

Catch Up and Control of Malnutrition in Stunted Children Under the Age of 5 Years by Using Recent Recipe of Nutrition

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Abstract

Stunting is a health problem affecting children in the peak of their linear growth. It's prevalence is decreasing in the developed countries but in some African Countries the incidence still increase. This health problem usually appears in child that have stopped exclusive breast feeding and now on external food. Causes of stunting are usually nutritional, and as a result management is mainly by adding high energy food, macronutrients and micronutrients (zinc, vitamin A) to increase the quality of ingested food. This review highlights definition, risk factors and management of stunting in children, in addition of increasing awareness about the use of food products containing natural additives. Also, increasing the utilization of fresh fruits, vegetables, food products containing natural additives such as vitamins, minerals, fiber and natural antioxidants to overcome the problems of malnutrition.

Keywords: Malnutrition; Stunted Children

Introduction

Growth stunting is one of the most serious problems that is impeding child growth and development, it is a state related to chronic malnutrition and can contribute to linear growth failure, it has both long term and short-term consequences. Short term effects are developmental delay and cognitive deficits. Long term effects are small constitutional size as an adult and obesity in adulthood. Stunted children are usually diagnosed in the complementary feeding period where they are stopped from exclusive breast feeding and are frequently catching infections. The factors most significantly associated with stunting are low birth weight, lower consumption of proteins, children whose mother's height was less than 145 centimetres, low household and poverty. Multiple micronutrients together with energy and macronutrients are also needed for the management of stunting.

Definition and causes

Defined as height for age below the 5th percentile on the growth chart, stunted growth is primarily caused by chronic malnutrition, that is, insufficient, inadequate, or inappropriate macronutrients and micronutrients, or a diet lacking the recommended number of daily servings from the food pyramid [1].

In low income countries, child stunting is one of the early life health concerns [2,3]. Diarrhoea and pneumonia are leading causes of morbidity and mortality among young children in low income countries and the case fatality for these illnesses is increased in undernourished children [4,5].

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Furthermore, Merryana and Bambang [6] signify the fact that zinc is important for metabolism of growth hormone, androgens and thyroid hormone and its deficiency impairs the function of all of them. Also, it was reported by them that zinc deficiency can lead to stunted growth during gestation, new born interval, childhood and adulthood.

Malnutrition is detected to provide to more than one third of all child deaths, although it is rarely recorded as the direct cause. Malnutrition and food-borne illnesses hypothesizes large current and future human, economic, social and fiscal costs on countries.

Younis, *et al.* [7] reported that different types of malnutrition such as Protein energy malnutrition and Dietary Vitamins and minerals, especially deficiency of thiamine (vitamin B1), niacin (vitamin B2), (vitamin C, D) and selenium, iron, zinc, respectively, cause an increasing of different types of disease.

In Indonesia, UNICEF [8] reported that ‘vitamin A Deficiency (VAD) continues to be a major public health concern. The Lancet series on maternal and child undernutrition [9] reported critical associations between stunting (length/height-for-age z-score <-2 standard deviation) at age 2 years and the long-term consequences.

Stunting in the first two years of life can lead to some irreversible damage in the body as poor attained schooling, short for age height and in adults can lead to decreased income and small offspring birth weight. So, stunting problem does not end in childhood but extend to the offspring as well if the environmental conditions persists.

It was identified that the proximal factors contributing to stunting in growth was inappropriate breast feeding and complementary feeding practices, childhood infection, household and family factors [10].

Prevalence

The prevalence of stunting, underweight and wasting were studied by Xiaoli, *et al.* 2009 [11]. Results indicated that the percentage reached to 30.2%, 10.2% and 2.9%, respectively (Figure 1). In Africa this prevalence jump to 40% of children. Also, in low or middle-income countries the stunting reaches around one third of children under the age of 5 years [2]. Unfortunately stunting increase the morbidity and mortality rates, besides developmental delay, cognitive functions in children and in adults can lead to low income [9]. Due to its adverse outcomes and increased prevalence stunting in children is considered as one of the major health priorities [12].

