COMBATING IRON DEFICIENCY

2. Prevalence of Anaemia in Sri Lanka

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Summary

Haemoglobin (Hb) measurements were included in the Third National Nutrition and Health Survey, conducted between October 1994 and January 1995 by the Ministry of Policy Planning, Ethnic Affairs and National Integration, in order to obtain nationally representative data on the prevalence of anaemia in Sri Lanka. Finger prick samples of blood were placed immediately in a HemoCue (photometer) cuvette and the Hb reading recorded. A Hb concentration below 11 g/dL among children below 60 mo and among pregnant women was taken as an indication of anaemia. For children 5 yr and older and non-pregnant women the cut-off point was 12 g/dL, and 11 g/dL for pregnant women.

For children between 3 and 59 mo, the Hb concentration was 11.0 g/dL (S.D 1.5 g/dL), 11.6 (S.D 1.3) g/dL for children 5 to 10.9 yr, 12.3 (S.D 1.4) g/dL for children between 11 and 18.9 yr and 12.0 (S.D 1.5) g/dL for non pregnant mothers. The mean Hb concentration varied by province, the lowest levels being in the North Western Province and highest in the Uva Province. A sectoral difference was seen among non-pregnant women only, being significantly lower in the estate sector than in the rural and urban sectors. Anaemia prevalence was 45% among pre-school children, 58% among children between 5 and 10.9 y, 36% among adolescents. Among women, 45% of non-pregnant and 39% of pregnant women were anaemic. Two percent of children 6-11, 12-17 and 24-35 mo were severely anaemic (Hb below 7 g/dL) and 1% of pregnant women were very severely anaemic (Hb less than 4 g/dL).

The results indicate that several groups in the population could benefit from interventions, including iron supplements and food fortification.

Introduction

Anaemia, the major clinical manifestation of iron deficiency, is the most common nutritional problem throughout the world (1) and is recognized as a serious public health problem in Sri Lanka (2). The last island-wide survey was conducted in 1975 (3) but, due to problems with the blood samples, the results were not considered reliable. Since then a number of small *ad hoc* surveys have been carried out, mostly among pregnant women, showing that anaemia is prevalent among this group in the population (4). In order to obtain nationally representative data on the prevalence of anaemia, the Ministry of Finance, Planning, Ethnic Affairs, and National Integration included haemoglobin measurements in its Third National Nutrition and Health Survey, which was conducted between October 1994 and January 1995.

Methods

A full description of the sampling procedure is given elsewhere (5). Briefly, the National Nutrition and Health sample is based on the Department of Census and Statistics' (DCS) Quarterly Labour Force Survey (QLFS) sampling frame, which was developed using the 1981 population census. Using the 1981 census data, the DCS constructed 65,000 census blocks (CBs) for the QLFS. These 65,000 CBs cover the entire country and are stratified into urban, rural, or estate strata. CB size is dependent on the population density; thus rural CBs tend to be smaller than urban CBs.

For logistical reasons, it was decided that the Nutrition and Health Survey sample would be limited to 2,000 household units (HU) so that field work and data analyses could be

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completed in a timely manner. Pretests conducted by the DCS, in two districts, showed that about 30 percent of HUs have children under the age of five years; thus 772 CBs would be needed. CBs were selected from all parts of the country except the Northern and Eastern provinces because of security reasons.

Sample selection involved a two-stage, stratified, systematic sampling procedure. In the first stage, 772 CBs were selected and each of the included provinces was allocated a near equal number of CBs (the average being around 100), which were divided more or less equally between the urban stratum and the combined rural and estate strata. The exception was the Western Province, which received an allocation of 172 CBs. Of these, 68 were allocated to Greater Colombo, which was treated as a separate stratum because it contains a relatively large population and economic activities and labour markets are more diverse in Greater Colombo than elsewhere. The urban and rural/estate strata within each province were further subdivided by district and CBs were allocated proportional to the population size of the district; thus, the more HUs in a district, the more CBs assigned to it.

