CHALLENGES WITH NUTRITION OF SCHOOLCHILDREN

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BACKGROUND

Sri Lanka is an island situated in the Indian Ocean with the Bay of Bengal to its north and east and the Arabian Sea to its west. The total land area of the country is 65,610 sq. km. including inland water. Sri Lanka is divided into nine provinces and 25 administrative districts. The total population of the country was 18.7 million estimated after the Census of Population and Housing 2001.

In 1997 the government enacted regulations to ensure compulsory education for all children of 5-14 years. The Population Division of the Ministry of Health estimates that 17.9% of the population are of compulsory school-going age 5-14 (3.4 million) and only 3% are not attending schools, while 24.6% of the population would be in the age span 5-18 (4.6 million). Still the dropout rate is around 5 –10%. There is no sex difference on school enrolment (male: female ratio – 1.03:1.0).

There are over 10 000 government schools island-wide and 4 functional types of schools within this system, i.e. Type 1AB – Schools with classes up to Grade 13 including GCE A/L Science, Arts and Commerce stream, Type 1c – Schools with classes up to Grade 13 with GCE A/L Arts and Commerce stream, Type 2 – Schools with classes up to Grade 8 (or up to Grade 11) and Type 3 – Schools with classes up to Grade 5 (or up to Grade 8). In addition to these schools there are national schools which are generally more resourceful and prestigious and located mainly in the urban areas (Ministry of Education, 1998).

There are more children of school age, and more children going to school than ever before. Ill health and nutrition compromise both the quality of life of school-age children and the potential to benefit fully from what might be the only education they receive and ultimately to the whole nation (ACC/SCN 1998).

The Ministry of Health, Sri Lanka first started school health programme in 1918. The Medical Officer of Health is the key person responsible for the school health programme at district level. At present, the following major components are included in the total health care package to school children: Medical examination of children, treatment of minor ailments, antihelminthic treatment, immunisation, school dental services, referral to medical institutions and follow-up, School Environment, School Health Education and Promotion, School Community Participation.

Poor nutrition in schoolchildren seriously compromises their health and learning capacity. It creates a disastrous trend towards damaging dietary patterns, which affect the prevalence of disease in adults. However, the current radical changes in lifestyle among both poor and better-off population, means that personal preference about foods, fashion, physical activity levels and the media are now diving the nutritional patterns of schoolchildren more than the availability of food itself. Addressing the nutrition of schoolchildren probably helps at preventing adult diseases (SCN 1998). Schoolchildren can be used as messengers to promote good health within their families and communities. The infrastructure of the

school system provides an opportunity for health services to reach children in a cost-efficient way.

Aims of this study were to assess the pattern of the growth and the prevalence of under nutrition, over nutrition of schoolchildren at district level.

METHODS

This was a cross sectional study. It was carried out in 12 out of 25 districts in Sri Lanka, i.e. Anuradhapura, Polonnaruwa, Badulla, Moneragala, Colombo, Hambantota, Kurunagala, Vavuniya, Ampara, Kalutara, NuwaraEliya and Rathnapura to cover minimum of one district from each province. The study population was identified as schoolchildren aged 5-14 years.

The required sample size for each district was calculated on the basis of the prevalence of underweight among children under 5 years was 30% with the 95% of confidence interval and 5% of error. The sample size was 800 children from each district giving a total sample size of 9600 for all 12 districts.

A multi-stage stratified sampling technique was used to identify the sample. It was decided to study 12 schools from each district. During the first stage the number of schools from each sector (urban/rural) was identified proportionate to the population in the urban and rural areas in each district. During the second stage the schools were selected from a list of all schools in Sri Lanka that was provided by the Department of

Education. The required number of schools were identified using population proportion to sampling technique. In the third stage, types of schools were considered. During the fourth stage of sampling, all classes of grade 1, 4 and 7 were listed out and one class from each grade was randomly selected from each school. Grade 1,4 and 7 was selected to study by considering the school health programme in the country which is mainly carried out in these grades. All children in each selected class were included in the assessment of nutritional status.

Three teams each comprising of 3 field investigators was responsible for data collection. Fieldwork was carried out district by district. All selected schools were informed about the study. The schools were informed the date of the visit. The consent forms were distributed to all children in the selected classes prior to the study with a letter from the investigator forwarded through the class teacher.

Collection of data

The following information was obtained:

1. Basic information: birthday and sex and other identifying information
2. Measurement of height and weight

All children in selected classes who had obtained the consent of their parents and were present on the day of the study were identified as participants. A structured format was developed to obtain identification data, age and sex of children in the selected classes. The information was

obtained from the attendance register and marked on the format by a member of the study team.

Measurement for height and weight

Heights and weights of all children in selected classes were measured. Measurements were taken by the trained field investigators. Height was recorded to the nearest centimetres by using an anthropometric rod. The children were weighted with the use of an electronic balance to the nearest 0.5g after removing shoes and socks. Instruments were checked daily by using a standard weight. The observer variation was assessed by taking duplicate measurements of 10% of sub sample representing all districts, by one specially trained investigator.

