

## Childhood Malnutrition in Sri Lanka: Past, Present and Future

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The current economic downturn in Sri Lanka has affected the nutritional status of all, including children. This is related to scarcity of food, reduced purchasing power due to increase in prices of food and reduced earning capacity of individuals. The

topic of child malnutrition received widespread news coverage recently with many stake holders, in health, policy and political spheres expressing views and suggesting remedies.

Effects of current economic scenario on nutrition of children would be both immediate and long term. Immediately it could affect the rates of wasting and in the long run it could increase stunting rates. However, this is on the part of macronutrient deficiency, but the impact of micronutrient deficiency could be

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higher especially in the long-term resulting in poor neuro cognitive development, school performance and susceptibility to infections.

Unpublished island wide data from the third quarter of 2022 indicates that there is increase in wasting to 20.2% with Severe Acute Malnutrition(SAM) increasing to 2.7% in the under-five group(personal communication R. Jayatissa). (Table) Further in the 5 – 9-year-old category, thinness has increased up to 25.5% with slight reduction in overweight (4.6%) and obesity (2.9). In 10–17-year-old adolescent group, thinness has increased up to 25% with a reduction in overweight (7.8%) and obesity (3.9%) compared to last quarter of 2021.

The contemporary discussion around child malnutrition in Sri Lanka calls for a more detailed review of the topic

### Historical context

Sri Lanka's economic development raised it to a lower-middle income country (LMIC) by 2015. This was parallel to improved health and social conditions evident by improved female literacy, life expectancy, infant mortality, maternal mortality, nutritional status and living conditions.

Introduction of open economy in 1977 accelerated this socio-economic, cultural, and health-service-related transitions. These transitions moved Sri Lankans from a traditional indigenous starch-based unrefined diet to a fat, protein and sugar-rich, refined, processed food consuming society. People began to consider use of such imported food as a status symbol, while shedding a side healthier traditional practice. These socioeconomic transitions transformed the mindset of the society which depends more on imported processed food rather than locally cultivated and produced traditional food thus discouraging local cultivation and production. Socio-economic and information technological advances

and urbanization increased sedentariness, and along with the newly acquired food habits gave rise to obesity and related cardio-metabolic diseases across all ages. Although communicable diseases, which has a clear relationship to undernutrition, is well controlled, the increasing obesity rates led to an increase in non-communicable diseases(NCD) burden, which is responsible for more than 80% of deaths with 17% being at risk of premature death between 30-70 year of age.<sup>1</sup>

Since independence, undernutrition rates have been very high, and almost half of the under-five population had been suffering from underweight and stunting by 1975.

Thereafter, a gradual decline in undernutrition was seen over next quarter of a century coinciding with the socio-economic transformation seen in the country. But since the turn of the century, it has plateaued. Sri Lanka, while has improved many health indices has failed to improve on its undernutrition levels beyond this level. Sector wise analysis spanning between the last two DHS surveys (2006 and 2016) have shown that wasting had been similar in all three sectors, urban, rural and estate.<sup>2</sup> Stunting has improved in all sectors during the last two DHS surveys, but prevalence has been almost twice as high as in the estate sector compared to urban and rural sectors.

2016 DHS survey showed that moderate acute malnutrition(MAM) (WHZ<-2) to be 12.1% while severe acute malnutrition (WHZ<-3) to be 3.0% in under five years and stunting( HAZ<-2) was 17.3% while 4.1% were severely stunted (HAZ<-3).<sup>3</sup> Island wide survey done on children older than 6 months during last quarter of 2021, in the post-COVID era but before the economic downturn, showed prevalence of wasting to be 13.2%, SAM to be 1.7% and over weight (WHZ>+2) 1.2% in 6-59month old group.<sup>4</sup> Similarly stunting was 12.7%, with severe stunting being 2.1%. The prevalence of underweight, was 17.7%, and overweight being 1.5%. In