In the second stage, 10 HUs were systematically selected from each of the 772 CBs; thus, the survey provides data that is representative at the provincial and sector level. Households were considered eligible and included in the survey if they had at least one child between the age of 3 and 59 months.

Data were collected on household demographics as well as the health and nutrition status of children under the age of 5 years and their mothers. For the anaemia prevalence component, children age 3 to 59 months and, where they existed, one child age 5 to 10.9 years and one child age 11 to 18.9 years in each household were selected. Where more than one child per household existed in the 5 to 10.9 and 11 to 18.9 year age group, the child whose date of birth wad closest to January was slected. Mothers were also included in the anaemia survey.

Finger prick blood samples were taken by nurses. Blood was placed in a HemoCue (photometer) cuvette and the haemoglobin (Hb) reading recorded immediately on the questionnaire. Although a low Hb concentration is neither highly sensitive nor specific as an indicator of iron deficiency, it is the easiest and most common measure of iron deficiency and is a useful indicator of the extent and magnitude of iron deficiency.

Following the WHO guidelines (6), anaemia was defined as having a Hb concentration below 11 g/dL among children under the age of 59 months and pregnant women and below 12 g/dL for children 5 years and older and non-pregnant women.

Data were entered using the U.S. Census Bureau's IMPS program and analyzed using SPSS PC+version 4.0. The statistical analyses presented here include Chi-square tests and ANOVA.

Results

Overall, the mean and standard deviation Hb concentration for children between 3 and 59 months was 11.0±1.5 g/dL. Corresponding results for children between 5 and 10.9 years old, 11 and 18.9 years old and non-pregnant mothers were 11.6±1.3 g/dL, 12.3±1.4 g/dL, and 12.0±1.5 g/dL respectively (Table 1). For all age groups, the mean Hb concentration varied by province ($p<0.001$); Hb levels were consistently lower in the North Western province and higher in the Uva province than in the other provinces. There was a sector difference in mean Hb levels only among non-pregnant women; the mean Hb level of women residing on the estates was significantly lower ($p<0.001$) than that for women living in urban or rural areas.

The distributions of Hb concentration disaggregated by age were normal. Table 2 shows the cumulative distributions for Hb concentration for each age group. Taking 11 g/dL as the cut off point for anaemia among children 3 to 59 months, 45 percent of children were anaemic and the prevalence declined with age within this age group. Using a cut off point of 12 g/dL for children over 5 years old and non-pregnant women, 58 percent of children age 5 to 10.9 years, 36 percent of adolescents, and 45 percent of non-pregnant women were anaemic. Thirty-nine percent of pregnant women were

Table 1

Mean and standard deviation of Hb concentration (g/dL) by age group, province, and sector

	3-59 months g/dL Hb			5-10.9 years g/dL Hb			11-18.9 years g/dL Hb			Non-pregnant women g/dL Hb		
	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Overall	11.0	1.5	1995	11.6	1.3	652	12.3	1.4	708	12.0	1.5	1267
Province												
Western	10.9	1.5	368	11.9	1.5	99	11.9	1.5	109	12.0	1.4	260
Central	11.3	1.5	403	11.7	1.3	171	12.5	1.4	136	11.8	1.9	233
Southern	10.9	1.3	296	11.5	1.2	99	12.3	1.3	129	11.9	1.5	199
N. Western	10.4	1.8	233	11.1	1.4	85	11.8	1.6	78	11.8	1.3	141
N. Central	10.7	1.5	183	11.4	1.4	50	12.1	1.2	47	11.8	1.5	109
Uva	11.5	1.4	274	12.0	1.3	84	12.7	1.4	116	12.4	1.5	173
Sabaragamuwa	10.0	1.6	238	11.8	1.0	65	12.4	1.5	93	12.1	1.3	152
ANOVA	p<0.001			p<0.001			p<0.001			p<0.001		
Sector												
Urban	11.0	1.6	924	11.7	1.4	267	12.3	1.4	285	12.1	1.3	620
Rural	11.0	1.6	769	11.6	1.2	270	12.2	1.4	296	12.0	1.5	482
Estate	11.1	1.6	302	11.8	1.4	115	12.3	1.5	126	11.2	2.0	165
ANOVA		ns		ns			ns			p<0.001		

ns = not significant

anaemic using a cut off point of 11 g/dL, which takes into account the haemodilution associated with pregnancy.