All fieldwork was completed during, November 2001 - June 2002. The data entry and analysis was carried out using the EPI/INFO package. Analysis of anthropometrics was done compared with NCHS/WHO reference standards using the ANTHRO Software of the Centres for Disease Control, Atlanta, USA. The data were processed using the Statistical Package for Social Sciences (SPSS) was used for further analysis.

Ethical clearance was obtained from the ethical committee of the Medical Research Institute and permission obtained from the relevant educational and health authorities.

Indices used

When weight and height of the study subjects were compared with the NCHS/WHO weight for height for age reference table, the age of the child was above 10years, 81.0% of records were flagged. Therefore weight for height was used as the indicator to assess wasting and overweight up to 10 years of age and BMI-for-age (NHANES1/WHO 1995) was used as the indicator to assess thinness and overweight from 10 years of age.

Children were considered wasted and stunted if their Z scores were less than -2SD of the NCHS/WHO median for weight for height and height-for-age respectively. If their Z scores were more than +2SD and + 3SD of the NCHS/WHO median for weight for height it was considered as overweight and obesity respectively. Cut-off points proposed by WHO (1995) for BMI-for-age table to assess thinness (less than 5th percentile) and overweight (at or above the 85th percentile) was applied.

RESULTS

During the study 9659 children participated the study, which was more than the targeted sample size of 9600. This increase was due to the fact that all children in a selected class were included in the study.

In the study 48.9% of were males and 51.1% were females. Two age groups were identified and classified into groups, primary school children (5-9.9 years) and adolescents (10-14.9 years). Number of children in each age group was 5637 (62.0%) and 3455 (38.0%) respectively.

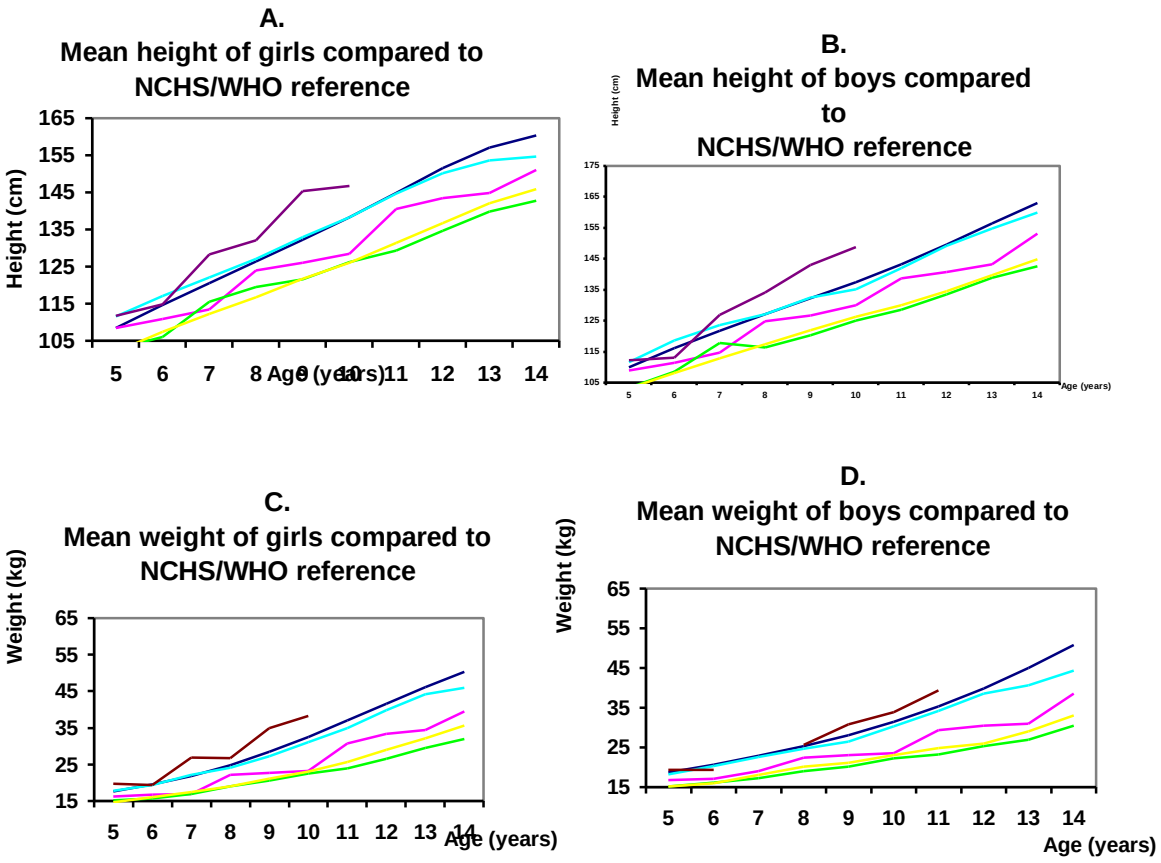
Results of the study will be presented as follows:

- Mean weight and height of children
- Prevalence of wasting/thinness
- Prevalence of stunting
- Prevalence of overweight and obesity

Mean weight and height

Figure 1 shows that, on average, the weights and heights of school children of 5-9 years were close to the international/WHO-NCHS growth standard, whereas those of above 9 years were far below the international standard. There is a trend towards improving physical stature of the schoolchildren born in later years. Growths of the boys were better than girls.

