

Rickets on the rise: Vitamin D deficiency

Wendy Fidler considers the rise in incidence of childhood rickets and examines the latest research which indicates that Vitamin D deficiency in pregnant mothers and infants is also increasing.

Rickets was first documented by doctors in the mid 17th century. During the Industrial Revolution many people moved from the countryside to work in factories in smoggy cities and rickets became an epidemic in the UK and across Europe. Although the link between a lack of sunlight and the rapid rise of rickets had been established it was impossible for people to get more sunshine when their daylight hours were spent in factories. By the early 20th century the epidemic had spread to North America.

Vitamin D is naturally manufactured in the skin when it is exposed to sunlight. It also occurs in some foods such as cod liver oil, oily fish such as salmon and mackerel, and in smaller quantities in beef, eggs, milk and cheese. In the USA the government intervened by fortifying bread, milk and orange juice with Vitamin D thus largely eradicating the disease. In Britain, where most children were given supplements of cod liver oil, rickets, which is entirely preventable, ceased to be a major health issue.

Today, however, many cities of the world, including Bradford, Leicester and Newcastle in the UK, are seeing a disturbing increase in the incidence of rickets in young children.

What is the cause of the current rise in numbers of children with rickets?

There are many known reasons why children are born with Vitamin D deficiency and hence are at risk of developing rickets:

Causes before birth (pre-natal causes)

- A mother's nutrient deficiency has a profound effect on her baby during gestation and pregnancy. The importance of Vitamin D during pregnancy is widely recognized; however, a recent study in Northern Ireland indicated that mothers may not be getting enough Vitamin D, even those taking supplements at the recommended doses (*British Journal of Nutrition*, Vol. 102). According to the study the developing foetus accumulates about 30 grams of calcium in the womb.
- Vitamin D is critical to tissue formation in the developing foetus, especially in the primitive gut, and for the development of the small intestine and its villi which will play a crucial role in nutrient absorption.
- Women who develop a severe form of pregnancy-related high blood pressure – early on-set severe preeclampsia – tend to have lower

What is Rickets?

Rickets is a serious disease related to vitamin D deficiency. When children have rickets their bones do not absorb calcium and phosphorous and the bone tissue fails to mineralise properly. This results in soft bones and skeletal deformities, particularly in the legs where the bones are not sufficiently strong to carry the body's weight.



Children with rickets also suffer from bone pain and weak muscles, but these symptoms can be subtle and go undetected in the early stages.

Rickets is a 'short latency' disease – the symptoms show up in a relatively short period of time.

blood levels of Vitamin D than healthy mothers-to-be. (*American Journal of Obstetrics and Gynecology* online, August 25 2010). It is thought that Vitamin D deficiency helps explain why mothers with darker skin are at greater risk of the complication than other racial groups, even when income and healthcare are taken into account. Vitamin D is naturally synthesised in the skin when it is exposed to sunlight, but this process is less efficient in people with darker skins.

Causes after birth (infancy)

- Feeding children Vitamin D-rich food and supplements after birth may be too late to ensure optimal bone health if the mother's intake of Vitamin D was inadequate during pregnancy.
- If a breastfeeding mother is deficient in Vitamin D her baby's

'Entirely Preventable'

"I am dismayed by the increasing number of children we are treating with this entirely preventable condition. Fifty years ago, many children would have been given regular doses of cod liver oil, but this practice has all but died out."

Dr Tim Cheetham, Newcastle University, *British Medical Journal*

"Paediatricians have been concerned for some time about the number of children they are seeing with Vitamin D deficiencies – it is increasing. We are still seeing children with rickets and low calcium levels due to lack of Vitamin D. We should not be seeing any children with it at all."

Shirley Brierley, Specialist Registrar in Public Health, Bradford City Teaching PCT

requirements may not be met. A recent US review of rickets found that most cases occurred among young, breastfed African Americans. The American Academy of Pediatrics recommends that exclusively or partially breastfed infants receive daily supplement drops of 400 IU Vitamin D.

Causes in childhood

- Vitamin D is produced naturally when unprotected skin is exposed to sunlight and so children need to work or play outdoors for part of everyday. In the summer, most children should be able to get sufficient 'sunshine vitamin' from playing outdoors. However in autumn and winter, children living in latitudes higher than 50 degrees are unlikely to get sufficient exposure to the ultraviolet B rays which are necessary for cutaneous production of Vitamin D.
- The popularity of indoor games for children, and parents' worries about risks when children are out of doors, have impacted on the opportunities for children to absorb their sunshine vitamin.
- Over-zealous use of sunblock, and swimming costumes which cover most of the skin are thought to have contributed to the rise in Vitamin D deficiency in childhood.