Hb concentrations below 7 g/dL indicate severe anaemia and those below 4 g/dL very severe anaemia. Two percent of children 6-11, 12-17, and 24-35 months of age and 1 percent of pregnant mothers were severely anaemic (Table 2).

Among children between 3 and 59 months, anaemia was associated with the province in which they lived (Table 3). More children in the North Western province (57 percent) were likely to be anaemic than children living in the other provinces, while the opposite was true for children in the Central and Uva provinces (36 percent). Children from households on welfare (i.e. receiving food stamps and/or Janasaviya benefits) were more likely to be anaemic than those from households not on welfare (53 versus 47 percent). There was also an association between a child being anaemic and his/her nutritional status. Using the Waterlow classification (7), anaemia was more prevalent among children who were both stunted (height-for-age z-score more than 2 standard deviations below the median of the NCHS/CDC/WHO reference population) and wasted (weight-for-height) z-score more than 2 standard deviations below the median of the NCHS/CDC/WHO reference population) (63 percent) than among those who were stunted only (44 percent), wasted only (42 percent), and neither stunted or wasted (44 percent). Anaemia was not associated with the sex of children between 3 and 59 months old, the sector where they lived, whether they had diarrhoea in the preceding week, household income, type of toilet facilities,

Table 2

Cumulative distribution of Hb concentration (g/dL) by age group

	Age groups for children 3-59 months old							Age groups for entire sample				
	months							months	years		non preg.	preg.
Hb	3-5	6-11	12-17	18-24	24-35	36-47	48-59	3-59	5-10	11-19	women	women
g/dL	n=74	n=184	n=216	n=229	n=383	n=441	n=398	n=1924	n=652	n=708	n=1268	n=88
3					.5			.1			.1	
4					.5			.1			.3	
5		.5	.5		.8		.3	.3			.5	
6	1.4	2.2	2.3	0.4	1.8	.7	.8	1.2	.2		.6	1.1
7	5.4	5.4	4.2	3.1	5.0	2.3	1.8	3.4	.6	.7	1.3	3.4
8	18.9	10.3	13.0	14.8	11.0	8.4	5.8	10.2	2.9	2.3	3.6	5.7
9	29.7	29.9	29.2	32.8	22.3	18.4	14.3	22.8	10.0	6.5	8.2	17.0
10	52.7	56.0	56.9	54.1	45.8	40.8	30.7	45.0	27.3	16.2	20.9	38.6
11	81.1	80.4	81.0	79.9	73.0	68.0	59.5	71.8	58.4	36.0	44.6	67.0
12	95.9	95.1	96.3	95.6	91.6	88.0	83.2	90.5	85.0	67.4	74.5	86.4
13	98.6	99.5	99.5	100.0	98.2	97.1	97.5	98.3	96.6	88.1	92.2	95.5
14	100.0	100.0	100.0		100.0	100.0	100.0	100.0	99.7	97.3	99.0	98.9
15									99.8	99.6	100.0	100.0
16									99.8	99.9		
17									99.8	100.0		
18									99.8			
19									100.0			

and number of times eggs, fish, or meat were eaten by the household in the preceding week.

A similar provincial pattern for anaemia was found among children age 5 to 10.9 years old (Table 4) with the prevalence of anaemia (Hb<12 g/dL) being higher in the North Western province (72 percent) and lower in the Uva (50 percent) province than elsewhere. Once again, the sex of the child and the sector in which the child lived were not associated with anaemia. However, children who did not go to school were more likely to be anaemic than children who did go to school (69 vs 55 percent).