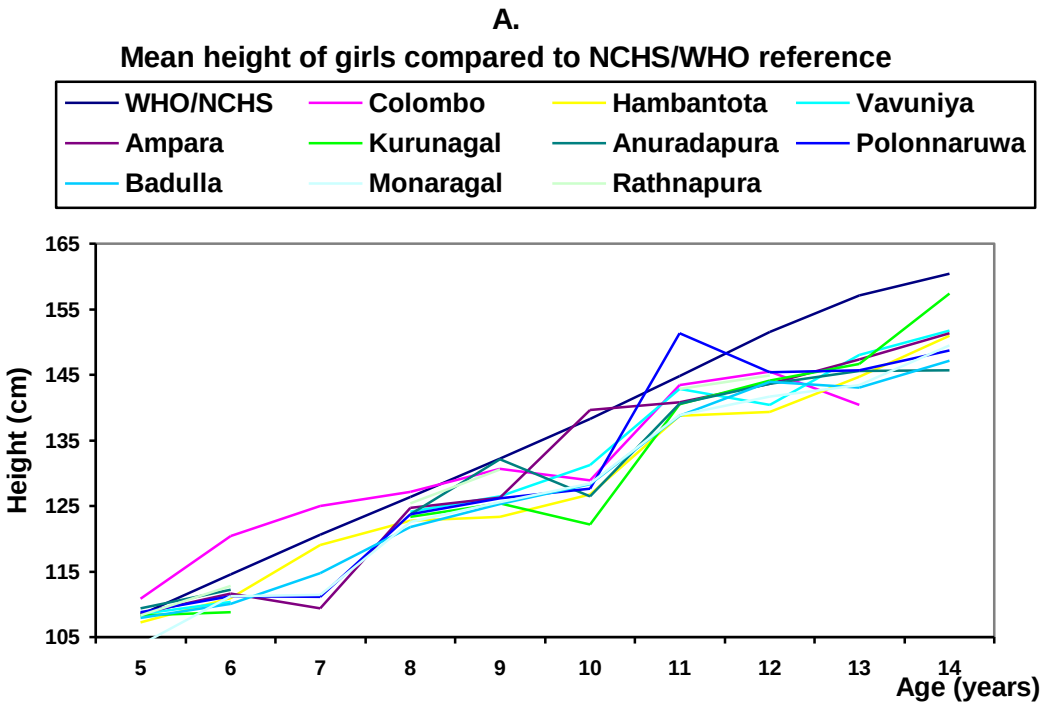
Figure 1
Mean height of girls (A) and boys (B), and mean weight of girls (C) and boys (D), compared with WHO reference and study values



There are inter-district variations in mean heights and weights of girls and boys when comparisons are made with NCHS/WHO reference.

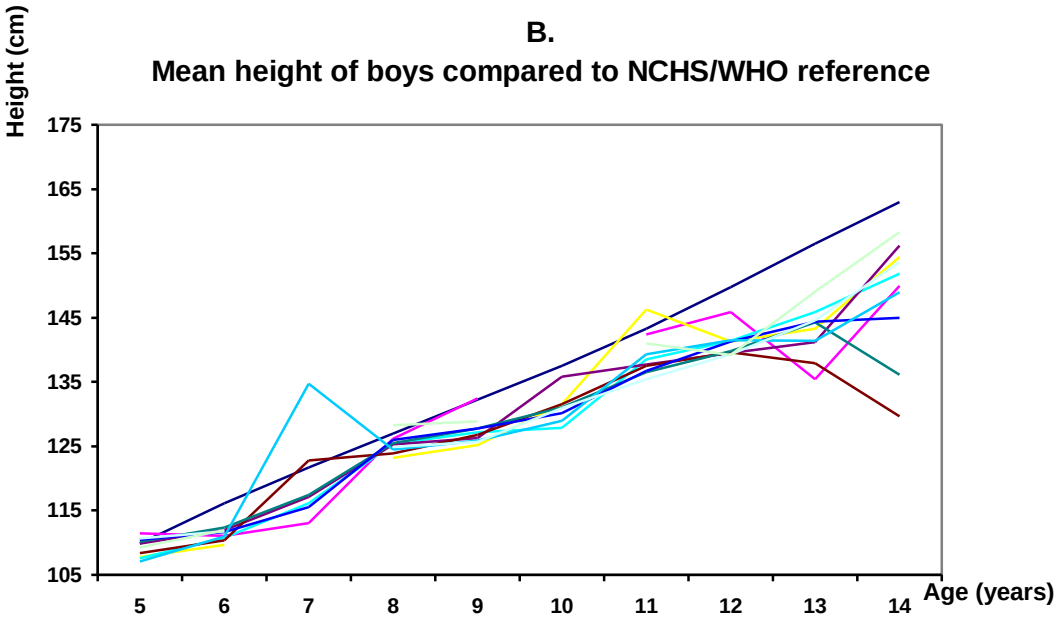
Colombo district data indicates: children were on average taller and heavier than those from other districts (Figure 2). This observation was true for both boys and girls and for all ages. Comparison with the NCHS median showed the Colombo district children to be taller than the NCHS population till age 8 years for girls and age 5 years for boys. Thereafter the curve diverged, the NCHS population being taller. Mean weight of Colombo district girls' starts above the NCHS median at 5 years then go on the NCHS median till 8 years and go down after that. The mean weight of the Colombo district boys were below the NCHS median till the age of 8 years and go with the reference till 10 years and divulged down after that. Nicholls study of a representative sample in Colombo urban well to do sample carried out 50 years earlier shows a similar growth pattern.