**Table:** Childhood malnutrition in Sri Lanka over the years

	1975-76#	1977-78#	9280-88#	1987#	1993#	1995-96#	2000#	2006#	2016#	2021 Dec <sup>5</sup>	2022 Sep*
<b>Underweight</b>	57.3	54.3	43	37.3	33.8	29.3	22.8	21.1	20.5	-	-
<b>Stunting</b>	49.9	44.6	36.2	27.3	29.7	26.1	18.4	17.3	17.3	12.7	14.0
<b>Wasting</b>	13.9	13.9	11.5	11.5	17.5	15.3	15.5	14.7	15.1	13.2	20.2

Source: # WHO. World health organization - noncommunicable diseases (NCD) country profiles, 2018: WHO; 2018 [available from: <https://www.who.int/publications/m/item/noncommunicable-diseases-lka-country-profile-2018>]; \$Jayatissa R, Marasingha, W. Nutrition status and gaps in the diet of Sri Lankans during the pre-economic crisis period: Department of Nutrition Medical Research Institute Ministry of Health in collaboration with WHO & UNICEF; 2022; \*(personal communication Jayatissa, R.; unpublished MRI data).

this age group about a fifth of the population had at least one nutritional disorder.

In the 5-9-year age group stunting was 7.1% and thinness 20.9%. Overweight 5.0% and obesity being 7.6%, with higher prevalence in the older age group (7 to 9.9-year group)(4). In the adolescent group(10-17 yrs) 14% stunting and 21.3% thinness was recorded with overweight being at 10.5% and obesity 8.2%.<sup>4</sup> Therefore, it could be seen that while undernutrition was coming down and had plateaued, over nutrition has increased paving the way to a new disease pattern in the country beginning from younger age. Although nationally representative data does not exist on communicable disease risk in children in Sri Lanka, smaller studies confined to urban and suburban settings have shown a rise in NCD risk from younger age. A 5-15 year old healthy cohort of 920 children from Colombo district showed 15.1% having hypercholesterolemia and 3.9% having hypertriglyceridemia.<sup>5</sup> Almost a quarter of the children had low HDL-c. A third of this normal population had at least one abnormal obesity related metabolic risk factor and 1.6% having metabolic syndrome while it was 22.1% when children were obese. In a cohort of four hundred overweight/obese 7-17-year children from Negambo education zone showed that 46.8% had Insulin resistance.<sup>3</sup> Dysglycaemia was seen among 20.8% with 84% having at least one obesity related metabolic abnormality and 19.8% having metabolic syndrome. Third of the sample had different levels of hepatic steatosis with elevated ALT/AST ratio, a marker of early hepatic steatosis, was seen in 58% of the cohort. The shift in the pendulum from communicable diseases to NCD could be partly attributable to this transition occurring in the nutritional status of our children. Micronutrient deficiency, also known as the hidden hunger, is also present due to poor diet diversity practiced by many.

### **Growth Assessment**

Growth is the unique feature that differentiate children from adults. Optimum growth is paramount for educational and socio-cultural achievements. Growth assessment is mainly based on anthropometric (height & weight) measurements. Based on defined anthropometry based cutoff values, at a given time point, the nutritional status of a child is determined. Thus, nutritional status reflects deviated growth.

A single stand-alone measurement value in the assessment of growth is meaningless as an accurate interpretation cannot be provided and therefore serial anthropometric measurements should be

plotted on the appropriate growth charts to obtain a proper insight to the growth of a child. Based on the collated data, a proper interpretation needs to be made and necessary actions should be taken.