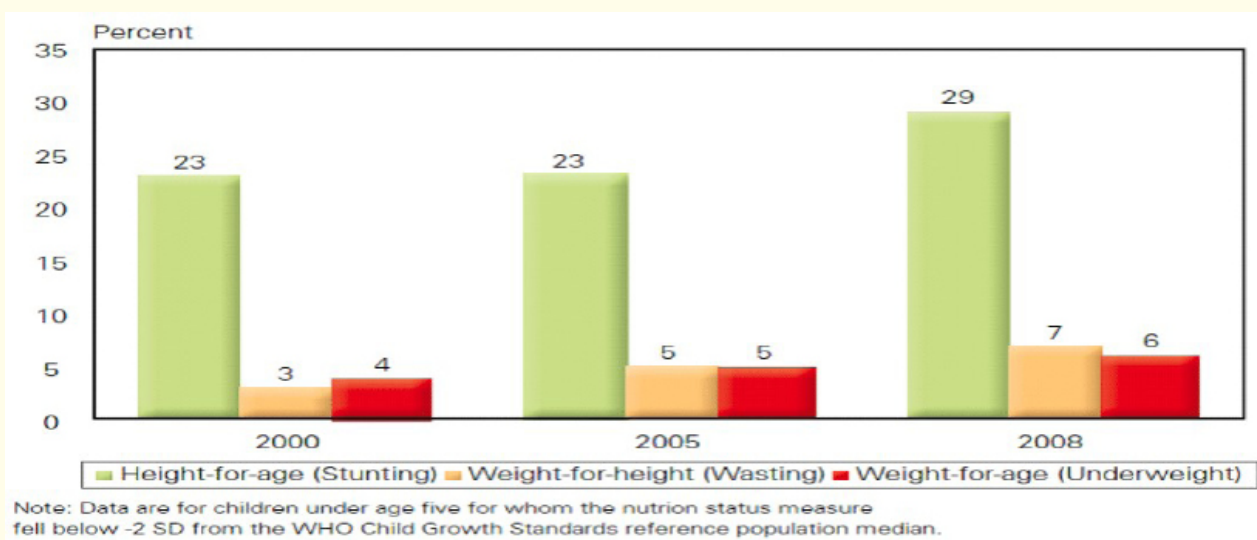


Figure 1: Prevalence of stunting, wasting and under weight.

Around the world, nearly 25% of children under the age of 5 years (i.e. 159 million) are known to be stunted [13,14]. According to Black., *et al.* [2] study, stunting is the leading cause of 1 million deaths among children annually. Globally 25.7% (164.8 million) of children under the age of 5 years are diagnosed as stunted when compared to World Health Organization Child Growth Standards [a height-for-age below minus two z-scores of the median height-for-age] but for Africa the rates rise to 36.5% (56.3 million child).

Unfortunately, in their study they found that over a 10-year period (1990 - 2010), Africa was the only region where the number of stunted children under 5 years increased, and Projections to 2025 show the increasing trend is likely to remain.

Victora., *et al.* [9] in her study stated that stunted children are prone to be obese in adulthood with increasing the risks of having nutrition related non-communicable diseases.

As the world’s economy has grown, the prevalence of undernourishment - eating too few calories to sustain an active life - has fallen only half as fast as poverty [15]. The world has done so poorly on nutrition compared with poverty partly because of people’s choices. People often prefer to buy a new cellular phone or a bike rather than better quality food leaving many habitants of whole villages under-nourished or stunted by misunderstanding of their condition.

UN region	1990	1995	2000	2005	2010	2015	2020
Africa	40.3	39.8	39.3	38.8	38.2	37.6	37.1
Asia	48.6	43.1	37.7	32.6	27.6	22.9	19.0
Latin America and Caribbean	23.7	20.9	18.1	15.7	13.5	11.6	10.0
All developing countries	44.4	40.1	36.1	32.5	29.2	26.2	23.7
All developed countries	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Global	39.7	36.3	32.9	29.7	26.7	24.1	21.8

Table 1: Estimated prevalence (%) of stunted pre-school children 1990-2020, with 95 % confidence intervals, by UN region and sub-region [16].

Intervention in stunting for catch up

The best interval identified for intervention in stunting is the period from the beginning of pregnancy to the first 24 months of life giving the maximum impact [5].

Defining catch-up growth has different ways in the literature. Cameron., *et al.* [17], Lundeen., *et al.* [18], Leroy., *et al.* [19] and Prentice., *et al.* [20] summarised catch up as absolute and relative definitions. Absolute catch-up growth can be defined as a decrease over time in the absolute height deficit, measured in cm, between the individual or population and the reference mean for a healthy population. Relative definitions of catch up are more commonly used in the recent literature on catch-up growth in height [21-23] and account for the increasing variability in height as children age, and the associated decreasing importance of a given absolute cm deficit. Chris and Daniela [24] found that the prevalence of catch up is about 19% - 93% and is highly sensitive to the way catch up is classified.

Nutritional status

World Health Organization, WHO [25] assessed the nutritional status of children and their mothers by measuring their height and weight by special agreed anthropometric measurement procedures.

Nutrition mission in Maharashtra needs to prioritize policies, programmes and investments to achieve results in three key areas: (1) improve women’s nutrition and reduce low birthweight; (2) improve complementary foods and feeding practices for children 6 - 23 months old; and (3) improve access to and use of sanitation facilities while mitigating household poverty through effective social safety nets coupled with effective communication and counselling [26].

Innovative recipe for malnutrition and stunting

Innovation of recipes (meals) for complementary foods using local food stuffs will be studied by different authors. The core of the recipes was based on of a mixture of powered grains and legumes as well as bioactive ingredients to increase the protein and micronutrient content, particularly iron and zinc, and essential amino acids.

The recipes were designed so that each 100 gm contains (approximately) Calories 656 kcal, Protein 25.45g, Carbohydrate 108.5g, fat 13.35g, potassium 543.3 mg, sodium 43.3 mg, phosphorus 390 mg, calcium 111 mg, iron 5.47 mg, magnesium 71.8 mg, fiber 2.25g, zinc 10.2 mg, vitamin A 9.7 mg.

