National Strategy for Prevention and Control of Micronutrient Deficiencies in Sri Lanka (2017-2022)

Nutrition Coordination Division

Ministry of Health, Nutrition and Indigenous Medicine

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Message of the secretary of Health, Nutrition and Indigenous Medicine

Health is a state of complete physical, mental, social & spiritual well-being and nutrition contributes a vital role in determining ones health status. The Government of Sri Lanka has displayed great commitment towards the upliftment of health and nutritional status of its population. Recent national data on nutritional status suggest that micronutrient deficiency is a major public health problem in Sri Lanka.

The micronutrient requirements vary with the stages of the lifecycle. The correct supply of micronutrients at the correct period is very important to have healthy and productive life.

All relevant stakeholders in the discipline of nutrition must exert a concerted effort to achieve this common goal of uplifting the nutrition status of the country by preventing and alleviating micronutrient deficiencies. As one of the important measure necessary to meet this challenge, this document, National strategy for prevention and control of micronutrient deficiencies in Sri Lanka (2017– 2022) was developed, and I hope this important document will provide the strategic direction and guidance for this mission.

Anura Jayawickrama
Secretary
Ministry of Health, Nutrition & Indigenous Medicine

Message of the Director General of Health Services

Micronutrient deficiencies are considered as a major public health problem in Sri Lanka. Micronutrient surveys c onducted during the past few decades revealed that the prevalence of anemia is high among children aged 6-12 months pregnant and lactating women. In addition, Vitamin A deficiency is also a problem among the above age groups

However, recently updated national data are not available on micronutrient status of school children and adolescents. Elderly and adult males are another group that needs focus in the future.

The Ministry of Health, Nutrition & Indigenous Medicine has been very successful in bringing down the total goiter prevalence nationally. However, maintaining the quality of salt at production and distribution level by effective supervision and monitoring need to be emphasized.

Ministry of Health as a key stakeholder in the improvement of the nutritional status of the Sri Lankan population has implemented the National strategy for prevention and control of micronutrient deficiencies in Sri Lanka (2017-2022). Thus it is imperative that other relevant stake holders and all programme managers will utilize this document to ensure that the country will successfully combat the burden of micronutrient deficiencies.

Dr.J.M.W Jayasundra Bandara
Director General of Health Services
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Preface

Nutrition plays a vital role in building a healthy nation and therefore it is one of the high priority areas in the health sector. Ministry of Health, Nutrition & Indigenous Medicine has conducted several intervention programmes to uplift the nutritional status of the population. However, the nutrition related indicators have not been impressive during the past few decades.

Micronutrient deficiency among the population has been identified as one of the key contributors. Iron deficiency among under 5 children, and pregnant and lactating mothers is one of the major public health problems prevailing in Sri Lanka inspite of many targeted interventions taken place all over the country.

School children, adolescent and non-pregnant women of child bearing age, elderly have also been identified as other vulnerable groups.

Vitamin A deficiency and Iodine deficiency are two other major micronutrient deficiencies among Sri Lankan population which need to be addressed.

In the view of addressing the above mentioned deficiency states, the Ministry of Health, Nutrition & Indigenous Medicine has implemented targeted interventions for the vulnerable groups.

However, despite of this comprehensive evidence based interventions, micronutrient deficiencies still prevail in the country. I hope the National strategy for prevention and control of micronutrient deficiencies in Sri Lanka (2017-2022) will provide guidance to improve the nutrition status of the population by preventing and alleviating micronutrient deficiencies and that will pave the way forward for a healthier future for all Sri Lankans.

Dr. Rasanjalee Hettiarachchi
Director
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We wish to express our sincere gratitude to all members of the technical committee for their continuous support and guidance provided to make this task success.

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List of Abbreviations

BCC	Behavioral Change Communication
CHDR	Child Health Development Record
DHS	Demographic and Health Survey
FAO	Food and Agriculture Organization
FHB	Family Health Bureau
GoSL	Government of Sri Lanka
Hb	Haemoglobin
HMIS	Health Management Information System
IDD	Iodine Deficiency Disorders
MMN	Multiple Micronutrients
MOH	Medical Officer of Health
MRI	Medical Research Institute
TGR	Total Goiter Rate
UNICEF	United Nations International Children's Fund
USI	Universal Salt Iodization
WFP	World Food Programme
WHO	World Health Organization
WIFS	Weekly Iron Folic acid Supplementation

Introduction

Recent national data on nutritional status suggest that micronutrient deficiencies are as important health problems as energy protein deficiency. Iron deficiency, vitamin A deficiency and iodine deficiency have been recognized as public health problems in Sri Lanka and strategies have been developed to prevent and control these deficiencies. Studies in selected populations also suggest the existence of other micronutrient deficiencies such as folate, calcium, zinc and vitamin D [Hettiarachchi, et. al, 2006; Medical Research Institute (MRI), 2014].

National surveys conducted during the past decade have not shown a reduction in the prevalence of anaemia during pregnancy and lactation in spite of the greater coverage of iron and folic acid supplementation and improvement in dietary habits. National nutrition and micronutrient survey of pregnant and lactating women in Sri Lanka (MRI, 2015) revealed that 31.8% of pregnant women were anaemic. However, anaemia due to iron deficiency was only 9.9% and 19% of mothers were found to be iron deficient. The same survey showed 95.7% of pregnant mothers had received iron and folic acid supplements at antenatal clinics. However, only 21% of pregnant mothers have taken 90 or more iron tablets throughout their pregnancy (MRI, 2015).

The national nutrition and micronutrient survey among children 6 months to 5 years of age showed that although there was a decrease in the overall prevalence of anaemia, it remained high (34%) in the age group 6-12 months (MRI, 2012). Further, nearly one third of the children studied were iron deficient and the highest prevalence of iron deficiency (47.2%) was noted during the second year of life. The same survey showed that the overall prevalence of iron deficiency was more than 30% among children in the age group 24-35 months and more than 20% in the age group 36-59 months.

To prevent and control iron deficiency among children in the age group 6 to 23 months, a programme to provide multiple micronutrient (MMN) powder sachets (containing 15 vitamins and minerals, including iron, zinc and vitamin A) for home fortification of complementary foods, in 12 vulnerable districts was initiated in 2009. Evaluation of this programme during the period 2009-2012 showed that only 45.2% had ever received the multiple micronutrient powder thus indicating the need to

increase coverage (Senarath, Jayatissa & Siriwardena, 2015). Intake of multiple micronutrient powder was associated with a significant reduction in prevalence of anaemia, but no difference in iron or zinc status was noted. In a subsequent study, compliance, knowledge, attitude and practices were assessed among mothers of recipient children. In this study too, only 53.2% had received MMN powder within the last 6 months and the major reason was non-availability. Major beneficial effects reported by mothers (41%) was weight gain and being more active, while 21% complained of issues relating to intake (Dhanapala, 2015).

A national survey on vitamin A status among children 6-59 months of age (MRI, 2006) showed that 29% of children had subclinical vitamin A deficiency (serum vitamin A <20 μg/dl), indicating a public health problem. Vitamin A status of non-pregnant women was also studied in this survey and 14.9% of women had low serum vitamin A levels. Following this survey, vitamin A supplementation schedule among children 6-59 months was revised to provide supplements every 6 months. The Nutrition and Food Security Survey carried out in 2009 showed an increase in intake of vitamin A rich foods and nearly 70% coverage of vitamin A supplementation among children 6-59 months of age [MRI, United Nations International Children's Fund (UNICEF) & World Food Programme (WFP), 2010].

A national survey among schoolchildren aged 10-15 years showed the prevalence of anaemia is 11.1% (MRI, 2006). However, there is no recent national data on micronutrient status of school going adolescents. Studies in selected populations have indicated that low iron and folate status is a problem in this age group (Hettiarchchi et.al, 2006). A weekly iron-folate supplementation (WIFS) programme with a nutrition education component has been introduced by the government for all school children since 2013. Data is not available on the effectiveness and feasibility of this programme. Though there are no specific programmes for out of school adolescents, studies in selected populations suggest that out of school adolescents are more vulnerable to micronutrient deficiencies than school going adolescents (de-Lanerolle-Dias,et al, 2012).

Available national surveys showed that non-pregnant women of childbearing age had a higher prevalence of anaemia than pregnant women [Demographic and Health Survey (DHS), 2006; MRI, UNICEF & WFP, 2010). A nutrition education and behaviour change communication (BCC) programme is being implemented for non-pregnant women after registration of marriage, and they are encouraged to take folic acid supplements. It is preferable to promote dietary strategies to increase folate intake and limit supplementation to the most vulnerable women and those planning a pregnancy. As this programme is only available to women after marriage, it is important to develop a nutrition education programme targeting all women of childbearing age.

Data on micronutrient status of adult males and the elderly are limited. It is necessary to develop programmes to address micronutrient deficiencies in the elderly as this is likely to improve their quality of life. It is also necessary to address micronutrient deficiencies among people displaced for long periods by natural disasters or other causes.