Growth monitoring across the world has a long history and in 1975 WHO recommended the use of NCHS/CDC charts worldwide with height and weight reference charts for nutritional surveillance.<sup>6</sup> Countries that did not have local reference were guided to develop their own charts but for those who could not, recommended to use NCHS/CDC charts.<sup>7</sup> However, with time the disadvantages were noted, and distortion of national statistics emphasized the requirement to have an internationally applicable growth standard for better comparison of growth of children across the world. As it was considered that height and weight of well-fed healthy children from different ethnic groups and continents showed only little variation in growth, the WHO considered to develop international growth standards based on healthy children, raised under most suitable conditions. In 1996, representative samples from six countries worldwide were selected and longitudinally followed up from birth to 24 months of life and cross-sectional data of 25 to 60 month old children were included.<sup>8</sup> Smoothed height and BMI-for-age growth charts for children and adolescents of both sexes aged 5 to 18 years were developed based on the 1977 NCHS data.<sup>9</sup> The INTERGROWTH-21st project developed preterm growth charts by assessing fetal growth and newborn size using an international representative sample from 8 countries.<sup>10</sup> Combining INTERGROWTH-21st data with the WHO growth standards provided a set of international standards for assessment of growth from conception to birth including preterm babies up to 6 months of post term age.

Assessment of growth in Sri Lankan children spans several decades, and it was mostly done using WHO recommended standards. Island wide growth monitoring began in the 1970s with a weight-for-age chart without sex discrimination. The chart had only two reference lines, 50th centile for boys and 3rd centile for girls up to 5 years of age were based on WHO/NCHS standards. It aimed at detecting under-nutrition rather than over-nutrition. Since 2007, Sri Lanka adopted the new WHO charts (2006) for growth assessment of children from birth to 5 years of life and since 2014 WHO 2007 standards for older children which were mainly marked in SD scores spanning from -3 to +3SD for each assessed parameter. In 2017, Sri Lanka adopted the preterm charts developed by INTERGROWTH-21st,

in the national growth monitoring programme.

### **The question of reference standard**

Growth references are statistical summaries of anthropometry, conditioned (usually) on age and sex. References describe how children do grow, in contrast to growth standards that prescribe how children should grow.<sup>11</sup> Growth references are prepared from the general population based on the presumption that growth occurs in the best possible way according to the conditions and availability of resources such as the nutritional, health and socio-economic status.<sup>12</sup> Although international charts help to compare between different countries, socio-economic and ethnic groups, they could distort the true picture of prevalence of stunting, wasting, underweight and overweight/obesity in many countries, especially in developing countries such as Sri Lanka.

Growth is a function of many factors and it's not only nutrition, but genetic inheritance, hormones, illnesses, and even social setting. Social-Economic-Political-Emotional (SEPE) factors have been shown to have a closer interaction with biology of growth, and many SEPE factor directly determine the growth outcomes.<sup>13</sup> Higher SEPE community are taller while lower SEPE community are shorter with broader skeletal growth. It is important to consider that stunting is not a synonym of malnutrition.<sup>14</sup> Nutrition is only one factor that affects height. Thus, growth references must not be used to define malnutrition directly without validating to a local population. This is because even if the pattern of growth of different populations shows similarity, the distribution of many growth parameters (such as weight-for-height, body composition) are often different. The difference might be based on genetics as well as environmental factors and their complex interactions.<sup>13</sup>

Giving biological meaning to these population variations in the distribution of parameters is not easy. Some researchers proposed that it is most appropriate to select a local reference population that is known to be healthy and develop tools for screening and monitoring of the health of the population who could be suffering from malnutrition, SEPE inequalities and distress, or any other pathology.<sup>15-18</sup> This applies for Sri Lanka as well. If we want to focus on malnutrition, it is important to stress that assessing an individual's health status needs specific information on nutrition as well as other sociodemographic factors. This includes information on food availability, on diet diversity, SEPE factors and even body composition. Therefore, malnutri-

tion is not only a cause of nutritional factors but a multitude of factors and focus should be on correcting all of them rather than nutrition only.