Among adolescents age 11 to 18.9 years, anaemia (Hb<12 g/dL) was also associated with the province but not the sector in which they lived (Table 5). More children in both the North Western and Western provinces (53 percent) were anaemic than children living elsewhere (28 to 45 percent). Although girls were more likely to be anaemic than boys (40 vs 32 percent), whether a girl had reached menarche was not associated with her being anaemic. Going to school was not associated with being anaemic in this age group.

Table 6 shows that pregnant mothers were more likely to be anaemic than non-pregnant mothers. Among non-pregnant mothers, the prevalence of anaemia (Hb<12 g/dL) in the Uva (31 percent) and Sabaragamuwa (38 percent) provinces was lower than in other provinces (47 to 49 percent) (Table 7). Unlike among children, the prevalence of anaemia among non-pregnant mothers was associated with sector and was more prevalent among mothers in the estate sector (59 percent) than those living in urban (40 percent) or rural (46 percent) areas. Not unexpectedly, a higher prevalence of anaemia

Table 3

Distribution of Hb concentration (g/dL) by background factors for children age 3-59 months

	..... Hb (g/dL)				
	<11	11	12+	n	chi
Overall	44.8	26.9	28.3	1995	square
Province					
Western	47.3	25.5	27.2	368	
Central	36.2	29.0	34.7	403	
Southern	47.6	30.1	22.3	296	
N. Western	56.7	25.3	18.0	233	
N. Central	54.6	23.5	21.9	183	
Uva	36.1	27.7	36.1	274	
Sabaragamuwa	42.9	24.4	32.8	238	p<0.001
Household on welfare					
Yes	53.5	26.9	19.6	572	
No	47.2	28.4	24.4	997	p<0.05
Nutrition status					
Stunted only	44.0	23.1	32.9	359	
Stunted & Wasted	62.9	22.9	14.3	70	
Wasted only	41.7	32.1	26.3	156	
Not stunted or wasted	43.6	27.9	28.5	1307	p<0.01

Table 4

Distribution of Hb concentration (g/dL) by background factors for children age 5-10.9 years

	..... Hb (g/dL)				
	<11	11	12+	n	chi
Overall	27.3	31.1	41.6	652	square
Province					
Western	27.3	28.3	44.4	99	
Central	27.6	28.2	44.1	170	
Southern	27.3	34.3	38.4	99	
N. Western	36.5	35.3	28.2	85	
N. Central	40.0	20.0	40.0	50	
Uva	19.0	31.0	50.0	84	
Sabaragamuwa	15.4	41.5	43.1	65	p<0.05
Attends school					
Yes	24.4	30.2	45.4	454	
No	40.8	28.2	31.0	71	p<0.02

Table 5

Distribution of Hb concentration (g/dL) by background factors for children age 11-18.9 years

	..... Hb (g/dL)				
	<11	11	12+	n	chi square
Overall	16.2	19.8	64.0	708	
Province					
Western	24.8	28.4	46.8	109	
Central	14.0	17.6	69.4	136	
Southern	11.6	16.3	72.1	129	
N. Western	28.2	24.4	47.4	78	
N. Central	17.0	27.7	55.3	47	
Uva	8.6	14.7	76.7	116	
Sabaragamuwa	15.1	16.1	68.8	93	p<0.001
Sex					
Male	11.5	20.1	68.4	304	
Female	20.0	20.0	60.0	365	p<0.01

Table 6

Distribution of Hb concentration (g/dL) by pregnancy status for mothers with children under 5 years old

	..... Hb (g/dL)				
	<11	11	12+	n	chi square
Overall	22.1	24.0	53.9	1356	
Pregnant					
Yes	38.6	28.4	33.0	88	
No	20.9	23.7	55.4	1268	p<0.001

was positively associated with increasing number of pregnancies.