Each recipe was subjected to a battery of tests before shifting to the industrial scale such as, Nutritional analysis (Macro and micro content), organoleptic tests (to ensure palatability and attractiveness) functional properties (shortening, plasticity, elasticity, suspension etc.) keeping Quality and accelerated stability testing [12].

90% of women received antenatal care during their last pregnancy with nutrition counselling as a part of it, it was found that 30% of them ate less than normal, 40.5% did not eat foods from animal origin, 48.8% eggs and 55.4% milk and dairy products. In the same study upon anthropometric measures 10.5% of mothers were stunted (height < 145 cm) and 32.2% of them were too thin (body mass index less than 18.5 kg/m²). For their children aged 6 - 23 months old, low feeding frequency and low consumption of eggs, milk and dairy products, in addition to fruits and vegetables were associated with stunting and decreased linear growth detected.

Consuming grains, roots and tubers was associated with a 34% increased odd of stunting (OR 1.34; 95% CI 1.01 - 1.78). As for low consumption of eggs it was associated with a two-fold increase (OR 2.07; 95% CI 1.19 - 3.61), respectively.

Nutritional value

In low income countries, due to low nutritional value of complementary foods, there is a higher incidence of childhood growth stunting. This was proved by Sonja, *et al.* [26] in his study by testing addition of lipid-based nutrient supplements (LNS) and this result in reducing the incidence of severe stunting among at-risk infants and promoting linear growth.

Most of the children are breastfed until the age of two years, but exclusive breastfeeding ends at about 4 months of age with adding of complementary food. Maize is the principal complementary food added, in very young infants it is cooked as a thin porridge and in late infancy cooked as a thick porridge with addition of vegetable soup and fish [27]. The main staple, maize, is normally grown and harvested between December and March and dietary inadequacies in food consumption and nutrient intakes are common especially in the months preceding the only annual harvest [28].

Nutrient composition named Nutributter contained peanut paste, milk powder, or soy flour, vegetable oil, sugar and multiple micronutrient mixture were closer to the 'preventive' supplement (Table 2).

Nutrient	Milk-LNS	Soy-LNS	CSB
Amount of food supplement (g)	54	54	71
Energy (kcal)	285	276	284
Protein (g)	8.2	7.5	10.4
Fat (g)	17.9	18.5	3.1
Retinol (µg RE)	400	400	139
Folate (µg)	160	160	43
Niacin (mg)	6	6	3.5
Panthenic acid (mg)	2	2	-
Riboflavin (mg)	0.5	0.5	0.3
Thiamin (mg)	0.5	0.5	0.13
Vitamin B6 (mg)	0.5	0.5	0.34
Vitamin B12 (µg)	0.9	0.9	0.9
Vitamin C (mg)	30	30	45
Vitamin D (µg)	5	5	-
Calcium (mg)	366	366	72
Copper (mg)	0.4	0.4	-
Iodine (µg)	90	90	-
Iron (mg)	6	6	5.5
Magnesium (mg)	78.5	78.5	-
Selenium (µg)	20	20	-
Zinc (mg)	6.0	6.0	3.6
Phosphorus (mg)	186	186	-
Potassium (mg)	319	307	-
Manganese (mg)	0.6	0.6	-

Table 2: shows Nutrient composition, multiple micro-nutrients and their quantities in the three supplements.

Recent biofortification of crops by Selenium, Fe, Cu, Zn and Mn, Protein, Iodine, probiotic foods and food processing technology, gave the potential to overcome the malnutrition. A recently developed treatment for acute malnutrition is simulating the lives of hundreds of thousands of children a year [7].

Food processing technology has a main potential to increase varieties of diet, product and to enhance concentrations of macro and micronutrients in consumed foods. Also, food processing is applied to preserve foods by different methods, enhance food safety and quality such as improve flavour, enhance nutritional value, and save energy [29].

Furthermore, Ouwole., *et al.* [30] investigated that the nutrient constituents, antioxidants and phytochemicals of *Moringa oleifera* could be incorporated into human diet, particularly during infancy, to prevent or reduce protein-energy malnutrition.

In general, UNICEF [31] does not apply ready-to-use food products for the prevention of child malnutrition. Also, Contribute to distribution of food safety or food security programmers. Prevention of all types of malnutrition is the best undertaken method to decrease all disease to expanding access to high quality foods, quality health care, improved water sources and use macro and micronutrient supplements for children also increase the better knowledge of nutrition, health, safety and hygiene practices in communities [32].

Conclusion

Stunting is best treated during the first two years of life giving the maximum catch up. Programmes needed to achieve this must work upon several axes including improvement of women nutrition, reducing low birth weight, improving quality of food given in complementary meals, feeding practices for infants and improving access to and use of sanitation facilities.

Return to nature by increasing the utilization of fresh fruits and vegetables and decreasing the uses of processed products have contained preservative materials and artificial colorants.

Also raise awareness about the use of food products containing natural additives such as vitamins, minerals, fiber and natural antioxidants (reliable sources) to raise the nutritional value and health. Thus, we can overcome the problems of malnutrition and increase the rates of health growth in children and the public consumer.

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