Universal salt iodisation (USI) and strengthening of the iodisation programme has resulted in a reduction in the total goitre prevalence rate from 18.8% in 1986 to 3.8%, 4.4% and 1.9% in the national surveys conducted by MRI in 2005, 2010 and 2016 respectively. The 2016 survey showed median urinary iodine concentration of 232.6µg/L in schoolchildren aged 6-12 years, indicating that adequate level of iodine in the population. It further showed adequately iodized salt at household level was 79.8% (MRI, 2016). All these findings indicated iodine deficiency is no longer a public health problem in Sri Lanka. National survey conducted by MRI in 2015 showed that the median urinary iodine level of pregnant women is optimum at national level, just above the cut-off value of 150 µg/L. However, four provinces (Western, Central, Uva and Sabaragamuwa) indicated inadequate iodine intake (MRI, 2015). Further, the iodine content of salt was lower than the specified level in nearly one third of the households studied in this survey, highlighting the need to maintain the quality of salt at production and distribution levels by increasing the effectiveness of monitoring.

As iron deficiency is the commonest micronutrient deficiency and limited data suggest that low folate status is also a problem, the feasibility of fortification of rice and wheat flour with iron and folate has been suggested as a strategy for improving iron and folate status. All avenues to strengthen fortification should be explored.

A programme to provide Thriposha, a precooked food supplement containing a vitamin mineral premix to all pregnant and lactating women and to underweight children 6-59 months of age has been carried out for several decades. Data from the National Nutrition and Micronutrient Survey (2015) showed that 91% of pregnant mothers had received Thriposha at antenatal clinics and only 11% of them had consumed it as prescribed. A quasi experimental study conducted among 6-24 months old Thriposha beneficiaries revealed that the group of children who received Thriposha regularly, with close monitoring for compliance and nutrition education showed a significantly higher weight gain compared to children who received Thriposha under existing situation (Nutrition Coordination Division, 2016). It is necessary to ensure regular supplies and include a strong education component in the programme, reinforcing the need of targeting it to pregnant women, lactating mothers and undernourished children (6 month- 5 years).

Preventing micronutrient deficiencies requires several complementary approaches. These include nutrition education and behaviour change communication; food based approaches (dietary diversification, food fortification, food supplementation); micronutrient supplementation; and public health interventions to improve sanitation. A food based approach focusing on dietary diversification and food fortification is likely to be the most sustainable approach for improving micronutrient status. It should be complemented with strategies for increasing food availability and promoting increased intake of a diversified diet.

Goal, targets & strategic objectives

- **Goal**
  Improve the nutrition status of the population by preventing and alleviating micronutrient deficiencies

- **Targets to be achieved by 2025 following implementation of the strategy**

1. To reduce the prevalence of anaemia among children under 5 years, adolescents, pregnant women and women of reproductive age by 50% from the level at 2012

2. To reduce the prevalence of vitamin A deficiency among children under 5 years by 50% from the level at 2012

3. To ensure more than 90% of the population are iodine sufficient

- **Strategic objectives to improve micronutrient status of the population**

1. To strengthen the regulatory mechanism for enforcement of relevant legislation, policies, and guidelines

2. To strengthen advocacy and awareness to improve the consumption of micronutrient rich food and micronutrient supplementations among the target populations

3. To promote sustainable partnerships and multi-sectoral involvement in improving micronutrient status of the population

4. To empower relevant stakeholders and communities with regard to knowledge, skills and service delivery to improve micronutrient status of the population

5. To implement evidence based nutrition interventions throughout life cycle at individual and population levels

6. To monitor and evaluate the current interventions and promote operational research

Key Priority areas of action for each Strategic Objective

Strategic Objective 1:

To strengthen the regulatory mechanism for enforcement of relevant legislation, policies, and guidelines

This strategic plan focuses on the development and/or modification of specific policies, legislations and guidelines that are necessary to provide the framework for implementation of evidence-based and effective programmes to address micronutrient deficiencies.

Priority areas of action

1. Revisit and update the policies, legislations and guidelines on micronutrient supplementations for children aged 6-59 months, pregnant and lactating women, adolescent girls and non pregnant women in the context of evidence based recommendations.

2. Introduce and update regulations regarding marketing of energy dense, micronutrient poor foods and beverages.

3. Reinforce compliance by private sector as key players in the Iodine fortification programme.

4. Develop and implement policy on food fortification (such as flour, rice, salt) with iron and appropriate micronutrients.

5. Develop and implement policy on bio-fortification of staple food with appropriate micronutrients (eg: iron-rich paddy varieties).

6. Include animal source foods and micronutrient rich food items in safety net and food security programmes implemented for vulnerable groups.

Strategic Objective 2:

To strengthen advocacy and awareness to improve the consumption of micronutrient rich food and micronutrient supplements among the target populations

Nutrition education and Behaviour Change Communication (BCC) play a key role in bringing about desirable practices and achieving a satisfactory micronutrient status to maintain health.

Priority areas of action

1. Develop high-profile communication campaigns to prevent and control micronutrient deficiencies targeting policy makers, stakeholders, academia, private sectors, other non-health state sectors and the general population.

2. Develop and reinforce nutrition education and BCC programs with greater attention to food based approaches to increase intake of micronutrient rich foods, combine food to increase bioavailability (methods of food preparation to minimize losses of micronutrients) and intake of supplements.

3. Advocate policy makers to develop sector policies and programmes that are nutrition sensitive and to support implementation of the national strategy.

4. Facilitate private sector to engage in ethical marketing of micronutrient rich foods and fortified foods.

5. Promote community support groups to enhance the awareness on micronutrients rich foods and programmes through mother support groups, peer-to-peer support, community forums, etc.

6. Advocate mobilizing resources for new interventions, technologies and scaling up of evidence-based interventions.

Strategic Objective 3:

To promote sustainable partnerships and multi sectoral involvement in improving micronutrient status of the population

Sustainable partnerships and multisectoral involvement is a key to achieving increased availability of a variety of micronutrient rich foods. It can be reached through improving practices in livestock, fisheries, agriculture, trade and promoting home gardening and urban agriculture.

Priority areas of action

1. Enhance partnership with all the relevant health and non-health sectors to increase availability of micronutrient rich foods by promoting nutrition oriented crop production, home gardening, urban agriculture, livestock, fisheries and trade.

2. Ensure coordination with other programmes, especially economic development, food security, agriculture and fisheries sectors to ensure availability and accessibility of variety of food

3. Strengthen coordination between all the relevant ministries, other ministries and partner organizations including civil societies and private sector in implementing nutrition specific and sensitive interventions

4. Facilitate multi-sector divisional and district coordination and joint evaluation for the implementation of the national strategy.

Strategic Objective 4:

To empower relevant stakeholders and communities with regard to knowledge, skills and service delivery to improve the micronutrient status of the population

It is needed to focus on building the capacity of health and non-health workers to ensure quality service delivery, accurate monitoring and reporting for improved outcomes in relation to the micronutrient status of targeted groups.

Priority areas of action

1. Increase knowledge and skills of service providers through appropriate and adequate capacity building with special emphasis on vulnerable populations such as plantation, urban low income and displaced communities.

2. Ensure coordination and capacity of Community Support Organizations (CSOs) and private sectors to improve compliance on targeted interventions and outreach to communities.

3. Enhance capacity of relevant stakeholders on supply chain management.

Strategic Objective 5:

To implement evidence based nutrition interventions throughout life cycle at individual and population levels

Many interventions have been implemented over the years, which require strengthening, while other interventions available at global context require adaptation to the country context and systems development.

Three main areas for intervention will be focused namely; dietary diversification, food fortification and supplementation.

Priority areas of action

Dietary diversification:

1. Promote food security and agriculture programmes to enhance availability, affordability, diversity and quality, including food safety and scaling up home and school gardening.

2. Promote animal sources of foods to improve vitamin A, pre-formed vitamin A intake, iron and zinc intake especially for pregnant, lactating women and children through livestock and fisheries programmes.

3. Strengthen home-based traditional practices for improving micronutrient intake and scaling up food based best practice models in districts to improve micronutrient status.

4. Strengthen dietary counselling services to improve micronutrients rich food intake at facilities and communities.

Food fortification:

1. Strengthen the salt iodization programmes to achieve elimination criteria while ensuring salt intake is limited to less than 5 g/per person/day.
2. Promote fortification of staple foods or commonly consumed condiments/spices, to increase iron and appropriate micronutrient intake of the population.
3. Enhance the availability of fortified food to improve intake of micronutrients among special groups such as patients with cancer, Tuberculosis etc.

