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Publication on

Child growth & development

The first few years of a child's life are characterized by rapid growth and development, which require a healthy and nutrient-rich diet. Adequate feeding and intake of essential nutrients are important during this critical period of growth and development for children to reach their full potential.

Window of opportunity

Optimal nutrition is vital in the early years, particularly in the first 2 years of life (WHO, 2009). During the early years, cognitive growth and development occur rapidly: the brain forms rapidly in utero and reaches nearly 80% of its adult weight within the first 2 years of life. Throughout this period, the brain undergoes rapid neurogenesis, neuronal proliferation and myelinization (Tau *et al.*, 2010), all of which are dependent on optimal nutrition. Hence, proper nutrition during this period is crucial to the child's brain development (Nyaradi *et al.*, 2013). Besides the brain, a child's physical growth and development occur at a rapid pace: a newborn's weight is doubled after 3-4 months and tripled after 12 months (Thomson, 1998). Early nutrition has both direct and indirect effects on an infant's brain growth, development and immunity, which in turn impact the child's long-term cognitive performance and physical health (Hanley *et al.*, 2010). Research indicates that there is a lasting health impact of environment and nutrition during early life, from pre-pregnancy to early childhood (Koletzko et al., 2017; Georgieff *et al.*, 2007). The World Health Organization (WHO) noted that the first two years are an important window of opportunity to correct any nutritional deficiencies (WHO, 2018). Among the long term effects of nutrition deficiency are stunting and wasting. As modifying risk trajectories in early life will have a large impact (WHO, 2018; Koletzko *et al.*, 2017), parents and paediatricians should pay close attention to the nutrition received by infants and young children.

* Stunting is the impaired growth and development that children experience from poor nutrition, repeated infection, and inadequate psychosocial stimulation. Children are defined as stunted if their height-for-age is more than two standard deviations below the WHO Child Growth Standards median.
* Wasting indicates in most cases a recent and severe process of weight loss, which is often associated with acute starvation and/or severe disease. However, wasting may also be the result of a chronic unfavourable condition.

Key nutrients

A well balanced and sufficient intake of essential macro- and micronutrients are important for growth and development. Key essential nutrients include protein, calcium, vitamin D and iron. Protein provides the essential amino acids needed to aid in the building and maintenance of body tissues, helps in tissue building, and height and weight growth (Puentes *et al.*, 2016). Calcium helps to support development of strong bones and teeth. Similarly, vitamin D plays a role in bone strength and the absorption of calcium (International Osteoporosis Foundation, 2001). Iron contributes to normal cognitive development and is needed to produce haemoglobulin. Another example of important nutrients are long-chain polyunsaturated fatty acids (LCPUFA), particularly n-3 fatty acids, that play a role in the visual, neural and behavioural development of the infant and child (Calder, 2018). Besides physical and brain development, nutrients also play a part in the immune system. The immune system gradually matures during infancy still leaving young children vulnerable to infections (Simon *et al.*, 2015). Research indicates that LCPUFA intake is associated with lower incidence of upper respiratory infections, common allergic diseases, as well as diarrhoea (Lapillonne *et al.*, 2014; Birch et al, 2010). In addition, vitamin A contributes to the normal function of the immune system (Stephensen, 2001), whereas zinc, selenium, iron and copper are crucial for B and T cell function (Maggini *et al.*, 2007). Vitamin D modulates the innate and adaptive immune responses (Momentti *et al.*, 2018)

Growth standards

When given an optimal start, children from all over the world have the potential to grow in similar patterns. There are always individual differences among children, but across large populations, regionally and globally, the average growth is remarkably similar. Differences in growth of children up to the age of 5 are more influenced by healthy nutrition, a healthy environment and good health care, than by genetics or ethnicity. The WHO has published growth standards for infants and young children, and they are widely used across the globe. These standards are a robust tool to monitor the growth and nutritional status of children under 5 years of age, and can be used to asses children all over the world, regardless of ethnicity, socioeconomic status and type of feeding. Some examples of the WHO growth standards are the length/height-for-age, weight-for-age, weight-for-length/ height and body mass index-for-age charts. (WHO, 2006)

