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ORIGINAL PAPER

Early Detection of Childhood Obesity Through Extended Routine Growth Monitoring of Children Below Two Years of Age in Asia Pacific Region

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Leilani Muhardi,[1] Eline M. van der Beek,[2,3] Marieke Abrahamse-Berkeveld,[4] Hamid Jan b. Jan Mohamed,[5] Ngee Lek,[6] Wendy H. Oddy,[7] V.Pujitha Wikramasinghe[8]

1. *MD, MSc, Head of Healthcare Nutrition Science- Danone Nutricia Early Life Nutrition Indonesia*
2. *PhD, Research Director, Nutricia Research, Utrecht, The Netherlands*
3. *Professor, Nutritional Programming, Department of Pediatrics, University Medical Center Groningen, The Netherlands*
4. *PhD, Developmental and Physiology, Nutricia Research, Utrecht, The Netherlands*
5. *PhD, Associate Professor, Nutrition and Dietetics Program, School of Health Sciences, Universiti Sains Malaysia, Malaysia*
6. *FRCPCH, Senior Consultant, Department of Pediatrics, KK Women's and Children's Hospital, Singapore; and Assistant Professor, Duke-NUS Medical School, National University of Singapore*
7. *PhD, Professorial Research Fellow, Nutritional Epidemiology, Menzies Institute for Medical Research, University of Tasmania, Australia*
8. *MD, PhD, Professor, Department of Paediatrics, University of Colombo, Sri Lanka*

Abstract

Introduction Increased body fat deposition during early life predisposes to higher obesity and metabolic disorder risks in later life. This is particularly relevant in the Asia Pacific region where historically prevalent under-nutrition is now been paralleled or even overruled by over-nutrition over the last few decades. This overview aims to evaluate the potential of early detection of obesity (risk) among experts through addition of specific growth monitoring assessments in children during the first two years of life. **Methods** A discussion among experts from Malaysia, Singapore, Sri Lanka and Australia on infant growth and a qualitative evaluation of current practice highlighted the need to measure body composition to assess the quality of growth. Current tools are mainly directed towards simple anthropometric measures such as body weight, length and head circumference which do not adequately reflect concurrent changes in body composition to detect early life adiposity development. Recent findings have shown benefits of measurement such as the sum of four skinfold thickness (S4SFT) during the first two years of life for risk assessment of later overweight/obesity. We recommend this assessment for routine practice as a proxy for fat deposition in young children. Further studies to understand implementation hurdles and cost-effectiveness of S4SFT and health outcomes in young children in the Asia Pacific region are necessary. **Conclusion** Inclusion of four skinfold thickness measurements as part of routine growth monitoring assessment, in addition to weight and height, could be recommended to assess adiposity development in early life allowing identification of infants at risk for obesity.

Keywords early life, children, obesity, four skinfold thickness

Corresponding author:
Leilani Muhardi
Cyber 2 Tower, 15th Floor
Jl. HR. Rasuna Said Blok X-5 No. 13
South Jakarta 12950, Indonesia
Email: Leilani.muhardi@danone.com

Introduction

Several cohorts in Europe and Asia have traced the origins of childhood obesity to the first year of life attributing it to differences in BMI development.[1-3] In 2014, the World Health Organization (WHO)

estimated that about 41 million children under five year of age were overweight or obese, of which 48% live in Asia.[4] Current growth monitoring practices among young children are traditionally targeted to detect under-nutrition and any upward deviations are considered favourable.

Asians are reported to have significantly more body-fat per kilogram body weight than Caucasians which is typically referred to as the "thin-fat phenotype".[5] Although it is clear that origins of childhood obesity are from early childhood, current growth monitoring practices were not used for early detection of excess adiposity. However, because of the epidemic of childhood obesity and its contribution to an ever increasing prevalence of non-communicable diseases, it is of paramount importance that excess gains of adiposity are identified early in life.

This overview aims to evaluate the potential of early detection of obesity (risk) among experts through addition of specific growth monitoring assessments in children during the first two years of life.

Methods

Experts from the field of infant growth (paediatricians, researchers, nutritionists) from Asia Pacific and Europe met in 2013 to discuss practices and potential research gaps in growth and body composition assessment of children in the Asia Pacific region. Although qualitative approach using Delphi method was not administered, one highlighted area was how to include effective anthropometric measurements in early growth monitoring to detect excess adiposity gain. Some of the practices and the gaps in this sphere were highlighted in this review.

