Nutri Scene

DR TEE E SIONG

starhealth@thestar.com.my

International growth references for infants, children and adolescents are now available.

WHO growth standards

ANTHROPOMETRIC measurements such as weight and height and the associated indicators, for example, height-for-age, weight-for-age, and weight-for-height, are among the principal tools used by researchers, public health workers and clinicians to assess the health and nutritional well-being of individuals and population groups at nearly all life stages.

These simple and yet practical measurements are the best tools for consumers to monitor growth of their children and the weight status of their family members.

Weight and height measurements taken must be compared with some accepted references or standards to determine appropriate growth or body weight status. Various references have been used for the various age groups. These include the National Centre for Health Statistics (NCHS), the Centre for Disease Control (CDC) 2000 growth charts, the International Obesity Task Force (IOTF) cut-offs. Serious limitations of these references have been recognised over the years.

To ensure that growth charts are scientifically robust and effective for public health and educational purposes, the World Health Organisation (WHO) embarked on a systematic programme to develop improved growth standards and references.

Resulting from these efforts, WHO launched a new global Child Growth Standards for infants and children up to five years of age in 2006. The following year, WHO released a growth reference for school-aged children and adolescents.

This instalment of *NutriScene* highlights the availability of these growth references. The types of charts and data available and their use are summarised. I will also touch on the use of the current BMI cut-offs for adults to provide a complete range of growth monitoring guides from infants to adults provided by WHO.

Readers working in the area of nutrition would remember that since the late 1970s, the National Center for Health Statistics (NCHS)/ WHO growth reference has been in use to chart children's growth. This reference was based on data from a limited sample of children from the United States. It contains a number of technical and biological drawbacks that make it less adequate to monitor the rapid and changing rate of early childhood growth. It describes only how children grow in a particular region and time, but does not provide a sound basis for evaluation against international standards and norms.

Recognising these significant shortcomings, WHO in 1993 undertook a comprehensive review of the uses and interpretation of anthropometric references. The review concluded that the NCHS/ WHO growth reference did not adequately represent early childhood growth and that new growth curves were necessary.

WHO undertook the Multicentre Growth Reference Study (MGRS) between 1997 and 2003 to generate new curves for assessing the growth and motor development of children all over the world.

The MGRS combined a longitudinal follow-up from birth to 24 months and a cross-sectional survey of children aged 18 to 71 months. Primary growth data and related information were gathered from 8,440 healthy breastfed infants and young children from widely diverse ethnic backgrounds and cultural settings (Brazil, Ghana, India, Norway, Oman and US).

The MGRS is unique in that it was purposely designed to produce a standard by selecting healthy children living under conditions likely to favour the achievement of their full genetic growth potential. Furthermore, the mothers of the children selected for the construction of the standards engaged in fundamental health-promoting practices, namely breastfeeding and not smoking.

Prior to their release, the new growth standards were field-tested in four countries. The main objective was to compare children's length/height-for-age and weight-for-length/height based on the new standards with clinician assessments of the same children. The study sampled children less than five years old attending well-child clinics in two affluent populations (Argentina and Italy) and two less-affluent ones (Maldives and Pakistan).

The overall concordance between clinical assessments and the WHO standards-based indicators attested to the clinical soundness of the standards.

The new WHO Child Growth Standards differ from any existing growth charts in a number of innovative ways:

● For the first time they describe "how children should grow", which is a prescriptive approach, not just descriptive. These charts show that all children across all regions can attain a similar standard of height and weight and development with correct feeding practices, good healthcare and a healthy environment. The new standards prove that differences in children's growth to age five are more influenced by nutrition, feeding practices, environment, and healthcare than genetics or ethnicity.

● As such, a key characteristic of the new standard is that it establishes breastfeeding as the biological "norm" and the breastfed infant as the standard for measuring healthy growth. Previous reference charts were based on the growth of a random mixture of breastfed and artificially-fed children.

The following growth standards have been made available by WHO:

● Length/height-for-age
● Weight-for-age
● Weight-for-length
● Weight-for-height
● Body mass index-for-age (BMI-for-age)
● Head-circumference-for-age
● Arm-circumference-for-age
● Subscapular skinfold-for-age
● Triceps skinfold-for-age
● Motor development milestones

For each of the indicators above, charts for boys and girls, based on z-scores and percentiles are separately made available. These can be printed out for use in homes, schools or clinics. Z-scores and percentile tables for each of the above indicators for boys and girls are also made available, in pdf and as text files.

WHO also highlighted that the development for the first time of a standardised Body Mass Index (BMI) charts for infants to children up to five years of age is a major innovation in assessing healthy weights of children.