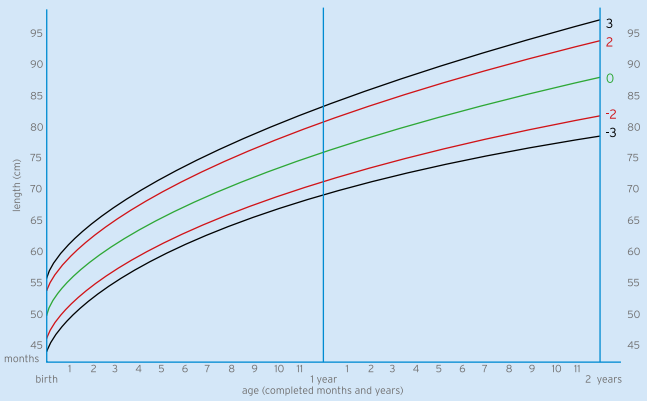

FIGURE 1: Growth standard 'Length-for-age' for Boys from birth to 2 years

Figure adapted from WHO Child Growth Standards

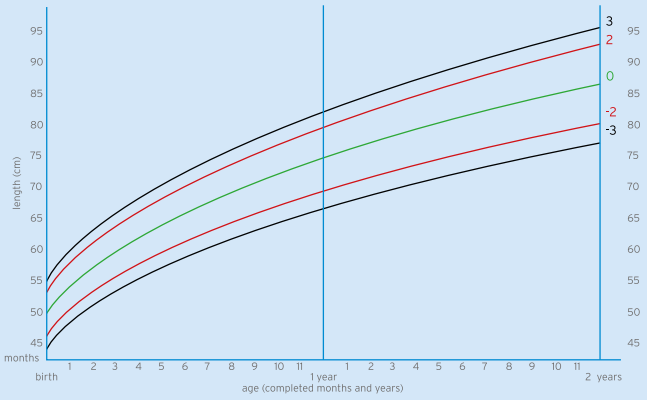

FIGURE 2: Growth standard 'Length-for-age' for Girls from birth to 2 years

Figure adapted from WHO Child Growth Standards

Nutritional status and intake of children in South East Asia
South East Asian Nutrition Survey (SEANUTS), a multicentre study, reveals insights on the nutritional status and dietary intake of 16,744 children between the ages of 0.5- 12 years in four countries in South East Asia; Indonesia, Malaysia, Thailand and Vietnam. The survey revealed that the prevalence of stunting in children 0.5-12 years of age in these four countries was around 15%, with rural Indonesia having the highest prevalence (38.8%) and urban Thailand the lowest prevalence (4.2%). The prevalence of underweight varied between 6.4% for urban Thai children and 28.9% for rural Indonesian children. Moreover, SEANUTS also found a high prevalence of vitamin D insufficiency in all of the four countries, varying from 20% in Thailand up to 44% in Malaysia. (Nguyen *et al.,* 2013; Poh *et al.,* 2013 ; Sandjaja *et al.,* 2013; Rojroongwasinkul *et al.,* 2013)

Dairy
Milk is a natural source of essential nutrients like protein, calcium, potassium, phosphorus, iodine, vitamin B2 (riboflavin) and vitamin B12. In many Asian countries milk and other dairy products are fortified with vitamin A and vitamin D. Recent analysis of SEANUTS data shows that the prevalence of stunting and underweight was lower in children who consumed dairy on a daily basis (10.0% and 12.0%, respectively) compared to children who did not use dairy (21.4% and 18.0%, respectively). The prevalence of vitamin A deficiency and vitamin D insufficiency was lower in the group of dairy users (3.9% and 39.4%, respectively) compared to non-dairy consumers (7.5% and 53.8%, respectively) ($p < 0.05$). This study suggests that dairy as part of a daily diet plays an important role in growth and supports a healthy vitamin A and vitamin D status in children 0.5-12 years in Indonesia, Malaysia, Thailand and Vietnam. (Nguyen *et al.,* 2018). This association between dairy consumption and growth among children has also been found in earlier studies in Indonesia (Semba *et al.,* 2011) and Malaysia (Chen, 1989).