Discussion

Current routine growth monitoring in selected Asia Pacific countries

The four countries included for assessment (Sri Lanka, Malaysia, Singapore, Australia) may not be representative of the whole of the Asia Pacific region, however they are at different stages of economic development with varied burdens of overweight and obesity. Current growth monitoring practices in these countries are primarily conducted to monitor physical growth (weight, height and head circumference) as a whole and not to evaluate changes in body composition (Table 1) with differences in practice influenced by the availability of resources' and national requirements.

Challenges in measuring body composition in early life

Several methods are well-established to assess body composition among adults *(*Air Displacement Plethysmography (ADP), Dual-Energy X-ray Absorptiometry (DEXA) and Body Impedance Analysis (BIA)). However, sensitivity and practicality of these tests to assess fat deposition in children during the first two years of life requires further validation and research.

An alternative yet sensitive assessment which could be implemented in daily practice using a simple tool is skinfold thickness (SFT).[6] This consists of individual values from the independent assessment of subscapular, supra-iliac, biceps and triceps skinfolds or combined central or peripheral SFT or the sum of four sites (S4SFT) or specific SFT ratios. The S4SFT is identified as a good predictor of the changes in the fat mass during the first year of life and measures are required for younger children.[7,8] S4SFT within the first few months of life has been associated with cardiovascular health risk with an increase of aortic intima media thickness at 6 weeks[9] and obesity risk at 6 years of age (OR 1.61, 95% CI 1.09, 2.38).[10]

Measurement of SFT has several requirements for successful implementation that include a standard protocol, adequate training of the measurement techniques to avoid observer variability[11] (because it takes longer than standard anthropometry to complete) and translation of S4FT into an estimated total body fat mass for Asian children. The existing limited translation is due to a lack of population specific equations as existing equations have not yet been validated for Asian populations in younger age.[12]

Table 1. Overview of current practices for growth monitoring among children 0-5 years of age across the four countries

Countries/ Practices	Sri Lanka	Malaysia	Singapore	Australia
Demographics	Birth rate: 20/ 1000 birth, GDP: $3,368. Prevalence of childhood overweight: 6.1%	Birth rate: 17/1000 birth, GDP: $10,878. Prevalence of childhood overweight: 12–16%	Birth rate: 9.7/ 1000 birth, GDP: $ 51,855. Prevalence of childhood overweight: 12–16%	Birth rate: 12.8/1000 birth, GDP: $54,708. Prevalence of childhood overweight: 25%
Venue and personnel to monitor growth	Medical Officer of Health at every village	Hospitals, general clinics, maternal & child clinic (nurses)	well-child clinics in government-run polyclinics and private paediatrician offices.	child health nurses in well-child clinics in community hospitals and private paediatrician offices.
Recording system	Child Health Development record (50 page)	Health book (118 page)	Health book	"Purple" growth and development book.
Anthropometric measures	weight, length/ height, head circumference	weight, length/ height, head circumference	weight, length and head circumference	weight, length and head circumference
Frequency of assessment	monthly up to 24 months of age, then 2–3 monthly from 3–5 years of age.	monthly for the first 6 months, every 2 months for the second 6 months, every 3 months between 1–3 years of age, every 6 months between 2–4 years of age and annually between 4–6 years of age	1 month, 3 months, 4 months, 5 months, 6 months, 9 months, 15 months and 18 months.	1 month, 3 months, 4 months, 5 months, 6 months, 9 months, 15 months and 18 months.

A call for action for daily practice and further research

As currently used anthropometric measures do not provide an opportunity for the detection of increased adiposity during early life, a measure of SFT could be used as an alternative. S4SFT has shown to be an accurate, practical, relatively low cost and easy to implement measure of fat mass in various cross-sectional and longitudinal studies amongst younger children.[7,10]

To enable the use of S4SFT as part of routine growth assessment, several initiatives need to be taken that include a feasibility study on the use of S4SFT in day to day practice; a concise but comprehensive easy-to-use measurement protocol, validation with other gold standard methods, standard reference to identify intervention levels, and comprehensive training for staff. Cost-effectiveness studies and a referral system when adverse levels of adiposity are detected are also important.[13]

There could be increased pressure in the implementing these initiatives to measure all children in a busy clinic. Therefore, measurement of S4SFT could be a required assessment after initial screening using traditional anthropometry for children at risk for overweight/ obesity. Adopting

S4SFT measures into routine child health monitoring would assist in early detection of children at risk of excess adiposity and introducing this initiative into each country's national program of healthcare is of paramount importance.

Conflict of Interest

Leilani Muhardi, Eline M van der Beek and Marieke Abrahamse-Berkeveld are employees of Danone Nutricia Research-Early Life Nutrition. None of the other authors have conflict of interest. No educational grant is provided to the rest of authors. Ethical Approval is not obtained as the manuscript is based on observation of current practice.

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