Paediatricians in Bradford have found that Vitamin D deficiency rates are higher among children of South Asian families, particularly girls. Many Muslim women who observe hijab are at higher risk because Islamic dress codes prevent the skin absorbing ultraviolet light at sufficiently high doses.

What is the recommended IU daily intake of Vitamin D?

The international unit (IU) is a unit of measurement based on an accepted standard and on biological activity of the substance. 1000 IU of Vitamin D equals 25 micrograms (mcg) of Vitamin D. The IU for Vitamin D is unique to this substance, i.e. 100 IU of Vitamin D does not equal 100 IU of, say, Vitamin E.

- In the UK the government's Committee on Medical Aspects for Food and Nutrition Policy has declined to set a 'Reference Nutrient Intake' value for people leading a 'normal lifestyle', arguing that

people can get the Vitamin D they need from food and sunlight. For pregnant women, the elderly and people confined indoors they recommend a daily intake of 10 micrograms a day, i.e. 400 IU.

- In the USA and Canada the Institute of Medicine recommends 200 IU per day for people aged below 50, 400 IU for people aged 50-70 and 600 IU per day for the elderly. There are no specific recommendations for pregnant women.
- In France Vitamin D post-menopausal women are recommended to take 800 IU per day

At the beginning of August 2010 scientists in Europe and the USA called for an increase in the daily recommendations for Vitamin D which they say is crucial to protect against childhood rickets and muscle weakness.

Can Vitamin D help with any other diseases?

Until recently, vitamin D was viewed primarily as a protective agent against diseases of the bone, such as rickets and osteoporosis. Current recommendations for the vitamin are based on preventing these disorders and call for a relatively small intake – a minimum of 400 IUs per day, and perhaps twice that for the elderly, who may not get outdoors as often.

Rickets is a 'short latency' disease – the symptoms show up in a relatively short period of time. Emerging research suggests that Vitamin D may also be effective in preventing 'long latency' diseases such as cancer, muscular sclerosis (MS), heart disease and Parkinson's disease. Children's conditions such as autism, asthma and type 1 diabetes have also become pervasive in the last 20 years, coinciding with the societal change to sun avoidance.

"We don't have a cause and effect relationship here yet proving that higher doses of vitamin D prevent such diseases", said biochemist Hector DeLuca of the University of Wisconsin. DeLuca

"It is high time that worldwide Vitamin D nutritional policy, now at a crossroad, reflects current scientific knowledge about the vitamin's many benefits and develops a sound vision for the future."

Anthony Norman, Prof. Emeritus Biochemistry and Biomedical Sciences, University of California, Riverside: 'Experimental Biology and Medicine'

"Although Vitamin D deficiency can be reversed in human infants through supplementation, it is unclear if deficiency in utero and neonatally continues to manifest as low bone mass and altered bone metabolism despite correction of Vitamin D status"

Dr Hope Weller, McGill University, Quebec, Journal of Nutrition

was the first to demonstrate how the vitamin interacts with the endocrine system, which manages the body's hormonal balance.

'In disease fighting, vitamin D gets an A', *Los Angeles Times*, June 10th 2008

How much sun is safe?

The vitamin is produced from natural precursors in the body by exposing skin to ultraviolet B in sunlight. Caucasian sunbathers can get 20,000 IUs in 20 minutes at noon in summer. Any further exposure simply damages skin.

Darker-skinned people need three to five times the exposure to produce the same amount. Sun block interferes with production by screening out ultraviolet light (*ibid.*) ■

Resources:

American Academy of Pediatrics (AAP) (2008) Prevention of Rickets and Vitamin D Deficiency in Infants, Children, and Adolescents *PEDIATRICS* Vol. 122 No. 5 November

Apple, S (2009), To D or not to D, *Financial Times*, 24/25 October, Pearson

Holick, M. F. and Jenkins, M. (2009), *The UV Advantage: the medical breakthrough that shows how to harness the power of the sun for your health*, iBooks, ISBN: 1596879009

Khalsa, S (2010), *The Vitamin D Revolution: how the power of this amazing vitamin can save your life*, 2nd Edition, Hay House, ISBN: 1401924706

UK Food Standards Agency (FSA): Nutrition and Bone Health http://www.food.gov.uk/science/research/nutritionresearch/optimalnutrition/n05pr ogramme/n05list_bonehealth/
World Health Organisation (WHO) <http://www.who.int/en/>

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