Discussion

Low Hb status, which is generally used to define anaemia, is prevalent in Sri Lanka. Anaemia was most prevalent among children age 5 to 10.9 years, where nearly three out of five children were affected, followed by children 3 to 59 months old and non-pregnant mothers, where close to one out of two people in each group was anaemic. One out of three adolescent children and one out of three pregnant women were also anaemic.

Among all children, anaemia was more prevalent in the North Western province and least prevalent in the Uva province. There was less variation in the prevalence of anaemia among non-pregnant mothers between provinces although the prevalence was lower in both the

Table 7

Distribution of Hb concentration (g/dL) by background factors for non-pregnant mothers with children under 6 years old

	..... Hb (g/dL)				
	<11	11	12+	n	chi
Overall	20.9	23.7	55.4	708	square
Province					
Western	23.5	23.8	52.7	260	
Central	24.9	24.0	51.1	233	
Southern	22.1	27.1	50.8	199	
N. Western	17.9	30.0	52.1	140	
N. Central	23.9	22.9	53.2	109	
Uva	12.1	19.1	68.8	173	
Sabaragamuwa	19.7	18.4	61.8	152	p<0.02
Sector					
Urban	18.2	21.5	60.3	620	
Rural	19.5	26.4	54.1	481	
Estate	35.2	24.2	40.6	165	p<0.001
No. of pregnancies					
1	13.5	22.0	64.5	296	
2	21.1	24.8	54.0	383	
3	18.8	22.0	59.2	250	
4	30.4	19.9	49.7	161	
5+	27.5	32.9	39.6	149	p<0.001

Uva and Sabaragamuwa provinces than elsewhere. Anaemia was more prevalent among non-pregnant mothers living in the estates than in rural or urban areas. Iron interventions that reach women, which are targeted to the estates, can reduce their prevalence of anaemia.

The high prevalence of anaemia in children under the age of 5 years may be due, in part, to the low Hb status of mothers during pregnancy and inadequate infant and child feeding practices. The latter is partly reflected in the first part of Table 3, which shows cumulative Hb concentration disaggregated by age groups for children under 5 years old. Between the age of 3 and 24 months 55 percent of children were anaemic but, after 2 years of age the prevalence of anaemia declined and between the age of 4 and 5 years old about 30 percent of children were anaemic. This suggests that as children become more dependent on the family diet their Hb status improves. This finding is not unexpected because breast milk does not contain enough iron to meet the requirements of rapidly growing infants beyond the age of four to six months. Anaemia was not associated with the number of times eggs, fish, or meat were eaten by the household in the preceding week, but these data do not reflect who in the household ate the food; thus no conclusions can be drawn from them.

Among children between 3 and 59 months old, anaemia was associated with whether children were from households receiving welfare and child nutrition. Targeting iron interventions at households on welfare and with undernourished children will reach infants and young children most vulnerable to iron deficiency.

The high level of anaemia among children 5 to 10.9 years may be related to the presence of worms and other parasites. However, without data on these parameters it is not possible to substantiate this. Children between 3 and 10 years are routinely dewormed through the primary health care and education system. Children who did not go to school, who would be less likely to be dewormed, and who probably came from the poorest households, were more likely to be anaemic than children who did go to school.

The lower prevalence of anaemia among adolescents, compared with children age 5 to 10.9 years old, may reflect that these children are more likely to wear shoes at all times and were thus less exposed to helminths. Anaemia was associated with gender among adolescents, increasing parity among non-pregnant mothers, and whether a mother was currently pregnant. The lower prevalence of anaemia among pregnant mothers, compared with non-pregnant mothers, suggests that the iron supplements routinely distributed to pregnant mothers during the last trimester to pregnancy were having some impact, albeit modest. The above findings were not unexpected and reflect the importance of protecting women of reproductive age, including the many adolescent girls who go to school, against anaemia.

These results from this survey indicate that there are a number of groups who could benefit from targeted and untargeted iron interventions, including the distribution of iron supplements and food fortification.

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