Figure 2
Mean height of girls (A) and boys (B), and mean weight of boys (C) and girls (D), compared with WHO reference and district study values



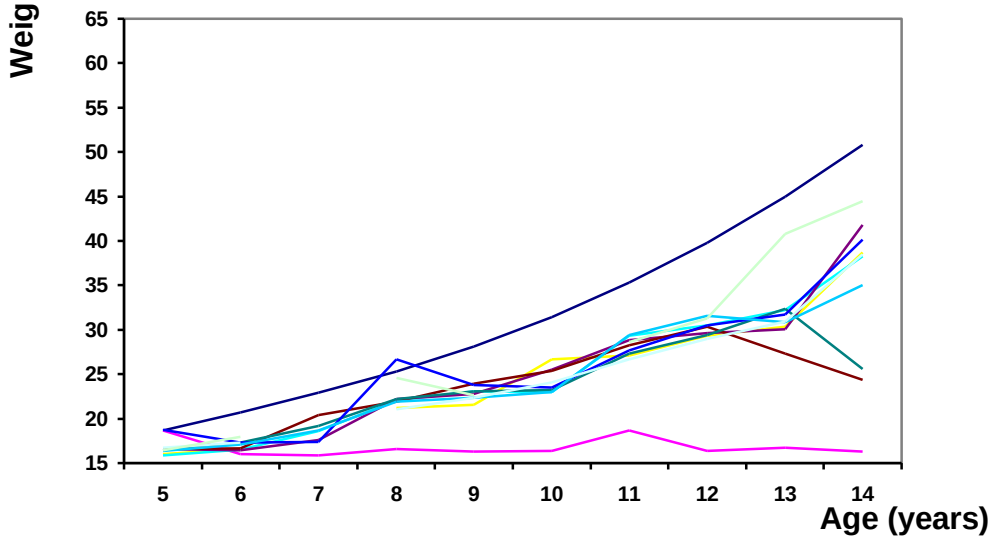
B.

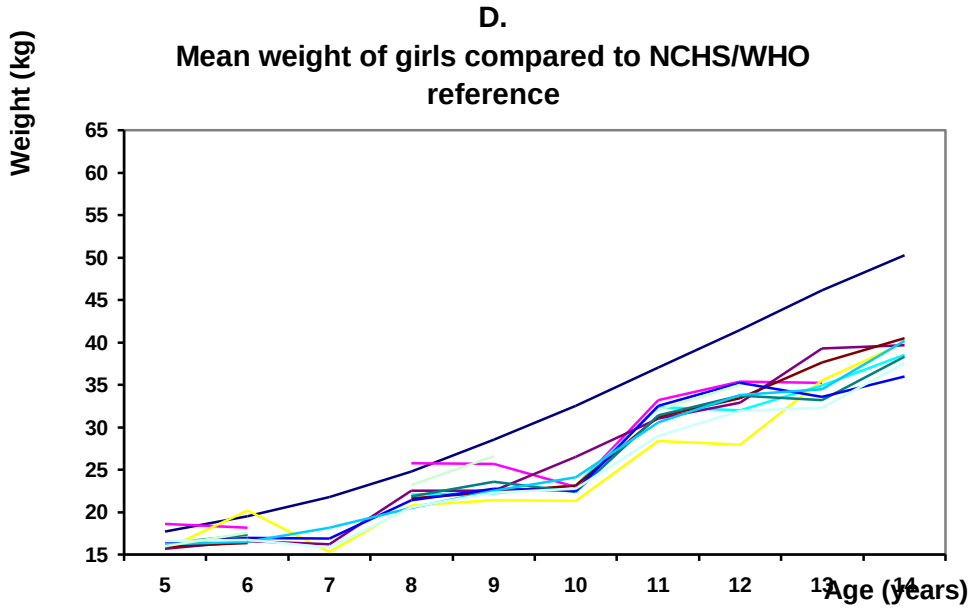
Mean height of boys compared to NCHS/WHO reference



C.

Mean weight of boys compared to NCHS/WHO reference





In Hambantota and Monaragala districts the mean heights and weights of children are below the NCHS standard compared to the other districts. Vavuniya district children are far below the NCHS median. The girls in Vavunya district are heavier and taller than boys.

Prevalence of under nutrition

The prevalence of under nutrition was assessed on the stunting and wasting among primary school children (5-9.9 years) and thinness among adolescents (10-14 years). Children were considered wasted and stunted if their Z scores were less than -2SD of the NCHS/WHO median for weight for height and height-for-age respectively. Cut-off points proposed by

WHO (1995) for BMI-for-age table to assess thinness (less than 5th percentile) was applied to assess under nutrition among adolescents.