Additionally, the development of Windows of Achievement for six

Standard reference

WHO undertook the Multicentre Growth Reference Study (MGRS) between 1997 and 2003 to generate new curves for assessing the growth and motor development of children all over the world. – Photos.com

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key motor development milestones (such as sitting, crawling, standing and walking) will provide a unique link between physical growth and motor development.

All charts, tables and documentation related to the WHO global growth standard for infants and children up to five years can be obtained from http://www.who.int/childgrowth/en/

Monitoring growth and development

You can use the above charts and tables for determining and monitoring the growth status of several individuals or small groups of individuals. But when you have to handle large numbers of individuals, you will need a software to help you analyse the data.

With the availability of the new growth standards, WHO has also updated its Anthro software in 2007. This programme is for use on desktop personal computers or laptops using MS Windows. It was developed to facilitate application of the WHO Child Growth Standards in monitoring growth and motor development in individuals and populations of children up to five years of age.

In addition, there are macros for the statistical software packages SPSS, SAS, S-Plus and STATA to facilitate survey data analysis.

The current version contains both sets of the WHO Child Growth Standards, namely weight-for-age, height-for-age, weight-for-height, BMI-for-age and windows of achievement for six gross motor milestones as well as the second set of standards for the indicators head-circumference-for-age, arm-circumference-for-age, triceps and subscapular skinfold-for-age.

Rather similar to its previous versions in the 90s, WHO Anthro consists of three modules:

● Anthropometric calculator to assess a child's nutritional status

● Individual assessment to follow a child's development and growth over time

● Nutritional survey to analyse data sets from community nutrition surveys

Check the WHO website to see how to obtain this software: http://www.who.int/childgrowth/software/en/index.html

Developing a growth reference

The need to develop an appropriate single growth reference for the screening, surveillance and monitoring of school-aged children and adolescents became more urgent, as a result of two recent events, namely the increasing public health concern over childhood obesity and the April 2006 release of the WHO Child Growth Standards for infants and preschool children (described in the previous sections).

The reference previously recommended by WHO for children above five years of age, i.e. the National Center for Health Statistics (NCHS)/WHO international growth reference, has several drawbacks. In particular, the BMI-for-age reference, developed in 1991, only starts at nine years of age, and covers a limited percentile range. Many countries pointed to the need to have body mass index (BMI) curves that start at five years and permit unrestricted calculation of percentile and z-score curves on a continuous age scale from five to 19 years.

WHO convened an expert group meeting in January 2006 to evaluate the feasibility of developing a single international growth reference for school-aged children and adolescents. The experts agreed that a multicentre study, similar to the one that led to the development of the WHO Child Growth Standards for up to five years, would not be feasible for older children.

Other alternative approaches were considered, especially the use of existing historical data. WHO finally developed the growth reference from five to 19 years based on the 1977 NCHS/WHO original sample (a non-obese sample with expected heights), supplemented with data from the WHO Child Growth Standards (to facilitate a smooth transition at five years), and applying the state-of-the-art statistical methods used to develop standards for preschool children.

WHO growth reference 2007 for five to 9 years

The following indicators are available in this revised 2007 reference:

● Body mass index-for-age (BMI-for-age)

● Height-for-age

● Weight-for-age

For each of the indicators above, charts for boys and girls, based on z-scores and percentiles, are separately made available. These can be printed out for individual use in various settings. Z-scores and percentile tables for these indicators, for boys and girls, are also available, in pdf and as text files. There are also expanded tables for constructing national health cards.

The following are the cut-offs suggested by WHO:

● Overweight: >+1SD (equivalent to BMI 25 kg/m2 at 19 years)

● Obesity: >+2SD (equivalent to BMI 30 kg/m2 at 19 years)

● Thinness: <-2SD

● Severe thinness: <-3SD

All charts, tables and documentation related to this 2007 growth reference can be downloaded from: http://www.who.int/growthref/en/

BMI cut-offs for adults

For adults, WHO continues to recommend the use of Body Mass Index (BMI) as a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in metres (kg/m2). The principal cut-offs recommended by WHO are: underweight = <18.5, normal range = 18.5-24.9, overweight ≥25, obesity ≥30.

There was a debate some years ago on whether there is a need to lower the cut-off points for Asians. However, upon reviewing available data, a WHO expert consultation recommended that the current WHO BMI cut-off points above should be retained as the international classification. The expert consultation however, recommended that the cut-off points of 23, 27.5, 32.5 and 37.5 kg/m2 are to be added as points for public health action.

■ *NutriScene is a fortnightly column by Dr Tee E Siong, who pens his thoughts as a nutritionist with over 30 years of experience in the research and public health arena. For further information, e-mail starhealth@thestar.com.my.*