Supplementation:

1. Strengthen the coverage, compliance and supply chain of existing supplementation programs and to be linked to nutrition education and behavior change communication

2. Scaling up the MMN supplementation programme to include children 6-23 months of age in all districts.

3. Strengthen the school meal programme to provide micronutrient rich foods.

4. Develop programmes to improve the micronutrient status of out-of school adolescents, elderly, urban poor, estate population, institutionalized adults (eg. prisoners), populations affected with disasters and other vulnerable groups.

Strategic Objective 6:

To monitor and evaluate the current programmes and promote operational research

A monitoring and evaluation mechanism is essential to assess the effectiveness of the micronutrient strategy. Monitoring and evaluation is needed to be done at all levels (national, provincial, district, divisional and village levels) using appropriate indicators (input, process, output, outcome and impact). Furthermore operational research provides evidence based information on micronutrient status of the population thereby to arrive at correct policy decisions.

Priority areas of action

1. Strengthen the monitoring and evaluation mechanism for existing interventions at national, provincial, district, divisional and village levels.

2. Establish an effective supply chain management system for supplementation programmes

3. Promote research on nutrient dense product development, food-to-food enrichment, processing and transport, nutrition-oriented agriculture research on crops, livestock and production systems.

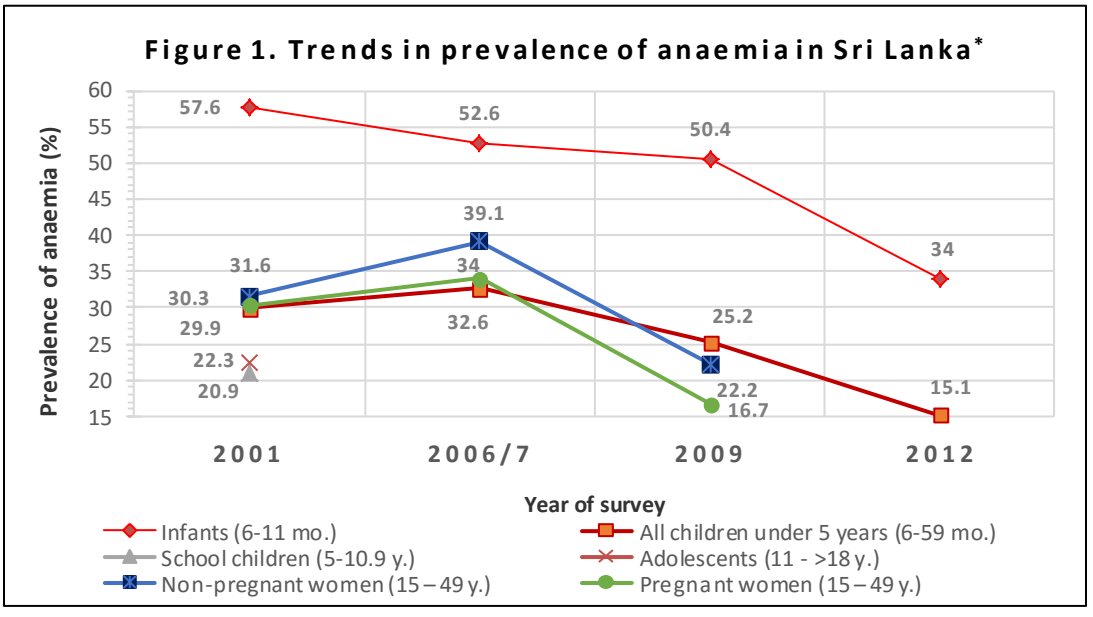
4. Support operational research to improve micronutrient rich food consumption, improvement of supplementation and enhancing fortification.

Annexure 1

1. Prevalence and consequences of micronutrient deficiencies

a. Prevalence of anaemia

The national surveys conducted during the past 15 years have shown a gradual reduction in the prevalence of anaemia (Figure 1).The prevalence of anaemia among children 6 to 59 months of age has decreased gradually from 29.9% in 2001 to 15.1% in 2012. However, the highest prevalence of anaemia was noted during the 6-12 month period in all studies and decreased gradually. This difference is likely to be due to deficiencies in complementary feeding.

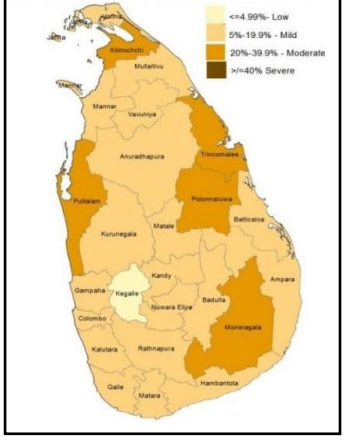


*Cutoff values suggested by WHO (2011) were used for all age groups

MRI 2001, Department of Census and Statistics 2006/7, MRI and UNICEF 2009, MRI and UNICEF 2012

Figure 2. Prevalence of anaemia among children <5 years by district

Source: MRI/UNICEF 2012

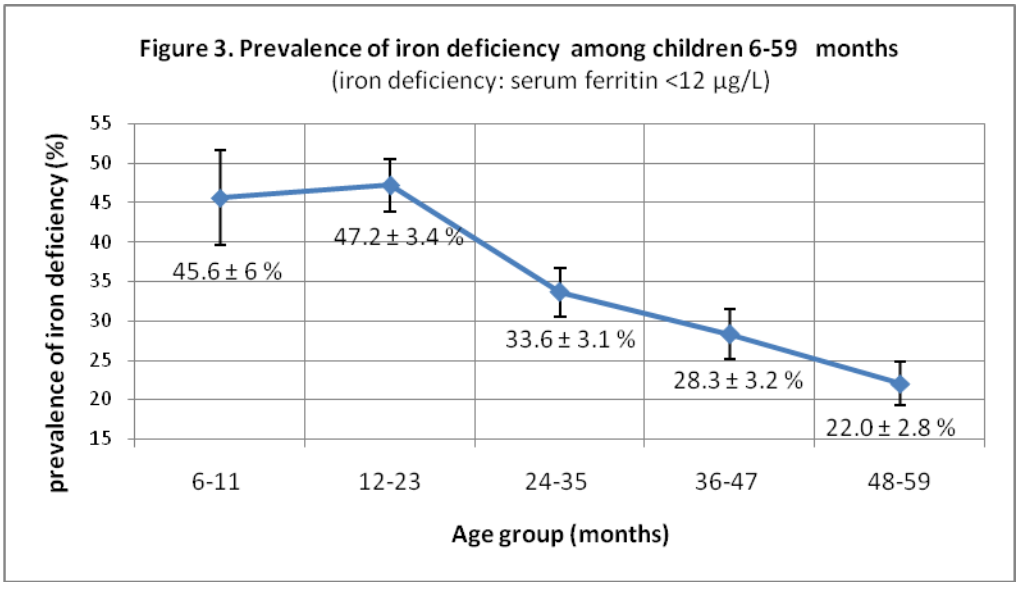


Considerable inter-district variation in the prevalence of anaemia was noted in the 2012 MRI survey (MRI/UNICEF, 2012a), with 5 districts having anaemia of moderate public health significance while it was a mild public health problem in other areas (Figure 2). It is necessary to identify factors contributing to the higher prevalence of anaemia in some districts.

There was no marked gender difference, or a consistent difference in the prevalence of anaemia among urban, rural and estate sectors in the above surveys. The prevalence of anaemia among school children (5-10.9 yrs) and adolescents (11-18.9 yrs) was assessed only in the 2001 survey and was 20.9% and 22.3% respectively (Figure 1). Data on prevalence of anaemia in pregnant and non-pregnant women is available in surveys carried out in 2001, 2006/7 and 2009. Although a gradual decrease in prevalence of anaemia was noted in both groups, the prevalence was higher among non-pregnant women than pregnant women in all surveys (22.2% vs. 16.7%, in the 2009 survey), highlighting the need to target this group for interventions (Figure 1). Factors affecting the prevalence of anaemia were examined in 2001, 2009 and 2012 surveys. It was revealed that the prevalence of anaemia decreased with increase in educational level of women and their spouses, the employment status, and an individual dietary diversity score of 4 or more, while a higher prevalence of anaemia was associated with non-availability or use of common latrines and living in temporary accommodation.

In the National Nutrition and Micronutrient survey (MRI/UNICEF, 2014) factors contributing to anaemia were studied and 52.3% of anaemic children had iron deficiency, while 12.8% had haemoglobinopathies and 4.3% had acute infections. The cause of anaemia could not be identified in remaining children.

Iron status was also assessed among children 6-59 months in this survey (MRI/UNICEF, 2014). Prevalence of iron deficiency among children 6-59 months of age as indicated by depleted iron stores (serum ferritin <12 μg/L) is given in Figure 3. The overall prevalence of iron deficiency among these children was 33.6% and the prevalence was higher among children in the age group 6-23 months than in other age groups. It is important to note that the prevalence of iron deficiency was highest among children who were overweight (41.1%, n=124).