In field assessment of growth, yet the growth chart is the most practical tool. As many factors, beyond nutrition, affect growth, the population being assessed should closely resemble the population that was used to develop the tool, specially socio economically. Agarwal and co-workers showed that 50th percentile for height of affluent Indian girls match the NCHS/WHO standard.<sup>19</sup> However, a study done in 2009 in India involving 2 to 5 year old children from affluent families showed mean SDscores for height, weight, and weight-for-height, were lower than median compared to WHO 2006 standards.<sup>20</sup> The mean height SDS of Indonesian children under 5 years for both boys and girls was -2.03 when referred to WHO standards, which indicates that more than half of the population would be stunted, but with local charts it had been only 13.3%.<sup>21</sup> Further the same study showed that the wasted children in that cohort were taller than their non wasted counterparts by about 0.5SD. Due to over estimation of the prevalence of under nutrition, authors strongly advised to defer using WHO charts. A study comparing the effect of body build across five main ethnic groups in Malaysia found growth charts had no effect on population level but had a marked impact on individual level leading to misclassification of nutritional status.<sup>22</sup>

Health depends on Body composition to a great extent. However, anthropometry cutoff does not reflect healthy body composition.<sup>23</sup> Many could have apparently normal weights but could have been made by excess body fat. Therefore, although weight shows comparable values, they could be having different body compositions.<sup>22, 24</sup>

Almost all growth parameter from lower middle-income countries showed to be lower than the WHO 2006 standard. This gives food for thought whether even the most well-to-do sectors of a country could adopt growth charts developed on other countries or ethnic groups. Such adaptation could lead to overreporting of undernutrition while underreporting over nutrition. The danger is that the undernourished would get over treated while over nourished would get their metabolic issues under investigated and definitive management would get delayed. This could also be a contributory reason for the increase in non-communicable disease burden in south Asia region which had been using growth charts and cutoff values developed on western populations to detect overweight/obesity.

Therefore development of growth charts specific to the population would be the most prudent action. As it would give the best match of its non-nutritional factors. However, developing a local reference is costly, time consuming and requires lot of expertise.<sup>25</sup> Therefore next best would be to validate available charts with revised cutoff points.<sup>24</sup>

Growth charts should assist parents and health care workers in guiding a child to achieve optimum growth. Appropriate growth references need to be identified, as individual health management and public health decisions would be based on these. An appropriate reference should reflect the height, weight, and body composition of a healthy local population and cutoff values above and below the 'healthy' range should reflect the risks for impairment in performance, disease, morbidity, and mortality. Anthropometry may have a place as a screening tool than a diagnostic tool for malnutrition, especially in terms of its relationship with morbidity and mortality but needs to be assessed in combination of many factors rather than one feature, such as height-for-age. Anthropometry charts are mainly based on population distribution of a parameter, and it would not always depict the morbidity and categorizing them on a single parameter could be disadvantageous to an individual. This is especially true for children categorized as undernourished based on anthropometry, but who are otherwise quite active and healthy with good school performance.<sup>14</sup> This clearly shows that in all stages of growth assessment one size tool does not fit all.<sup>26</sup>

As obesity is a major emerging health problem it is important that early detection is strengthened and empowering individuals to take care of it is important. A simple to measure and calculate, and interpret tool would be quite satisfactory and waist circumference to height ratios (WHtR) has shown promise with a self built cutoff value of 0.5.<sup>27</sup>

### The Way forward

**Growth monitoring** had been an integral part of maternal and child health programme of Sri Lanka. Up to 5 years of age, growth monitoring is carried out by Medical Officer of Health (MOH) at the local clinics at regular intervals and during school age at school medical inspections. School curriculum, both primary and secondary, promotes growth monitoring and secondary school children are empowered to measure their heights, weights, and waist circumference and to calculate

and interpret BMI and WHtR. During first three year of life, most of the weighing takes place coinciding with the immunization. However, afterwards the parents' enthusiasm as well as primary health care workers opportunity to assess is minimum. Regular measurement during late childhood and adolescence is minimum. Even most get measure in the curative sector, recoding of them on the Child Health Development Record (CHDR) happens seldom. The opportunity lies to a great extent on the medical staff of curative sector as, growth is assessed during illness but does not get recorded regularly.

