

## Editorial

# Windows of opportunity for setting the critical path for healthy growth

Worldwide, about 165 million children younger than 5 years of age are stunted and 42 million are overweight<sup>(1)</sup>, based on the most recent figures from 2011. Such nutritional imbalances have been linked to several communicable and non-communicable diseases<sup>(2)</sup>, making malnutrition a major global health challenge of our century.

Stunting disproportionately affects developing regions in the world, with countries in sub-Saharan Africa and South Asia carrying the biggest burden<sup>(3)</sup>. The growing evidence linking stunted linear growth in early life to health later in life is shaping health policies and driving interventions to focus on early prevention. Notably, the first thousand days from conception to the child's second birthday has been recognized as the critical window of opportunity for good nutrition and healthy development. Helping to advance our understanding of what determines healthy growth and how this is assessed is therefore a crucial step to effectively improve interventions designed to prevent childhood malnutrition and the associated health risks.

### Monitoring child growth

In this issue of *Public Health Nutrition*, Das *et al.*<sup>(4)</sup> and Hasan *et al.*<sup>(5)</sup> report a decreasing trend in childhood undernutrition in Bangladesh over the last two decades. Potential reasons, as highlighted, for this observed decrease include the economic growth of the country, the increase in maternal literacy and the improved access to health care. Despite the reported decline in prevalence of stunting, the prevalence of growth faltering (stunting) remained very high (>40%, in 2011). Studies in Africa and Asia on the onset of stunting have shown that length-for-age Z-scores often start with a deficit at birth and decline further in the first 2 years of life<sup>(6)</sup>. The study by Solomons *et al.*<sup>(7)</sup> in this issue reports a high prevalence of stunting in infants younger than 6 weeks (reflecting intra-uterine growth faltering) in the western highlands of Guatemala. Acknowledging the challenges of measuring length at birth, the authors argue that length measurements taken between 2 and 45 days of life can be viewed as birth length. They advocate that not only birth weight, but also the birth length of babies should be recorded. This is in line with the current view that stunting should replace underweight as the main indicator for childhood undernutrition<sup>(3)</sup>. In support of this is the fact that weight gain that is not simultaneously accompanied by adequate

linear growth is not considered healthy growth and, moreover, can contribute to a shift in malnutrition towards an increase in the occurrence of overweight and obesity in children, as was observed in the Bangladeshi study<sup>(4)</sup>.

The study of Kristiansen *et al.*<sup>(8)</sup>, also in this issue, shows that a composite index of weight and length (Ponderal index) at birth can be used to predict BMI at age 7 years. Using the Norwegian Mother and Child Cohort study (MoBa), the authors have shown that children in the highest tertile of the Ponderal index at birth had a BMI nearly one unit higher at age 7 years compared with children in the lower Ponderal index tertiles.

### Importance of mothers' nutritional status

The studies by Solomons *et al.*<sup>(7)</sup> and Kristiansen *et al.*<sup>(8)</sup> both show that anthropometric status at birth and in early childhood is associated with maternal nutritional status. For example, stunting at birth was related to the short stature of the mother<sup>(7)</sup>. On the other hand, maintenance of high body size from birth to 7 years of age was related to maternal BMI<sup>(8)</sup>. This reflects the intergenerational effect of malnutrition, possibly exacerbated by poor nutrition both pre- and post-conception and after delivery. However, it is generally agreed that well designed and timely health and nutrition interventions can break this intergenerational cycle of malnutrition<sup>(9)</sup>. These studies further highlight the importance of good maternal nutrition.

### Early childhood feeding

Ensuring optimal infant feeding through breast-feeding and complementary feeding is key to healthy growth in early life. The benefits of exclusive breast-feeding for child survival through the reduction of morbidity and mortality from infectious diseases have been well documented<sup>(10)</sup>. A growing number of studies are also indicating the benefits of exclusive breast-feeding in preventing non-communicable diseases like blood pressure and type 2 diabetes in later life<sup>(11)</sup>. The study by Yamakawa *et al.*<sup>(12)</sup> in this issue shows that exclusive breast-feeding also has the potential to protect against serious cases of asthma among Japanese children. Moreover, the study by Wright *et al.*<sup>(13)</sup> demonstrates that breast-feeding, but not Dietary Diversity Score (DDS), is associated with higher weight-for-age and length-for-age Z-scores among Filipino infants.