Source: National nutrition and micronutrient survey MRI/UNICEF, 2014

b. Prevalence of vitamin A deficiency

Severe ocular manifestations of vitamin A deficiency have not been a major problem in Sri Lanka during the past 50 years. The first national surveys was carried out among children 6 months to 59 years of age during the period 1995-1996 (MRI, 1998) and the second national survey was carried out in 2005 among children in the same age group in 20 out of 25 districts in Sri Lanka (MRI, 2006a). The prevalence of subclinical deficiency (serum vitamin A < 20 µg/dl) was greater than 20% in both studies, indicating that vitamin A deficiency is a public health problem in Sri Lanka according to the cut-off values suggested by the WHO (Table 1). However, no cases of Bitot's spots or night blindness were reported in this survey. National data on vitamin A status of older children, adolescent girls and women of childbearing age are not available.

Table 1. Prevalence of vitamin A deficiency among children 6 – 59 months of age

Indicator	Public health problem* (Cut-off value)	Prevalence in Sri Lanka	
		1995[1] (n=1750)	2006[2] (n=900)
Night blindness	> 1.0 %	0.8 %	NR
Bitot's spots	> 0.5 %	0.8 %	NR
Serum vitamin A <20 μg/dl	> 20 %	36.3 %	29.3 %

*According to cut-off values suggested by WHO (2011), NR – not reported
[1] Medical Research Institute, 1996, [2]Medical Research Institute, 2006a

According to the 2006 survey, only 61% of children have been consuming vitamin A rich animal and plant foods on more than 6 days per week indicating that the average consumption had not yet reached the acceptable level of 70%. Also, the prevalence of vitamin A deficiency was significantly higher in children who had respiratory tract infections during the two weeks prior to the survey.

c. Prevalence of iodine deficiency

Iodine deficiency disorders (IDD) were identified as major public health problem in the national survey carried out in 1986 among 5-18 year old school children in 17 of 24 districts (Fernando et al, 1989). The total goitre prevalence rate in this study was 18.8%.

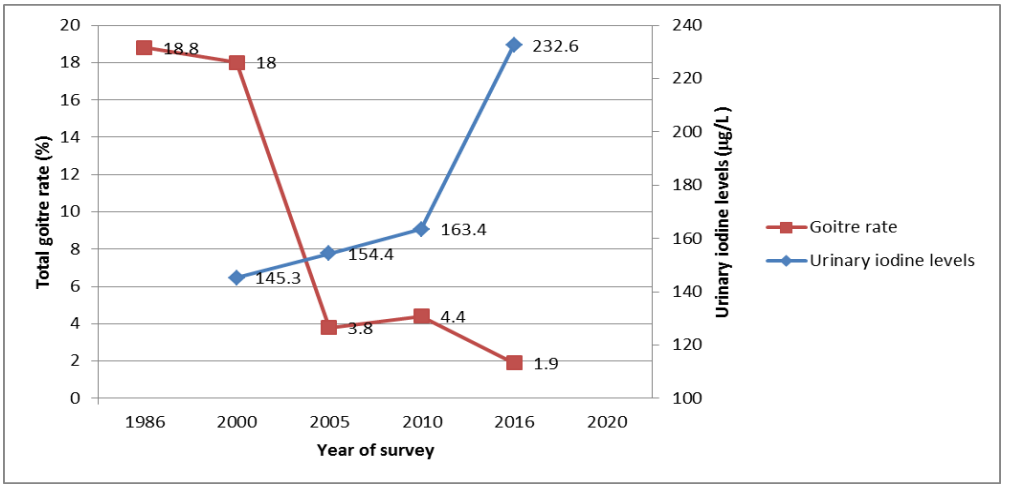


Figure 4. Trends in prevalence of goitre and variation in urinary iodine levels among children 6-12 years of age

Following this national survey universal salt iodisation (USI) programme was launched in 1995 as the main approach to control iodine deficiency. As there was no change in the goitre prevalence rate in the national survey carried out by MRI/ UNICEF in 2001, activities to strengthen the salt iodisation programme were increased and a reduction in goitre prevalence rate was noted in the MRI/ UNICEF national survey carried out in 2005 (MRI/UNICEF, 2006b) among 6- 10 year old school children (Figure 4). In the survey conducted in 2010 the overall goitre prevalence rate was slightly higher (4.4%), while the median urinary iodine level was > 150 µg/L indicating adequate intake of iodine (Figure 4).

d. Prevalence of other micronutrient deficiencies

In the National Nutrition and Micronutrient survey, serum zinc and calcium levels were also measured among children 6-59 months (n=7050) in households in 25 districts (MRI/UNICEF, 2014). Five percent of children studied had zinc deficiency (serum zinc < 65 µg/dl), while low plasma calcium levels (<8.4 mg/dl) were noted among 47.6% of children. National data is not available on the status of other micronutrients deficiencies.

e. Key findings on micronutrient status in some recent studies in selected populations

In a study of micronutrient status and its relationship with general nutritional status among 2-5 year old children (n=340) attending preschools in Ragama, Western Province, subclinical *v*itamin A deficiency (Serum vitamin A < 20 μg/dl) was noted among 38% of children, while vitamin D deficiency (<10 mg/ml) and insufficiency (10-20 mg/ml) were noted in 5% and 29.1% of children respectively (Marasinghe et al., 2015). Zn deficiency (serum zinc <65μg/dl) was noted in 67% of children, while elevated parathyroid hormone levels suggestive of hypocalcaemia were noted among 12% of children. The general nutritional status of the children was related to their vitamin D and haemoglobin status, while the zinc and vitamin A levels were low in children with severe stunting.

In a study of anaemia and iron, folate, zinc and vitamin D status among children 3- 5 years of age (n=248) in the Galle district, nearly one third of the children were anaemic and 38.3% were deficient in two micronutrients, while 17.7% had three micronutrient deficiencies (Hettiarachchi & Liyanage, 2012). Anaemia, iron, folate and zinc status was assessed among 12-16 year old male and female school children (n=945) in the Galle district (Hettiarachchi & Liyanage, 2006). Anaemia, low iron and folate status and zinc deficiency were present in more than one third of the children studied. Iron deficient children had a significantly greater risk of being deficient in both folate and zinc.

The iron, folic acid and vitamin B12 status were assessed among adolescent girls 15-18.9 years and women of childbearing age 19-30 years (n=550) living in the Colombo municipal area (Thoradeniya et al., 2006). Depleted iron stores suggestive of iron deficiency (serum ferritin <12 μg/L) and low iron stores (serum ferritin 12-20 μg/L) were noted in 25.3% and 21.3% respectively and low folate status was noted in 43% (serum folic acid <3 ng/ml), while <5% of subjects had low vitamin B12 status, although the prevalence of anaemia was 12.9%. Both depleted iron stores and low folate status were significantly associated with anaemia in this population.

Micronutrient status was assessed in female adolescent school dropouts (n=603) 15-19 years of age living in the Colombo district (urban area) and in a rural area of Kalutara district (de Lanerolle-Dias et al., 2012). Low iron status, low folate status and zinc deficiency were noted in nearly one third of the girls studied. Further, working girls had a poor micronutrient status than non-working girls. Also, dropping out of school early (<14 years of age) was associated with increased risk of micronutrient deficiency.

The consequences of micronutrient deficiency are summarized in Table 2.

Table 2. Consequences of micronutrient deficiency in different stages of the life cycle

Micronutrient deficiencies & stages of the life cycle	Consequences
Iron deficiency with or without anaemia • Infants, preschool and school-aged children • All age groups, specially infants and young children • Adolescents and adults • Pregnant mothers and neonates	• Impaired cognitive performance, behaviour, and physical growth • Impaired immune status and increased morbidity from infections • Impaired physical capacity and work performance • Increased risk of premature delivery, low birth weight, maternal and infant morbidity and mortality
Vitamin A deficiency • All age groups • Young children • Pregnancy	• Loss of epithelial integrity and xerosis of mucous membranes • Ocular manifestations: night blindness, Bitot's spots, xerophthalmia, leading to corneal xerosis, ulceration and blindness • Increased susceptibility to infections • Increased morbidity and mortality, specially from infections • Resorption or abortion, birth defects • Infant born with a handicap of low reserves

Iodine deficiency • Children • Pregnancy	• Goitre, impaired school performance and lower intelligence quotients • Maternal hypothyroidism Still births, abortions, congenital abnormalities endemic cretinism
Zinc deficiency • Children • All age groups • Pregnancy	• Stunting, growth retardation and hypogonadism • Increased risk of infection and childhood morbidity and mortality • Poor appetite, impaired taste acuity • Dermatitis, diarrhoea, alopecia • Neuropsychiatric disorders • Maternal zinc deficiency affects pregnancy outcome
Folate deficiency • During pre-conception period • All age groups	• Neural tube defects in newborn • Megaloblastic macrocytic anaemia • Accumulation of homocysteine a risk factor for: - cardiovascular disease - age-related cognitive impairment - increased risk of colorectal cancer
Vitamin B12 deficiency	• Megaloblastic macrocytic anaemia • Sub acute combined degeneration of nerve cord • Accumulation of homocysteine a risk factor for: - cardiovascular disease - age-related cognitive impairment
Vitamin D deficiency • Children • Adults, specially elderly	• Rickets • Osteomalacia • Increases risk of obesity, type of 2 diabetes, cardiovascular disease, autoimmune diseases and cancer