Stunting which is indicative of previous or long standing undernutrition, affected 17% of the primary school children. Boys appeared to be at greater risk of suffering from undernutrition than girls (Table 1).

Table 1

Prevalence of under nutrition in school children by sex

	5-9.9 years			10-14.9 years	
Sex	**Sample size**	**Stunting**	**Wasting**	**Sample size**	**Thinness**
Male	2754	539	458	1158	687
		19.6%	16.6%		59.3%
Female	2792	405	366	1801	658
		14.5%	13.1%		36.5%
Total	**5546**	**944**	**824**	**2595**	**1345**
		17.0%	**14.9%**		**45.5%**

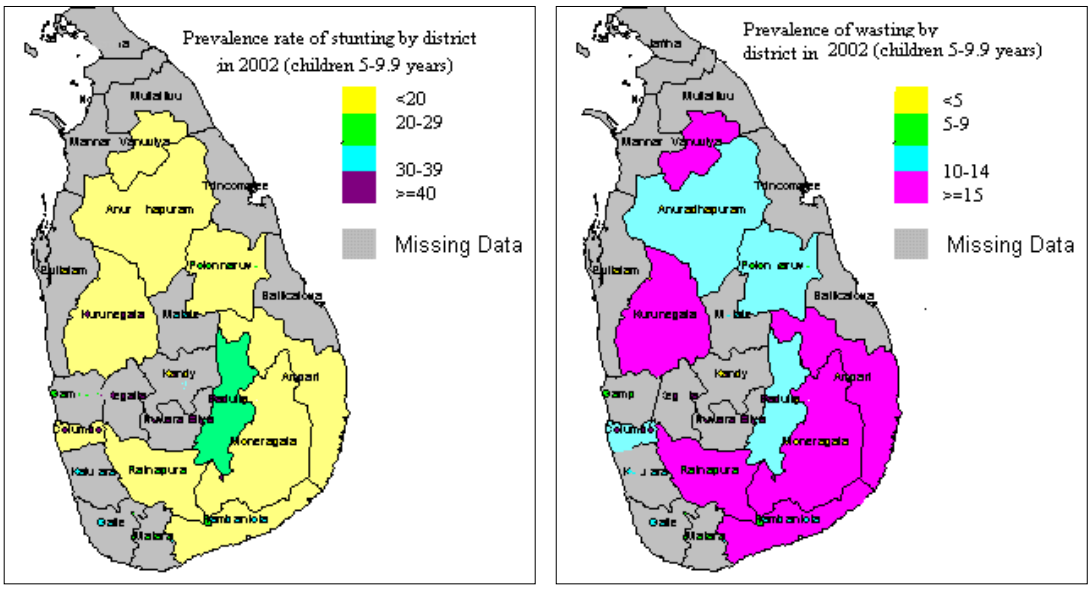
Prevalence of wasting which is indicative of acute under nutrition is 14.9% and more prevalent in boys than girls.

Undernutrition was more prevalent among adolescents than primary schoolchildren and more than half of boys were thin.

Prevalence of wasting and stunting was graded according to WHO classification (WHO Global Database) to assess the severity of the problem as follows: wasting (<5% - low, 5-9% - moderate, 10-14% - high and >=15 – very high) and stunting (<20% - low, 20-29% - moderate, 30-39% - high and >=40 – very high). In general, the severity of prevalence of

wasting and stunting was compared by districts and geographical distribution was illustrated in the Figure 3 and 4.

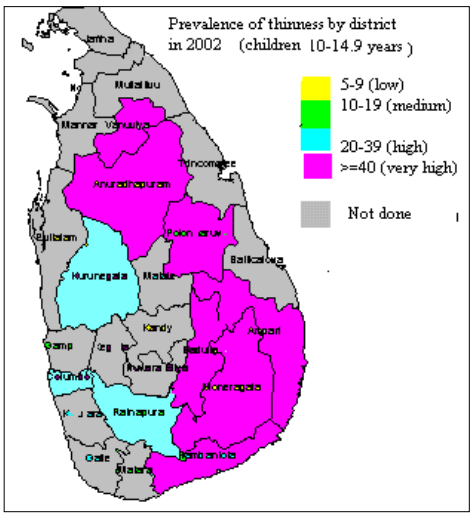
Figure 3 and 4
Prevalence of stunting and wasting among schoolchildren aged 5-9.9 years by district, 2002



The highest prevalence of stunting was reported in this study was in Badulla district which has 'moderate' degree of stunting. All other districts surveyed have mild degree of stunting. Figure 4 shows the wasting prevalence in the surveyed districts.

A 'very high' grade of wasting was found in Kurunagala, Monaragala, Vavuniya, Ampara, Rathnapura and Hambantota districts according to the population prevalence. All the other districts, which were studied, also have a high degree of wasting.

Figure 5
Prevalence of thinness among schoolchildren aged 10-14.9 years by district, 2002



The proportion of the population with thinness was classified by WHO (1995) was used to classify the severity of the thinness as low (5-9%), medium (10-19%), high (20-39%) and very high (>=40%) prevalence. Prevalence of the thinness was calculated among adolescents and the geographical distribution by districts is shown in Figure 5.