The lack of association of the DDS with child growth is in contrast to previous studies<sup>(14,15)</sup>, but the longitudinal study design used by Wright *et al.*<sup>(13)</sup> may have sharpened opportunities to investigate causality. It could also be that the association of DDS with linear growth is context-dependent. The DDS does not account for the frequency, quantity and variety of food consumed within a group, and was poorly associated with nutrient density, as highlighted by the authors. This calls for further refining of this tool to improve the assessment of the quality of the infant diet.

Another diet quality measurement covered in this issue, the Healthy Plate Variety Score (HPVS), is used by Jones *et al.*<sup>(16)</sup> to assess whether early feeding experiences and maternal HPVS influence early childhood consumption of healthy foods. The HPVS has fewer food groups than the DDS (five *v.* seven groups), but takes into account the frequency of servings per day and the variety of foods within each of the five groups. Using data from four European birth cohorts, the authors show that the HPVS at 2, 3 and 4 years were lower in children who were never breast-fed or breast-fed for a short period, indicating once again the potential benefit of optimal breast-feeding. The authors further show a positive association between the mother's HPVS and the child's HPVS, suggesting that maternal HPVS could be used to predict pre-school children's HPVS.

Besides dietary diversity, the nutritional quality (nutrient density) of complementary foods can be improved through the addition of animal-source foods. However, the accessibility and/or affordability of animal-source foods hinder the applicability of this strategy in low-income countries, where most of the cases of stunting are found. Alternatively, insects can be used in settings where their consumption is culturally acceptable. In the study by Bauserman *et al.*<sup>(17)</sup> in the Democratic Republic of Congo, also included in this issue, a cereal made from caterpillars (rich in protein, iron and zinc) was used as a supplement in complementary feeding. The effect of feeding a caterpillar-supplemented or a usual diet on the prevalence of stunting at 18 months of age was investigated, when provided from 6 months onwards. At 18 months of age, infants in the caterpillar cereal group had higher Hb concentration and fewer were anaemic, but the intervention had no effect on the prevalence of stunting. Such null effect of supplementing the diet with micronutrients is not unheard of, and reminds us that improving the nutrient density of complementary foods alone may not be sufficient to prevent stunting<sup>(18)</sup>. For instance, the high infection rate in these children may reduce nutrient absorption or lead to available nutrients being diverted from growth to the immune system to fight infection. Worth noting is the high prevalence of stunting at the start of the intervention (36% at 6 months of age), despite the high rates (>80%) of exclusive breast-feeding up to 6 months age. A significant proportion of the stunting could have been due to intra-uterine growth restriction,

but this was uncertain because data on birth length were unavailable.

## Summary

Stunting, although decreasing, remains a public health challenge in the developing world. Interventions aimed at reducing the prevalence of stunting should be cognizant of the current shift of malnutrition towards an increase in overweight. Altogether, the findings of the studies reported in this issue highlight the importance of optimal breast-feeding on the prevention of stunting and the early development of healthy eating habits. The findings further accentuate that a mother's dietary pattern and nutritional status, both pre- and post-conception and later in the early life of the offspring, are key determinants of healthy child growth. Recognizing that maternal, fetal and newborn outcomes cannot be disconnected from each other and that the food environment underpins what households eat, how wide should the critical window of opportunity be set? Should there be sets of critical windows of opportunity? Or, perhaps there should be a shift back to a more comprehensive lifecycle approach where nutrition interventions are designed for every stage in life? The answers to these questions may not be evident, but they may be the key for setting the critical path towards healthy growth.

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