Annexure 2

2.1 Current National strategies to prevent micronutrient deficiency in Sri Lanka

Following the 1990 World Summit for Children (United Nations, 1990), the government of Sri Lanka made a commitment to reduce micronutrient deficiency by the year 2000. A national strategy and plan of action for the prevention and control of anaemia in pregnancy was developed in 1994 with the focus on four main strategies, namely, information, education and communication (IEC) to achieve dietary modification, supplementation with two tablets of iron (60 mg elemental iron) and folic acid (400 μg) combined or separate, and 1 tablet of ascorbic acid (100 mg) to be taken once daily, clinical examination for pallor and control of helminthic infections with one course of mebendazole after the first trimester of pregnancy (Policy document, Ministry of Health 1994). Educational leaflets, posters and booklets were developed highlighting the importance of iron, consequences of iron deficiency and strategies for preventing iron deficiency. Later a strategy for the control of anaemia in Sri Lanka was developed to cover all age groups (Ministry of Health and Indigenous Medicine, 1999).

As the national survey on vitamin A status conducted in 1996 (MRI, 1998) showed that the prevalence of subclinical vitamin A deficiency was 36.6%, indicating a public health problem, a national policy for control of vitamin A deficiency in Sri Lanka was developed by the Nutrition Division, Ministry of Health (Policy document, Ministry of Health, 1999). It involved food based approaches and supplementation with a high dose of vitamin A (100,000 IU orally). For children < 5 years supplements were given at 9 months with measles immunization and at 18 months and 3 years, while school children were given supplements at years 1, 4 and 7 at school medical inspection and women were given 200,000 IU orally within two weeks after delivery. The second national survey (MRI, 2006) showed that there was no marked reduction in the prevalence of subclinical vitamin A deficiency (serum vitamin A <20 μg/dl) despite several years of supplementation with high dose vitamin A. Further, the mean serum vitamin A level was

low when the interval between supplementation was wide. Hence the supplementation schedule was revised so that supplementation commences at 6 months of age and is continued every 6 months up to 5 years (Ministry of Healthcare and Nutrition, 2009). There was no change in the schedule for postpartum supplementation. National data on vitamin A status is not yet available to ascertain the impact of the revised supplementation schedule.

The Government of Sri Lanka (GoSL) endorsed the recommendations made by WHO and UNICEF for virtual elimination of iodine deficiency disorders as a public health problem by the year 2000 (National Nutrition Plan of Action, 1997). USI was launched in 1995 and mandatory salt iodization at a level of 25 ppm was enforced by introducing legislation preventing sale of non-iodized salt. A survey carried out by the MRI/UNICEF (2006) showed that the total goitre rate in children 6-10 years has decreased from 18.0% to 3.8% (Figure 4), while urinary iodine levels >100 μg/L in all provinces and 91.2% of households had adequately iodized salt. Later the iodide content of salt was reduced to 15 ppm and the total goitre rate in children 6-10 years was 4.4% in the 2010 survey. It is important to note that only 68% of households had adequate iodized salt, indicating the need to maintain quality of iodized salt. Further, the median urinary iodine level in pregnant women (113.1μg/L) was low suggestive of inadequate intake.

A review of national strategies to prevent micronutrient deficiency is given in Table 3.

Table 3. Current micronutriment supplementation programmes in Sri Lanka

Micronutrient	Existing strategy	Composition	Duration
1. Pregnant and lactating women			
Iron	All pregnant women and lactating mothers	60 mg of elemental iron daily	During second and third trimesters and continue for 6 months during lactation
Iron	All pregnant women diagnosed with anaemia	120 mg of elemental iron	Until haemoglobin concentration rises to normal and continue the same dose for 3 months after which standard antenatal dose should be given to prevent recurrence of anaemia.
Folic acid	All pregnant women and lactating mothers	400 μg daily (available tablet strength 1 mg)	Throughout pregnancy and continue for 6 months during lactation
Ascorbic acid	All pregnant women and lactating mothers	100 mg daily	During second and third trimesters and continue for 6 months during lactation
Calcium	All pregnant women All lactating mothers	600 mg daily 300 mg daily	Starting from 13th week of gestation and during first 6 months of lactation
Vitamin A	All post-partum women	200,000 IU once	Within two weeks of delivery
Thriposha	All pregnant women and lactating mothers	50g daily	Throughout pregnancy and continue for 6 months during lactation
2. Children < 5 years of age			
Vitamin A	All children	100,000 IU every 6 months	Starting from the age of 6 months to 5 years
MMN powder	All children (except low birth weight & preterm)	One sachet daily	Starting from 6 months for 60 consecutive days at 6, 12, and 18 months

Iron	Infants on completion of 6 months of age who do not receive MMN	10-12.5 mg/day once daily	Starting from 6 months for 3 months (1 hour before or 2 hour after meal)
	All Low birth weight children (birth weight <2500g) and preterm children	3mg/kg/day once daily	Starting from 2 weeks continue iron supplementation up to 2 years
Multivitamin drops	All Low birth weight children (birth weight <2500g) and preterm children	0.3ml/Kg/day once daily	Starting soon after birth continue till completion of 2 years
Folic acid	All Low birth weight children (birth weight <2500g) and preterm children	500 microgram once weekly 1mg once weekly	Starting soon after birth continue till completion of 1 year Starting from one year till completion of 2 years of age
Zinc	All children with diarrhoea	10-20mg	Starting with onset of diarrhoea and continued for 10-14 days
Thriposha	All underweight children from 6 months of age to 5 yrs	50g daily	Until weight come to normal and continue the same dose for 3 months to prevent recurrence of underweight.
3. School children and adolescents			
Iron	All children in grades 1 to 13	60mg elemental iron once a week	6 months per annum continuously
Folic acid	All children in grades 1 to 13	400 µg once a week	6 months per annum continuously
Ascorbic acid	All children in grades 1 to 13	100 mg once a week	6 months per annum continuously
4. Pre pregnant women			
Folic acid	All pre-pregnant women	400 µg once a day	Starting 6months prior to planned pregnancy

Table 4. Review of national strategies to prevent micronutrient deficiency

Focus of strategy	Strategies	Comments
Strategy for the control of anaemia in Sri Lanka (Ministry of Health and Indigenous Medicine, 1999)	• Dietary diversification, nutrition education and fortification • Supplementation with iron, folic acid and ascorbic acid for: children 6-59 monthsprimary school children pregnant mothers women of childbearing age	• Educational leaflets, posters, booklets developed • Supplementation programme not implemented for children 6-59 months • Nutrition and Food security survey (2010) - 87.4% of pregnant mothers received supplements - 85.9% claimed to have taken daily
Control of vitamin A deficiency (Ministry of Health, 1999)	Food based approaches to increase intake and enhance absorption Supplementation: • Children < 5 years: 100,000 IU orally at 9 months with measles immunization, at 18 months and at 3 years • School children; 100,000 IU orally at years 1,4 and 7 with school medical inspection • Postpartum: 200,000 IU orally for women within two weeks after delivery	• Educational leaflets, posters, booklets developed but, effectiveness not evaluated. • National survey of children <5 years of age MRI (2006): Vitamin A deficiency continues to be a public health problem as percentage with serum vitamin A <20 μg/dl had decreased only to 29.3%. • Coverage reported by mothers was only 66%. The consumption of vitamin A rich foods had not reached the acceptable level

Control of vitamin A deficiency (Ministry of Health, 2009)	Revised supplementation schedule for children under five years • 6 months: single dose of 100,000 IU orally and continued every 6 months upto the age of 5 years • Postpartum: 200,000 IU orally within 4 weeks after delivery • School children; 100,000 IU orally at years 1,4 and 7 with school medical inspection	• % estimated infants given vitamin A high dose at 6 months – 71.9% • % estimated children given vitamin A high dose at 18 months – 74.9% • % estimated children given vitamin A high dose at 3 years – 74.5% • % of mothers receiving vitamin A megadose for reported deliveries – 93.3% • % of estimated mothers who received megadose of vitamin A – 74.1% Source: Family Health Bureau (FHB) 2015]
Iodine deficiency control programme	• Mandatory salt iodization with KIO_3Iodine content of salt: 25 ppm • Iodine content of salt: 15 ppm	• Total Goitre Rate (TGR) in children 6-10 years decreased from 20.1% to 3.8% • 91.2% of households had adequately iodized salt (Source: MRI/UNICEF 2006) • TGR in children 6-10 y: 4.4% Only 68% of households had adequately iodized salt (Source: MRI/UNICEF 2010) • TGR in children 6-12 y: 1.9% Only 79% of households had adequately iodized salt (Source: MRI/UNICEF 2016)

Annexure 3

3.1 Nutrition Education and Behaviour Change Communication

Nutrition education and Behaviour Change Communication (BCC) play a key role in conveying nutrition related information to bring about desirable practices and achieve a satisfactory micronutrient status and maintain health.