Hambantota district has shown a 'very high' level of thinness and all the other districts studied have indicated high level. It is interesting to note that this observation is comparable with the pattern observed among primary school children except in Monaragala and Kurunagala districts. In these districts there is an improvement from very high level to high level from primary school to adolescents. This finding could be due to the possibility of children 'catching up' in their growth, as they become older.

Prevalence of over nutrition

Primary school children whose Wt/Ht is >2SD in the NCHS/WHO reference and the adolescents whose BMI>=85th percentile in WHO 1995 reference, were classified as overweight children. The prevalence of overweight was considered in two broad age groups , i.e. 5-9.9 years and 10-14.9 years and the prevalence had increased in 1% in 10-14.9 years group compared to the 5-9.9 years group.

The prevalence of overweight among males was higher than females in 5-9.9 years aged group but the prevalence among females in the adolescents group was more than males. This pattern was consistantly shown in all 10 districts. When the prevalence of overweight is compared with the prevalence of wasting and thinness among the same group of children the prevalence of overweight is negligible.

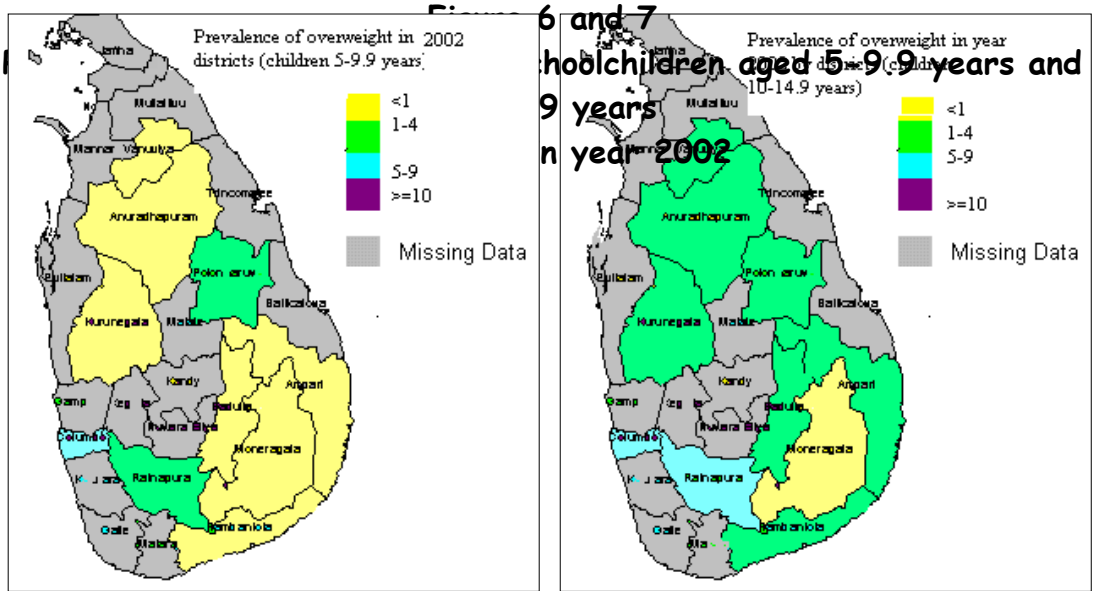
Table 2

Prevalence of over nutrition in school children by sex

	5-9.9 years		10-14.9 years	
Sex	**Sample size**	**Over weight**	**Sample size**	**Over weight**
Male	2754	33	1158	22
		1.2%		1.9
Female	2792	23	1801	43
		.8%		2.4
Total	**5546**	**56**	**2959**	**65**
		1.0%		**2.2**

The proportion of the school children with overweight was classified by taking arbitrary cut-off points to reflect the severity of the problem among children as follows: <1% - very low, 1-4% -low, 5-9% - medium and >=10% - high prevalence and geographical distribution is shown in Figure 6 and 7.

Figure 6 and 7
Prevalence of overweight in schoolchildren aged 5-9.9 years and 10-14.9 years in year 2002



In this study it was found that there is 'very low' and 'low' prevalence of over weight among primary schoolchildren in all the districts studied except in Colombo district. Colombo district has a medium level of overweight prevalence among adolescents' children and it showed a medium prevalence with primary schoolchildren also as shown in Figure 7. Even in other districts there is an increasing trend from 'very low' to 'low' prevalence. Rathnapura districts also shows the prevalence of overnutrition among adolescents to be 'medium'.

3. ANAEMIA

Anaemia was assessed by measuring haemoglobin levels of school children. Total number of children tested for anaemia was 1701 and 965 from primary school children and adolescents respectively. Age dependent haemoglobin levels were taken to detect anaemia by adjusting the altitude.