Conclusion

- Optimal nutrition is vital in the early years, particularly in the first 2 years of life. During the early years, cognitive growth and development occur rapidly.
- Dietary guidelines recommend a well-balanced diet including all major food groups for sufficient intake of necessary macro- and micronutrients.
- Research among children 0.5-12 years suggests that dairy as part of a daily diet plays an important role in growth and supports a healthy vitamin A and vitamin D status (Nguyen *et al.,* 2018).

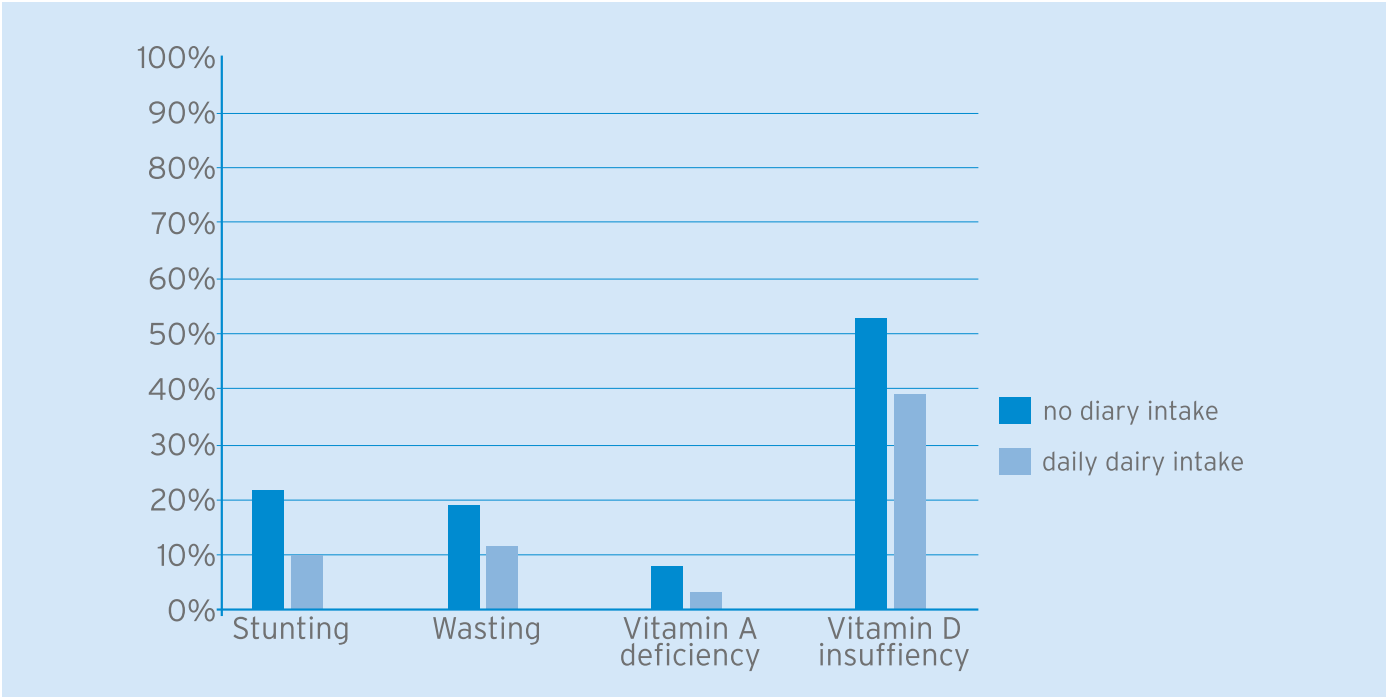

FIGURE 3: Health outcome and nutritional status of children (0.5-12 years) in Indonesia, Malaysia, Thailand and Vietnam who consume dairy on a daily basis vs no dairy intake

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