Issues to be considered in educational intervention:

- General nutritional status and knowledge, attitudes and practices
- Age, educational level, socioeconomic status and women's empowerment - gender equity
- Living conditions and sanitation
- Living in urban or rural area and land availability

Educational messages:

- Should be clear, simple, concise, uniform and not confusing
- General messages should be modified to have special relevance to each target group
- Should focus on:
    - importance of the key micronutrients
    - causes and consequences of micronutrient deficiency in different age groups
    - benefits of maintaining a satisfactory nutritional status
    - importance of dietary diversification to achieve micronutrient adequacy
    - how to optimize utilization of resources to achieve micronutrient adequacy
- Educational materials (pre-tested in a similar population) can be:
    - flip charts, posters, leaflets, booklets, newspapers, media campaigns
    - CDs and DVDs, displayed on TV, internet
    - special targeted educational programmes at clinics, other meeting places

- Educators:
    - Public health workers and curative sector health workers (eg. Paediatricians, Obstetricians and Gynaecologists, Physicians, General Practitioners, Medical officers)
    - peers, young adults, specially school leavers
    - Village leaders.

Behaviour change communication (BCC) which is an effective approach to ensuring compliance should be reinforced. Nutrition education in schools should not only be examination oriented, but also focus on behavioural changes. The education programmes should be properly planned, monitored and evaluated regularly.

Annexure 4

4.1 Food based approaches to improve micronutrient status

a. Dietary diversification

Most micronutrients have common sources and dietary diversification and modification have the potential to prevent deficiencies of many co-existing limiting micronutrients simultaneously. Including a variety of foods would ensure that all required micronutrients are provided in the diet.

To achieve dietary diversity increase availability of a variety of foods by:

- improving livestock, fisheries and agricultural practices and trade
- promoting home gardening and urban agriculture

Promote behaviour change to:

- achieve desirable change in food habits
- diversify the diet
- food preparation to decrease losses of micronutrients
- Improve method of reduce intake of micronutrient-poor energy dense processed foods

Dietary sources of micronutrients and factors affecting their absorption are summarized in Table 4.

Nutrition education should be food based, rather than nutrient based and should highlight food sources that provide several micronutrients rather than single micronutrients. It is necessary to develop nutrition education materials which focus on the following:

- benefits of micronutrient adequacy
- common food sources of micronutrients
- combining foods to increase bioavailability
- methods of food preparation to minimize nutrient losses.

The information given in Table 5 could be utilized for this purpose.

Table 5. Food sources and factors affecting bioavailability and stability of micronutrients

Micronutrients	Sources	Factors affecting bioavailability and stability
Iron, zinc	• Meat, poultry, fish (including small fish, dried fish eg. sprats) • Legumes, leafy vegetables, cereals	• High bioavailability • Lower bioavailability Absorption increased by: - acidic substances eg. ascorbic acid, citric acid - animal proteins in same meal - soaking, fermentation, germination - avoiding tea, coffee and calcium supplements within 1 h of meal
Vitamin A	• Preformed vitamin A - animal foods eg. liver, eggs, milk & milk products • Carotenoids – yellow fruits & roots, leafy vegetables	• Fat in the same meal increases bioavailability • Bio-accessibility of carotenoids in vegetables increased by chopping & mild cooking
Iodine	• Iodised salt, sea fish, water	• Cyanogenic glucosides (excessive intakes of cruciferous vegetables and manioc) can form thiocyanate which inhibits absorption of iodide
Folate	• Liver, green leafy vegetables, legumes, some fruits	• Bioavailability is nearly half that of folic acid • Food folates are relatively unstable to heat and oxidation, and large losses can occur during food preparation chopping and grinding increases bioavailability • Ascorbic acid increases stability • Boiling destroys 50-80% of folate in green vegetables and 50% of folate in legumes
Vitamin B12	• Animal source foods - milk & milk products, eggs, meat, fish, poultry	• Reduced absorption when gastric acid secretion is decreased

Vitamin D	• Requirement met mainly by endogenous synthesis on exposure to sunlight • Liver, oily fish, egg yolk, butter, fortified foods	• Fat in the same meal increases bioavailability
Calcium	• Milk and milk products, small fish eg. sprats, legumes and dark green leafy vegetables	• Gastric acidity or acidic foods promote absorption • Phytates (cereals, pulses), oxalates (spinach) - decrease absorption

b. Food fortification

Food fortification with micronutrients refers to the addition of one or more micronutrients to food and is an important and proven strategy to reduce and prevent micronutrient deficiency of a population at a very reasonable cost. The choice of a fortificant that is well absorbed and does not affect the sensory properties & which does not alter the quality of foods is important. Also, it is preferable to use food vehicles that are centrally processed and to have the support of the food industry. A trial of fortification of wheat flour with electrolytic or reduced iron in the estate sector of Sri Lanka did not result in a significant reduction in the prevalence of anaemia (Nestel et al., 2004). The success of fortification depends mainly on the choice of the fortificant and the vehicle used for fortification.

Table 6. Food fortification to prevent micronutrient deficiency

Method of fortification	Selection of micronutrient (s)	Vehicle (s)	Fortificant	Examples of fortification
Mass fortification for general population Mandatory or voluntary	deficiency of micronutrient (s) is highly prevalent Iron, iodine, vitamin A	Staple food: rice/rice flour, wheat flour Condiments, oils, salt, sugar etc.	Fe -NaFeEDTA - high bioavailability, stability and organoleptic properties[1] KIO_3 is preferred to KI for salt iodization as its more stable[1] Retinyl acetate or palmitate	Wheat flour fortified with iron, folic acid, zinc Salt fortified with iodine, iron Sugar, margarine, oils with vitamin A
Targeted fortification for foods eaten by a subgroup of the population	Children < 5 years Older children emergency feeding and displaced persons	Complementary foods School meals Biscuits	MMN powder[2] Microencapsulated ferrous fumarate sprinkles[3]	[2]Home fortification of complementary food [3]Home fortification of complementary food with iron in Galle district
Market-driven fortification	Food manufacturer takes initiative to add specific amounts of one or more micronutrients to processed foods	Bread, noodles margarines, breakfast cereals commercial complementary foods milk products	Calcium phosphate, $CaCO_3$, KIO_3, Ferric pyrophosphae, Retinyl palmitate	Flour, bread fortified with iron, calcium Margarines fortified with vitamins A,D Multiple micronutrient fortified cereals
Biofortification	Micronutrient deficiency is highly prevalent	Selective breeding and genetic modification of plants to improve their nutrient content and/or absorption eg. iron-rich rice: not commonly available, carotene-enriched rice: golden rice, carotene-enriched sweet potato		

[1]Silva KDRR. Report on Evaluation of Thriposha Food Supplementation Programme 2008
[2]MRI, WFP & UNICEF. Nutrition and Food Security Survey Report Sri Lanka 2010
[3]Data provided by Sri Lanka Thriposha Ltd (2015)
[4]Data provided by Nutrition Coordination Division, Ministry of Health (2015)

d. Micronutrient supplementation in different stages of the life cycle

i. Pregnancy and lactation

Iron deficiency and folate deficiency to a lesser extent, are major factors contributing to anaemia in pregnancy. Iron and folic acid supplementation to reduce risk of low birth weight, maternal anaemia and iron and folic acid deficiency, is an important component of the maternal care programme in Sri Lanka. In addition, screening of all pregnant women for anaemia at antenatal and postnatal visits, use of complementary measures to control and prevent anaemia (hookworm control, malaria control), and a referral system to manage cases of severe anaemia is included in the maternal care programme. The implementation of a behaviour change communication programme is vital to communicate the benefits of the intervention and management of side effects.

The World Health Organization has provided guidance on the effectiveness and safety of different schemes of iron and folic acid supplementation in pregnant women as a public health measure to improve pregnancy outcomes (WHO, 2012a). Delayed umbilical cord clamping is also an effective strategy to prevent iron deficiency in infancy (WHO, 2012b). Vitamin A supplementation during pregnancy for the prevention of maternal and infant morbidity and mortality is not recommended as part of routine antenatal care in Sri Lanka, in agreement with the recommendation by the WHO (2011). Table 7 gives the WHO recommendations (2012) and the practice in Sri Lanka.