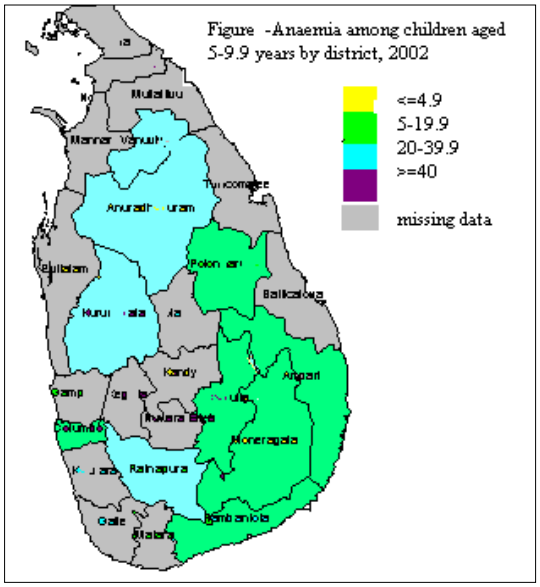
Table 5

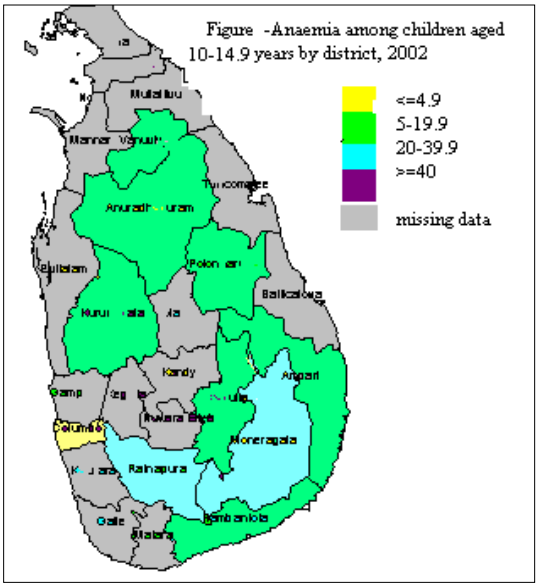
Prevalence of anaemia in school children by sex

	5-9.9 years		10-14.9 years	
Sex	**Sample size**	**Anaemia**	**Sample size**	**Anaemia**
Male	841	16.1%	472	13.6%
Female	860	18.1%	493	14.2%
Total	**1701**	**16.3**	**965**	**13.9**

Table 5 shows that the primary schoolchildren had high prevalence of anaemia (16.3%) than adolescents (13.9%). Girls are more affected than boys. The proportion of the school children with anaemia was classified by taking WHO cut-off points to reflect the distribution of anaemia among children as shown in Figure 8 and 9 (low, medium, high and very high prevalence).

Figure 8 and 9
Prevalence of anaemia among schoolchildren aged 5-9.9 years and 10-14.9 years by district in year 2002





Very high levels of anaemia were not seen in any district. A high degree of anaemia has been shown in Anuradhpura, Vavuniya, Rathnapura and Kurunagala districts. When it comes to the adolescent group Colombo district has a low level of anaemia and other districts have a medium level of anaemia prevalence except in Monaragala and Rathnapura districts.

4. VITAMIN A DEFICIENCY (VAD)

The clinical signs of VAD include night blindness, Bitot's spots, corneal xerosis and corneal scars or ulcers. The prevalence of clinical deficiency is estimated by combining night blindness and eye changes, primarily Bitot's spot to form a "total Xerophthalmia" prevalence (United Nation 2001).

Table 3

Prevalence of Vitamin A deficiency in school children by sex

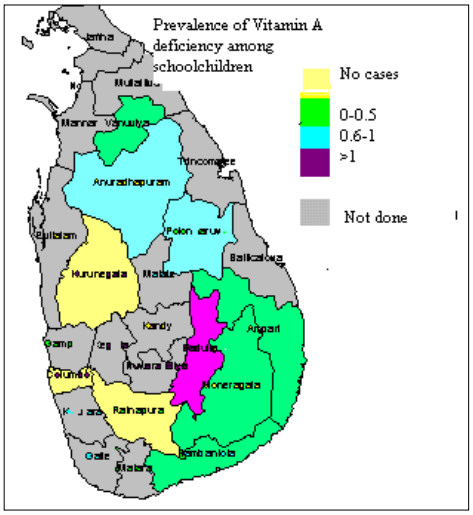
Sex	Sample size	Bitot's spot	
		1	2
Male	4616	22	4594
		.5%	99.5%
Female	4897	26	4872
		.5%	99.4%
Total	9513	48	9461
		.5%	98.7%

Clinical VAD assessed by eye deficiency (Xerophthalmia) is considered a public health problem at more than 1% prevalence (Asian Development Bank 1999). Bitot's spots were examined among the study subjects as shown in Table 3. It showed a 0.5% of prevalence with no

difference between males and females. It indicates that the Vitamin A deficiency among schoolchildren is not a public health problem in Sri Lanka.

Figure 10

Prevalence of Vitamin A deficiency among schoolchildren by district



The district distribution pattern is shown in Figure 10. Bitot's spots were not found in Colombo, Rathnapura and Kurunagala districts. When the geographical distribution was taken into consideration, we can see that the clinical VAD is a public health problem in the Badulla district, but not in the whole country.

5. IODINE DEFICIENCY

Iodine deficiency is an important problem among schoolchildren because it affects the psychomotor development and learning abilities. The following measurements were taken to assess the magnitude of the problem, i.e. goitre rates and median urinary iodine concentration. Goitre rates indicates the past intake of iodine and the median iodine concentration indicates the current iodine status.