One of the commonest periods in which growth faltering could be seen is between 4 to 6 months of age where majority is due to inadequacy of calories supplied by exclusive breast feeding. Growth faltering has to be addressed at the correct time, and if not so it is very difficult to improve as the internal milieu establishes to the low-calorie level. Therefore, introduction of complimentary feeds before completion of six months is important if growth faltering is noted. Apart from the health worker, even parents can note the deviations and seek medical advice, which is purely based on the pattern of growth rather than cutoff points. It's important that due attention is paid for both under and overgrowth which should be guided by either weight for length/height or BMI for age and ideally it should be maintained between -1 to +1SD which would be a healthier ratio, although -2 to +2SD range is designated as normal.

**Growth references used in Sri Lanka need to be locally validated.** She adopted WHO 2006 growth charts for children under 5 years of age, which primarily shows how children under 5 should grow. It has been quite useful in detecting growth faltering early and intervening timely. However, for 5–18-year-old children, the WHO references are based on 1977 NCHS data. Therefore, on one hand it is an old set of data and it is of a single country.<sup>28</sup> Growth patterns of children specially above 5 years differ across different populations. Therefore, its applicability across different populations specially as a reference or standard is not satisfactory without being tested for its validity.<sup>21</sup>

Growth charts developed in India, China, Indonesia, and Saudi Arabia have shown that Asian children have similar growth patterns while all of them differ from Caucasian children of European origin.<sup>21, 29-31</sup> Longitudinal data under two years of age in Sri Lanka has shown that they have a similar pattern of growth compared to WHO



charts, but about 1SD below the level of WHO (Nis-hani Lucas; Prof CC de Silva Oration -2022, SLCP). Further in the 5-15 year age group also it has been shown that the distribution of Sri Lankan references are about 1 SD below the level of WHO references (Wickramasinghe SLCP 2022 Annual Sessions). This clearly shows that Sri Lankan children also need to have their own growth charts or at least validate a regional chart such as Indian growth chart for the assessment of growth and further studies are necessary on this aspect.

**Improve the birth weight** is one of the most important factors for the improvement of child growth. In order to improve intrauterine growth, it is imperative that a female embarks on a pregnancy with a sound nutritional and health status. Low height and wasting are risk factors for low birth weight. Embarking on a pregnancy with these high rates of undernutrition increase the risk of giving birth to a low-birth-weight baby. Adolescent growth spurt is the last window of opportunity for the girl child to have an optimum growth. However, the local care services for adolescent falls in no man's land. Traditionally the paediatric care stops around 14 years of age and adult care begins around 18 years of age with minimum medical attention to this in betweenage group of adolescents. It is important that adolescent health is well managed by a multidisciplinary team with an adolescent health physician (paediatrician or physician), endocrinologist and a nutritionist to harness the optimum growth potential they were born with, as well as to prevent overweight.

**Pre-pregnancy counselling** is a very important aspect and through registration of eligible couples, this occur to a great aspect. However, optimizing the nutritional status, reducing either wasting or overweight does not happen optimally. MRI data which shows that 3.9% of pregnant women were underweight (<18kg/m<sup>2</sup>, BMI)(4). However, data from third quarter of 2022 shows that under nutrition among pregnant females have gone up to 8.3%, which would forecast a bleak future for newborn babies. In contrary the adolescent obesity would lead many young females embarking on a pregnancy being overweight and giving rise to overweight/obese newborns who are at a higher risk of developing NCD from a younger age. The high prevalence of overweight(42.2%) and obesity (19.6%) in pregnant mothers<sup>4</sup> has shown some reduction(overweight(33%) and obesity (14.5%)) due to current economic downturn (unpublished MRI data). Women in the reproductive age as well should be encouraged to attend well women clinics, specially to receive advice on nutritional state.