Table 7. Recommendations made by the WHO (2012) and the practice in Sri Lanka

	WHO recommendation	**Practice in Sri Lanka**
Supplement composition	Iron:30-60mg of elemental iron Folic acid: 400µg	Iron: 60mg of elemental iron (as ferrous sulphate or ferrous fumarate) Folic acid: dose to be reduced to 400 µg from 1 mg Ascorbic acid100 mg
Frequency	One supplement daily	One supplement daily
Duration	Throughout pregnancy Iron and folic acid supplementation should begin as early as possible	Iron and ascorbic acid: during second and third trimesters and continue for 6 months during lactation Folic acid: Throughout pregnancy and continue for 6 months during lactation
Supplement composition	1.5-2.0 g elemental calcium /day as part of antenatal care starting from 20 wks of gestation	600mg of calcium (two 300 mg tablets) daily during pregnancy starting from 13th week of gestation 300 mg of calcium during first 6 months of lactation
Frequency	One supplement daily	One supplement daily
Duration	From 20 weeks of gestation	from 13th week of gestation
Target group	All pregnant adolescents and adult women	All pregnant women and lactating mothers during first 6 months
Settings	All settings	All settings

In addition, anthelminthic therapy (mebendazole100 mg, twice daily for 3 days) is given to all pregnant women with the commencement of iron-folic acid, vitamin C and calcium supplementation in the second trimester of pregnancy (Ministry of Health, 2014).

- If a woman is diagnosed with anaemia [haemoglobin (Hb) <11g/dl] in a clinical setting, it is recommended that she should be treated with daily dose of 120mg of elemental iron (therapeutic dose) and folic acid 400 µg until her haemoglobin concentration rises to normal and continue the same dose for 3 months after which standard antenatal dose should be given to prevent recurrence of anaemia.

- Considering the food consumption pattern in Sri Lanka (consumption of calcium rich foods such as green leafy vegetables, small fish, grains and yams and the calcium content in drinking water), it has been recommended to supplement with 600mg of calcium daily during pregnancy starting from 13th week of gestation with the objective of prevention of pre-eclampsia and bone demineralization of mother and enhance bone mineralization of the foetus.

ii. Infancy and early childhood (6 to 59 months of age)

Micronutrient deficiencies, especially deficiencies of iron and vitamin A and possibly zinc and folic acid have been shown to be major problems during infancy and early childhood. Iron deficiency even without anaemia can lead to impaired motor and cognitive development and lower physical activity and increased susceptibility to infection. Even subclinical micronutrient deficiencies can have adverse consequences and cause irreversible damage to the young child. Hence it is necessary to ensure satisfactory micronutrient status during infancy and early childhood. Home fortification of foods with micronutrient powders containing at least iron, vitamin A and zinc is recommended by the WHO (2011).

Information regarding breastfeeding, complementary feeding, dietary diversity and information on nutrient supplementation is included in the Child Health Development Record (CHDR) wall charts, leaflets, booklets on child feeding are available for caregivers and flashcards on infant and young child feeding are available for healthcare workers.

Table 8. WHO and the Sri Lankan recommendations for micronutrient supplementation for children < 5 years of age

Micronutrient	WHO/UNICEF recommendation	Practice in Sri Lanka	Preparation available in the government sector
Vitamin A	100, 000 IU at 6 months & 200,000 IU from one year onwards twice/year	100,000 IU every 6 months from the age of 6 months to 5 years	Retinyl palmitate: 100,000 IU soft gel capsules
MMN powder	12.5mg of iron, 5mg Zn, 300ug of Vitamin A:minimum of 2 months supplementation with 3-4 months off supplementation Use of MMN is started every 6 months	The same – Daily supplementation for children in the age group 6-23 months for 60 consecutive days at 6, 12, and 18 months.	Purchased by GoSL (through UNICEF procurement services) with a composition of 10 mg iron, 4.1 mg Zn, 400 μg vitamin A and 12 other micronutrients
If MMN is not available Elemental iron	10-12.5mg/daily, three consecutive months in a year	Infants 6-9 months of age: 10-12.5mg/daily (1 hour before or 2 hour after meal) for 3 months from the age of 6 months	Syrup containing: 50 mg /ml (0.3 ml) or 25mg/ml (0.6 ml) provided by MSD
Elemental iron	Preterm and LBW babies (POA <37 weeks and/or < 2.5kg birth weight)	Infants from 2 weeks to 6 months of age 3mg/kg/ day until completion of 6 months, and continue iron supplementation upto 2 years	Syrup containing: 50 mg /ml (0.3 ml) or 25mg/ml (0.6 ml) provided by MSD

$ZnSO_4$ (during diarrhoea)	10 mg daily for 10-14 d for infants < 6 months 20 mg daily for 10-14 d for infants 6 months to 1 year and children 1-5 y	The same Started with onset of diarrhoea and continued for 10-14 days	$ZnSO_4$ 20 mg water dispersible tablet
Iodine	Use of iodized salt or 90 μg/day as a daily supplement or 200 mg per year as single dose of iodized salt	Use of iodised salt for children above one year of age	Iodized salt

Anthelminthic therapy: Mebendazole (500 mg chewable tablet) single dose at 18 months and every 6 months thereafter until 5 years in the 3 provinces with estates and in other six provinces at 18 months and 2,3,4,5 years

Evaluation of the programme for home fortification with multiple micronutrient (MMN) powder

Home fortification with MMN powder is being carried out among children 6-23 months of age in 13 vulnerable districts. However, evaluation of this programme during the period 2009-2012 revealed only 45% had ever received the MMN powder in these areas and the majority (85%) had received it between 6-12 months of age and only 34.7% of children had received the MMN powder either daily or every other day as recommended (Senarath et al., 2015). A significant reduction in the prevalence of anaemia (by 11.7%) was noted among children who ever received the MMN powder when compared with those who did not receive it, but there was no significant improvement in iron status.

In another study, compliance and practices of multiple micronutrient supplementation was assessed among mothers of 6-24 months old children in 13 districts (Dhanapala et al., 2015). In this study, 53.2% had received MMN powder within the last 6 months and the major reason (57.7%) for not receiving it within the past 2 months was non-availability with the PHM and a further 14.9% did not know about MMN powder. Among mothers who received the MMN powder 5% did not give it during the past 2 months. Among children aged 19-

21 months, only 16.7 % of the children had received MMN at the scheduled ages of 6, 12 and 18 months. Forty percent of mothers reported beneficial effects among children following intake of MMN powder and these include weight gain (58%) and being active (26%). Twenty one percent of mothers complained of issues after giving MMN and the reasons given were children did not like it and vomiting.

These two studies highlight the need to increase availability and reinforce the education component to increase compliance and minimize issues.

iii. School children and adolescents

In a study among school children in Sri Lanka, weekly iron supplementation given under supervised conditions was as effective as daily supplementation (Jayatissa and Piyasena, 1999). The Ministry of Health has commenced a weekly iron-folic acid supplementation (WIFS) programme in schools for children in grades 1-13 with the objective of ensuring a satisfactory iron and folate status among children. The WHO recommendation for intermittent iron supplementation for children 5-12 years and the Sri Lankan recommendation for all school children is given in Table 8.

Table 9. WHO recommendation and the practice in Sri Lanka for intermittent micronutrient supplementation for school children

	WHO recommendation	Practice in Sri Lanka[1]
Target group	School-age children (5–12 years)	School children in grades 1 to 13
Supplement	45 mg of elemental iron	$FeSO_4$: 200 mg (60 mg elemental iron) + Folic acid 1 mg + Ascorbic acid 100 mg
Supplement form	Tablets/capsules	Tablets
Frequency	One supplement per week	Once a week
Duration and time interval between periods of supplementation	3 months of supplementation followed by 3 months without supplementation after which the provision of supplements should restart If feasible, intermittent supplements could be given throughout the year	6 months per annum continuously
Settings	Where the prevalence of anaemia in school age children is 20% or higher	Children in government schools
Supplement	Vitamin A 100,000 IU	School children in grades 1,4 and 7 at school medical inspection[2]

[1]The recommendations made by the Ministry of Health in 2012

[2]The recommendations by the Ministry of Health in 2015: Identification, treatment and follow up of micronutrient deficiency disorders to be carried out based on SMI detection.

All children are given one tablet of mebendazole before starting WIFS programme.

In Uva, Sabaragamuwa and Central Provinces where prevalence of helminthic infection is categorized as high risk, and for areas categorized as provinces with moderate risk of helminthic infection, a second dose of mebendazole (500 mg) should be given at the end of the 6 month. cycle of WIFS. Northern and Eastern provinces are included in this category.

iv. Non-pregnant women of childbearing age

In all national nutritional surveys conducted from 2001 to 2009 (Figure 1) the prevalence of anaemia was higher in non-pregnant women than in pregnant women, highlighting the need to improve their nutritional status and prevent anaemia before they enter the stage of pregnancy. A new package for "preconception care" has been piloted and introduced to the Family Health Programme in 2012.