Table 4

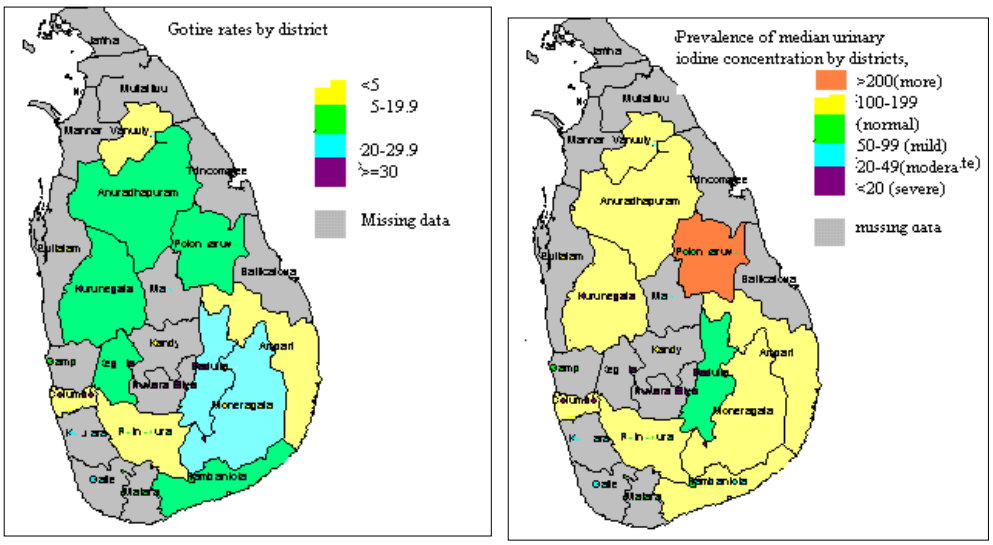
Prevalence of Iodine deficiency in school children by sex

Sex	Sample size	Total Goitre rate	Median urinary iodine concentration (ug/L)
Male	1506	189	
		7.4%	
Female	1557	233	
		13.0%	
Total	**3064**	**422**	
		10.2%	

The rate of goitres and median urinary concentration in schoolchildren of grade 4 was done to assess the iodine status of schoolchildren. Prevalence is higher in girls than boys. Figures 11 and 12 shows the distribution of goitre rates and median urinary iodine concentration by

districts. It shows the high goitre rates in some districts (Badulla and Monaragala) and the increase in some districts namely Anuradhapura and Polonnaruwa. Colombo, Ampara, Vavuniya and Rathnapura districts shows less than 5% of goitre rates, which is the indicator to the elimination of iodine deficiency. The median urinary iodine concentration shows that Badulla district has a mild degree of iodine deficiency and Plonnaruwa district has more than adequate level of urinary iodine iodine and all other districts showed ideal levels.l

Figure 11 and 12
Prevalence of goitre rate and median urinary iodine concentration among schoolchildren by district in year 2002



6. Risk factors

Table 5

Prevalence of risk factors in school children

Risk factors	Sample size	Yes	No	Odds ratio	

Discussion

This baseline survey have shed new light on the extent of under nutrition, micro nutrient deficiencies and some risk factors experienced by schoolchildren. The results of the study

clearly shows the effect of socio-economic ststus on nutruition by having better nutrition in Colombo district and poor nutrition in Hambantota, Monaragala and Ampara districts.

The height and weight data demonstrated that the growth pattern of younger children on average was close to the WHO reference standard. This was more clearly showed with the weight and height data of children from the Colombo district. This supports the established concept that the growth potential of underprivileged children is influenced more by environmental conditions than genetic factors. Previous researchers discussed the same observation (Wickramanayake et al, 1995). This study showed the positive secular change in both the height and weight distance curves and it is still continuing.

This study found that the younger children were taller and heavier relative to the older children. Schoolchildren's height has been considered of a valid indicator of the nutritional status of the population and a proxy for the socio-economic condition of the population (Ref). Boys had a slightly higher prevalence of underweight and overweight than girls. The difference was larger for the adolescent groups.

The prevalence of wasting and stunting (under nutrition) among the Colombo district study subjects was much les than that among other surveyed districts children. On the other hand, the prevalence of overweight was much greater than among other districtv children. The factor responsible for the difference should be further investigated to set up preventive programmes.

This is a situation to be aware of with the decreasing trend of under nutrition in the country.

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District	Serial No.	Total children	No. Schools	Total children in selected schools
1. Ampara	16	157838	404	3061
2. Colombo	11	357346	445	
Colombo urban	11	236916	240	
3. Hambantota	9	144626	331	
4. Kalutara	3	204136	461	
5. Vavuniya	13	44669	195	

6. N'Eliya	6	164286	525	
7. Anuradhapura	20	192522	568	8505
8. Polonnaruwa	21	85346	218	8310
9. Badulla	22	195844	577	7704
10. Monaragala	23	111624	266	13732
11. Ampara	13	44669	195	
12. Rathnapura	24	239278	600	
13. Kurunagala	18	337912	962	