**Food production in Sri Lanka** throughout the year should not be a problem. However, optimum utilization of soil and weather does not appear to occur. Further the abundant inland water tanks are underutilized, which could provide a good solution to the protein needs of the population in addition to the abundant marine resource all around the country. Most of the yield is not effectively distributed all around the country. Rather than a local distribution of the harvest, they are distributed to many central locations where the produce exchange in hands with many middlemen adding overheads and profits, thus increasing the final price of the commodity. Not effectively using the transport system such as rail network adds further cost when it reaches the consumer.

**Minimizing the pre- and post-harvest losses** plays an important step in ensuring food security. Many farmers are given small plots of land for cultivation and dwellings, which further shrinkers with generational handing over of these land. Any pest invasion could affect the entire plantation which otherwise would have been insignificant if there is mass cultivation. A country with limited land, if not shrinking due to sea erosion, should rethink on its land distribution policy of handing over small plots to individuals for both cultivation and dwelling, but build farming towns and separate farming land from inhabiting spaces and even construct multistoried housing apartments rather than individual units for the farmer. Adopting better storage methods during transportation of produce will help to reduce post-harvest losses and provide fresh food which are more nutritious. Further adopting environmentally friendly farming techniques is also important as livestock industry is one of the main factors that contribute to global warming as well as antibiotic resistance. Industry needs to develop to preserve the surplus of seasonal food to be used during off season. Canned food, dry food industry is not well developed in this country which has a huge potential and could easily contribute to solve many nutritional problems.

**Food taboos and mis concepts could contribute to child malnutrition** and Sri Lanka could be identified as one country with many food taboos. Apart from health taboos of food, majority consider imported foods have a better nutrient profile than locally available food, price is directly proportionate to the nutrient content. Many does not know how to select food based on price and seasonality but continue to purchase whatever they have been purchasing lifelong. Minimum knowledge on food preservation at household level could be identified as some of the knowledge gaps that exist among

the public.

**Gut microbiota** has shown to play a significant role in growth and health of children. It's quite clear that the food we take makes the gut microbiome and it is a signature of the local patterns of diet. Although many diets have been described in the world literature, their effectiveness outside those geographies of origin are doubtful. The concept 'microbiota directed food' has shown to improve child growth. A study using locally sourced foods that particularly enhance the gut microbiome, showed that food targeting the improvement of these microbiota enhanced biomarkers of growth, bone formation, neurodevelopment, and immune function in undernourished children.<sup>32</sup> This highlights the importance of use of locally available food for improvement of growth and health of children whether undernourished or normal.

**Socio Economical Political Emotion (SEPE)** are aspects beyond nutrition would affect the growth of a child.<sup>13</sup> Therefore, providing nutrition alone is not sufficient to a child but securing a conducive, less stressful socio-political culture and ensuring a secure future would invariably help a child to be happy and encourage growth. School environment as well as happy schooling and education system in addition to harvest the skills and talents, should help them become healthier. A publication by Habicht et al. stated that the differences in anthropometry in well-nourished children of different ethnicity is small (3-6%) compared to different socioeconomic status in the same ethnicity (12-30%) which led to the conclusion that growth standards for height and weight to represent optimal pre-school growth could be constructed from studies done on children with a good socioeconomic status irrespective of ethnicity.<sup>33</sup>

Lester W. Sontag (1901–1991), the director of the study the Fels Longitudinal wrote "... that modern understanding of the growth, health, behavior, and effectiveness of human beings could only be understood if the nature and significance of individual characteristics of each child's physiological, biochemical, nutritional, educational, and environmental characteristics could be assessed and integrated into a total picture".<sup>34</sup>

We, who care for health, have a great responsibility in harnessing the optimum growth potential in children thus reducing malnutrition. We need to empower all stakeholders involved directly and indirectly in this process.

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