted by the survey consultants and principal investigator. Monitoring on all aspects of project field activities will be done by the team on the standardized monitoring and quality assurance tools and duly recorded.

vi. Data management, transfer and analysis:

Data cleaning: Prior to data entry, all forms will be checked for completeness and consistency as well as coding of open- ended responses and area codes, etc. In case of inconsistency or missing responses, the editors will flag the errors/omissions and consult the interviewers for possible explanations.

Hard copies of the questionnaires will be transferred to the Data Management Unit (DMU) at Nutrition Department, MRI, Colombo. All the collected forms will be archived in Box files after allocation of unique ID. EPIINFO program will be used for data entry with inbuilt checks. Data will be further cleaned by data entry manager (Development Assistant) who is the permanent staff in the Nutrition unit..

For data entry, databases and entry screens will be developed using EPI6. The entry screens will employ range and consistency checks and skips to minimize entry of erroneous data. Special arrangements will be made to enforce referential integrity of the database so that all data tables are related to each other without problem. Data will be double

entered to check the data entry errors. For data analysis SPSS version 15, and Anthro 2006 will be used and data will be analyzed using univariate and multivariate methods.

All administrative, logistics and finances will be handled by the two Development Assistants. Report will be written by the Local Consultant in collaboration with 2 foreign Consultants. The final report will be shared with the concerned stakeholders of this study and a dissemination programme with key stake holders (Members of National Nutrition Steering Committee) will also be arranged in light of the availability and appropriate timings and the feedback and appropriate suggestions will be incorporated.