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Growth charts for babies

New WHO charts are based on breast fed babies from rich and poor countries

Are the growth charts that we currently use inaccurate? Recent press reports about new growth charts from the World Health Organization imply that they are, particularly for breast fed babies. These charts are an exciting development, but are our current charts really as inadequate as the press would have us believe?

The first widely used growth reference in the United Kingdom was produced nearly 40 years ago,[1] followed by the chart from the National Center for Health Statistics in the United States,[2] which has been used ever since as WHO's international standard. These established the value of plotting measurements on growth charts in order to properly assess growth and nutritional status. However, problems with their accuracy were recognised 20 years ago; the growth of breast fed and formula fed infants, when plotted on either chart, rose steadily in the first few weeks and then fell by around one centile space (2/3 standard deviation).[3] This is possibly because most of the children on whom the charts were based were born in the 1950s and fed fairly crude breast milk substitutes. Secular trends to increasing height and gender discrepancies also rendered the childhood charts less valid.[4 5] Because of these limitations, the new United Kingdom 1990 charts and the charts from the US Centers for Disease Control were developed.[4 6] These are based on larger, more recent datasets, constructed by using statistical rather than visual smoothing, and seem to fit infant growth patterns far better.[7 8] In the United Kingdom, the new charts were rapidly adopted in primary care. Some paediatricians were reluctant to leave their more familiar charts behind, but a consensus group of the Royal College of Paediatrics and Child Health has now recommended that only the new United Kingdom 1990 charts should be used in infancy.[9]

Charts to date have simply described growth at any one time in the reference population. This is the simplest approach methodologically, but it raises difficult issues. In affluent populations, increasing rates of obesity mean that the proportion of children above the upper centiles is rising, but there is understandable resistance to updating charts to reflect this. In the developing world, in contrast, chronic and intergenerational undernutrition means that average growth is suboptimal, making the construction of local reference charts difficult if not unethical.

The alternative to a reference chart is a growth standard based only on the growth of healthy children in optimal conditions. This describes how children should grow, rather than how they actually grow, and is what WHO set out to produce.[10] They collected data in six centres worldwide (Brazil, Ghana, India, United States, Norway, Oman), with those from poorer countries represented by subjects from affluent communities, and recruited only non-smoking mothers willing to breast feed exclusively for four months. Because of these stringent criteria, the study plan expected that as few as 20% might be eligible and willing to participate. This raises concerns that the infants studied may be different in other ways from the rest of the population. However, the resulting data (not yet in the public domain) are said to show great similarities in growth across all six study centres, which is in keeping with earlier studies,[3 7] indicating that differences in height between rich and poor populations reflect environmental far more than genetic variation.

Attention has been focused particularly on the differences in growth between breast fed and formula fed infants. Slightly slower growth has been consistently seen in exclusively breast fed, compared with formula fed, infants in observational studies, which has led to the suggestion that breast fed infants should have separate charts.[11] However, a strong argument exists that such differences are not actually caused by the differing feeding mode, since faster growth was seen in trial populations exposed to breast feeding promotion,[12] with the likelier explanation being reverse causation: relatively large babies feed more, are more demanding, and are thus less likely to remain exclusively breast fed.[12] Rather than picking out breast fed infants as exceptional, all charts should be based on breast fed infants since they are the biological norm, but such data do need to be unbiased. For the first time, WHO could supply such data, provided that most infants were retained in the study and breast feeding rates were well maintained, assisted by active lactation support programmes provided in all study sites.

Should the United Kingdom move over to the new WHO charts when they are released? We already have much improved charts that reflect the growth of breast fed and formula fed infants far better than the old WHO charts, and persuading colleagues to renounce the earlier inaccurate charts has already proved hard enough. Will it be worth the effort to make a change from one much improved chart to another? The key questions, which can be answered only once the peer review process has been completed, will be how much the rigour of the WHO method has succeeded in

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producing a true blueprint for optimum growth and how well the new charts actually fit to the growth of infants in the United Kingdom.

If they pass the test, for the first time infants worldwide could be compared with the same growth standard, with breast fed infants rightly established as the norm with which all other infants should be compared.

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Competing interests: CW has published a specialist growth chart based on the United Kingdom 1990 growth reference.

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Strontium ranelate for the treatment of osteoporosis

Is useful, but changes in bone mineral density need careful interpretation

The successful treatment of osteoporosis is a relatively recent phenomenon. Although bisphosphonates are now established as the treatment of choice,[1] this only came about with the publication in 1996 of the FIT alendronate trial.[2] Nowadays the main treatment options are anti-resorptive agents that prevent bone breakdown. Most studies of these agents show good protection against fractures of the spine, while the more potent nitrogen containing bisphosphonates also show a reduction in non-vertebral fractures.[1–5] For patients with previous fractures, treatment with an anabolic agent that enhances bone formation is clearly preferable, and this is now possible since the introduction of 1-34 recombinant parathyroid hormone (PTH).[6] However, the use of PTH is limited by its high cost and the need for subcutaneous self injection. Recently strontium ranelate has been licensed in the United Kingdom for the treatment of osteoporosis. Here we draw attention to the unusual effect of strontium treatment on bone mineral density and discuss the potential bonus that this effect can be used for assessing adherence to therapy.

The mechanism of action of strontium ranelate is not yet fully understood, compared with other treatments, but it seems to have a unique effect in that it inhibits bone resorption as well as stimulating bone formation.[7] Recent studies, the SOTI and TROPOS trials, have shown its efficacy at preventing both vertebral and non-vertebral fractures,[7 8] including hip fractures in older women.[8] Strontium ranelate was well tolerated in these trials without any major side effects. The most common side effects reported were a small increase in the incidence of nausea and diarrhoea.

Strontium ranelate is composed of two atoms of stable strontium combined with organic ranelic acid. The ranelic acid is a carrier that makes the treatment palatable, and the strontium is the active component with regard to the skeleton. As an alkaline earth element, strontium is similar to calcium in its absorption in the gut, incorporation in bone, and elimination from the body through the kidneys.[9] Strontium is naturally present in trace amounts with around 100 µg in every gram of bone,[w1] so treatment with strontium ranelate is simply making more strontium available for incorporation into bone. In the short term the strontium atoms are adsorbed on to the surface of hydroxyapatite crystals, and in the longer term some strontium will exchange with calcium in the bone mineral and may remain bound in the skeleton for years.[9] Strontium not incorporated into bone is excreted through the kidneys and faeces. After three years' treatment with strontium ranelate, bone tissue will contain around one strontium atom for every 100 calcium atoms. In animal studies, up to one calcium atom in 10 was substituted with strontium without any important modifications of bone mineral at the crystal level.[10] No human studies have yet reported how quickly bone strontium is washed out once treatment is stopped. However, studies with radioactive strontium show that much of the stable strontium present in bone after three years of treatment will still be there a decade later.[9]

What are the changes in bone mineral density with strontium ranelate? In the SOTI trial, an impressive increase in bone mineral density occurred in the spine (14.4%) and hip (8.3%).[7] However, some caution is necessary in interpreting these figures because much of this effect is due to the higher atomic number of strontium ($Z=38$) compared with calcium ($Z=20$). When bone mineral density is measured by bone densitometry, atom for atom strontium attenuates x rays more strongly than calcium. As a result a 1% molar fraction of

Additional references w1-w5 are on bmj.com

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