The components of this programme include the following:

- registration of married couples by public health midwives
- educational sessions and a booklet which includes dietary approaches to improve micronutrient status and importance of folic acid supplementation

Intermittent iron and folic acid supplementation is recommended by the WHO (2011) as a public health intervention in areas where anaemia is a problem, to reduce prevalence of anaemia and improve their iron status (strong recommendation). The target groups are all menstruating adolescent girls and adult women.

Table 10. Suggested scheme for intermittent iron and folic acid supplementation in menstruating women (WHO 2011)

Supplement composition	Iron: 60 mg of elemental iron and Folic acid: 2.8 mg
Frequency	One supplement once a week
Duration and time interval between periods of supplementation	3 months of supplementation followed by 3 months of no supplementation after which the provision of supplements should restart. If feasible, intermittent supplements could be given throughout the school or calendar year
Target group	All menstruating adolescent girls and adult women
Settings	Populations where the prevalence of anaemia among non-pregnant women of reproductive age is 20% or higher

As there is limited evidence for the effective dose of folic acid in intermittent supplementation, the recommendation for folic acid dosage is based on the rationale of providing seven times the recommended daily supplemental dose during pregnancy.

v. Strategies to improve micronutrient status of adults, including vulnerable groups and the elderly

Improving the micronutrient status of adult males and the elderly has received little attention. A major factor leading to micronutrient deficiency among adults, especially males, is lack of dietary diversity. Information available in print and electronic media regarding good dietary habits should have greater focus on achieving micronutrient adequacy. Improving the micronutrient status of more vulnerable groups such as, urban poor, institutionalized adults (eg. prisoners) and people living in the estate sector requires greater attention.

In the elderly, reduced access and intake of foods from animal sources, individual taste preferences and health problems limit the intake of micronutrient rich foods. Further, vitamin D deficiency is a cause for concern in the elderly, because of limited exposure to sunlight and reduced endogenous synthesis. Elderly are also at risk of vitamin B12 deficiency because of reduced intake of animal products and also impaired absorption due to atrophic gastritis which is common among the elderly. Motivating and increasing access of elderly to a variety of foods, specially, animal products (milk or milk products for vegetarians) and fortified foods are important.

Recent work suggests that deficiencies of several minerals and vitamins e.g. calcium, vitamin D, folic acid and vitamin B12 increase risk of non-communicable diseases. Vitamin D and calcium deficiency are major problems among the elderly. In addition to increased risk of fractures, falls and functional impairment, vitamin D deficiency also increases risk of obesity, type 2 diabetes, cardiovascular disease and some types of cancers. Deficiencies of folic acid, vitamins B12 and B6 lead to hyperhomocystinaemia, which predisposes to cardiovascular disease and decline in cognitive function.

vi. Micronutrient programmes for individuals exposed to natural disasters, or internally displaced persons and refugees from other countries

There is no separate programme to address micronutrient deficiency in these subjects and the foods and supplements distributed should provide sufficient energy and both macro and micronutrients. The food supplementation programmes to provide micronutrient-rich food supplements eg. Thriposha, should be reinforced. There should be screening programmes to correct specific micronutrient deficiencies for people who have been displaced for long periods. A guideline on feeding infants and children 1-5 years in emergency situations is available (Family Health Bureau, Ministry of Health, 2009) and it emphasizes the importance of breast feeding and inclusion of animal foods, pulses and vegetables in complementary foods. In addition, giving a high dose of vitamin A (100,000 IU) initially to children <5 years and continuing supplementation every six months until they move to permanent accommodation has also been recommended.

Blanket iron supplementation has been recommended to displaced persons and refugees (Strategy for prevention of iron deficiency, 1999). In addition, giving a high dose of vitamin A to children, or adults with clinical manifestations of vitamin A deficiency, has also been recommended (Policy document, Ministry of Health, 1999).

Annexure 5

Logistics, monitoring and evaluation of the supplementation programmes

5.1 Logistics

- Annual estimates are prepared by the Family Health Bureau based on the district birth rates.
- Micronutrients are procured through the Medical Supplies Division of the Ministry of Health following government procurement procedures.
- The total expenditure for micronutrients is obtained from the Government of Sri Lanka.
- Annual estimates are made by the FHB and micronutrients are distributed to Regional Medical Supplies Divisions (RMSDs) at the district level and line Ministry institutions/hospitals.
- The distribution system is monitored by obtaining quarterly reports.
- For $ZnSO_4$, the respective curative institutions should calculate annual estimates and directly request from RMSD/MSD depending on whether it is a line ministry institution or not.

Activities to improve effectiveness of the micronutrient supplementation programme:

- A system for regular reporting of stock positions of micronutrients at various levels of the delivery system need to be introduced (to determine whether stocks are adequate, insufficient or excessive); possibly linked to the existing mechanisms for other commodities such as contraceptives.
- A system should be setup to collect information from the RMSDs whether the requirements were distributed to Medical Officer of Health (MOH) offices, hospitals etc.
- Conditions for storage of supplements should be stated and specific provisions need to be made to ensure proper storage of micronutrients to retain their quality and prevent oxidation/ deterioration.
- Micronutrient supplements prescribed need to be issued in correct quantities together with proper instructions regarding storage and use.
- Regular random checks on testing quality of samples available at healthcare centres are necessary.

5.2 Monitoring and evaluation

5.2.1 Pregnancy and lactation

Routine consumption must be recorded in pregnancy record: H512`A and H 512B.The stock maintenance books need to be maintained at the each level.

The following indicators are used to monitor the supplementation programme:

Process indicators:

1. Percentage of pregnant women who were screened for anaemia
2. Percentage of pregnant women who have received iron, folic acid and calcium for 6 months during pregnancy
3. Percentage of pregnant women who have received folic acid from registration for ANC up to 12 weeks
4. Percentage of pregnant women who received anthelminthic therapy
5. Percentage of anaemic pregnant women who received double dose of iron supplement as per guideline
6. Percentage of lactating women who have received micronutrient supplements at least once during first 6 months after delivery
7. Percentage of lactating women who have received micronutrient supplements at least for three months during first 6 months after delivery
8. Percentage of lactating women who have received micronutrient supplements for six months during first 6 months after delivery

Outcome indicators:

1. Percentage of pregnant women who were anaemic at 28 weeks of gestation
2. Percentage of infants who are anaemic at 4-6 months
3. Incidence of neural tube defects among newborns

Activities to increase effectiveness

1. Regular review of data on process and outcome indicators is necessary to identify areas where implementation of the programme is not satisfactory and remedial action should be taken.
2. More frequent review of above data is necessary in vulnerable areas.
3. Quality of samples of supplements collected at random from antenatal clinics in different areas should be checked regularly for oxidation/stability.

5.2.2 Children less than 5 years of age

Micronutrient supplementation and de-worming should be recorded in the CHDR (For vitamin A, MMN and de-worming special cages are included in the CHDR to mark when those were given) and the information entered in to the routine Health Management Information System (HMIS).

The Family Health Bureau receives relevant information from the MCH Return (H509), annual data sheet and from routine MCH reviews and nutrition reviews. Impact of supplementation is obtained by special surveys such as DHS, MRI surveys etc. Clinical assessment of nutrition deficiencies are carried out at routine clinic visits by the MOHs and recorded in the CHDR. However, this information is not included in the routine HMIS at present and provision should be made to include it.

Process indicators

1. Percentage of children under the age of five years who had received vitamin A at selected ages – 6,12 and 18 months and 2, 3 and 4 years.
2. Percentage of children under the age of five years who had received Mebendazole at selected ages – 18 months and 2, 3 and 4 years .
3. Percentage of infants receiving MMN at the completion of 6 months.
4. Percentage of infants receiving MMN at the completion of 12 months.
5. Percentage of children receiving MMN at completion of 18 months.
6. Percentage of children aged 1-5 years who received one dose of vitamin A in the preceding 12 months.

7. Percentage of children aged 1-5 years who received 2 doses of vitamin A in the preceding 12 months.
8. Percentage of children aged 2-5 years who received 2 doses of Mebendazole in the past year (Uva, Sabaragamuwa, Central Provinces)
9. Percentage of children aged 2-5 years who received 1 dose of Mebendazole in the past year (other 6 provinces)

(collected through H 509 and annual data sheet):

Outcome indicators

1. Percentage of children under the age of five years with vitamin A deficiency
2. Percentage of children aged 6-59 months who are anaemic

(obtained through special surveys – DHS, MRI etc):

5.2.3 School children

Information regarding WIFS is included under Health education in the school curriculum.

Process indicators

1. Data regarding compliance, side effects etc, are collected in a form given to teachers in each school.
2. Health education sessions are conducted by health staff and screening for micro nutrient deficiency disorders at School Medical Inspection among all students in grades 1, 4, 7,10. Children are empowered to identify, monitor and intervene in their own micronutrient deficiencies and this aspect is included in the health education programme.

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