MINISTRY OF HEALTH
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Date	16 NOVEMBER 2009	Date sent to Director General	12 FEBRUARY 2010

NSAC 'Statement of Advice': Should women be screened for vitamin D during pregnancy in New Zealand?

To **Stephen McKernan, Director-General of Health, Ministry of Health**

From **Ross Lawrenson, Chair, National Screening Advisory Committee**

Executive Summary

1. Vitamin D consists of a group of hormones with a well-established role in bone metabolism, calcium homeostasis and parathyroid gland secretion. Severe vitamin D deficiency causes rickets in children and osteomalacia in adults. The main source of vitamin D hormone in New Zealand is sun exposure to the skin, however smaller amounts may be consumed in the diet.
2. Current research suggests that vitamin D deficiency affects most segments of the New Zealand population, including pregnant women and children. This may account for anecdotal reports of vitamin D deficiency rickets. The prevalence of vitamin D deficiency in early childhood has been found to vary with season and ethnicity. Vitamin D levels are lowest in the winter and spring. As well, individuals with dark-pigmented skin require longer periods of sun exposure than individuals with light skin to make the same amount of vitamin D. Skin pigmentation may drive inequalities in vitamin D status.
3. Screening for vitamin D antenatally is not recommended without high quality evidence of its effectiveness, however, assuming most pregnant women are vitamin D deficient, taking vitamin D as a supplement instead of screening for deficiency may be the more cost-effective option for achieving optimal vitamin D status. Randomised-controlled trials which identify the amount of vitamin D required to overcome vitamin D deficiency rickets and the consideration of option(s) for achieving it (e.g. food-fortification, supplementation and/or sensible sun exposure) are recommended.
4. A watching brief of the incidence of vitamin D deficiency rickets, by ethnicity, should be kept. Furthermore, as the effects of vitamin D deficiency are becoming more known, and vitamin D deficiency is being recognised as a worldwide population public health issue, a watching brief of research related to vitamin D deficiency and the incidence of serious health conditions should be kept.

Background

5. Vitamin D consists of a group of hormones with an established role in bone metabolism, calcium homeostasis and parathyroid gland secretion. Blood levels of 25-hydroxyvitamin D_3 (25-OHD), the active form of vitamin D, is the measure of vitamin D status. The Australia New Zealand Bone Mineral Society (2005) defines severe vitamin D deficiency and vitamin D insufficiency (a less severe form of deficiency) as 25-OHD blood levels less than 12.5 nmol/L and between 25 and 50 nmol/L, respectively. Severe vitamin D deficiency is associated with rickets in children (Munns et al 2006) and osteomalacia in adults (Working Group of the Australia and New Zealand Bone Mineral Society et al 2005).
6. Vitamin D deficiency rickets or "rickets" is a softening of bones in children potentially leading to fractures and deformity. The predominant cause is vitamin D deficiency, but lack of adequate calcium in the diet may also lead to rickets. "Osteomalacia" describes a similar condition occurring in adults, which is also generally due to vitamin D deficiency. However, evidence may be emerging of the role of vitamin D in other serious health conditions.
7. The main source of vitamin D is sun exposure, specifically to ultraviolet B radiation (UVB), to the skin. Vitamin D can also be consumed in smaller quantities from the diet where it occurs naturally from oily fish, milk and eggs (LINZ 1992). In New Zealand, vitamin D can also be consumed from vitamin D-fortified foods where permitted in: margarine, fat spreads, yoghurt, dried milk, and plant-based milks (Food Standards Australia New Zealand 2002).

Vitamin D Deficiency Rickets in New Zealand?

8. Over the past decade, there has been increasing evidence that vitamin D insufficiency (a less severe form of deficiency defined as 25-OHD < 50 nmol/L of blood) affects most segments of the New Zealand population, including pregnant women and young children (See Appendix 1. Table 1). As it affects the pregnant population, low maternal vitamin D status may partly account for anecdotal reports of rickets in infants in New Zealand.
9. In a clinical cohort study of pregnant women attending a multicultural general practice in Wellington, where 10 cases of childhood rickets were previously diagnosed, 78 women of 90 women (87%) screened were vitamin D deficient (defined as vitamin D_3 < 50 nmol/L) (Judkins and Eagleton 2006). Of the women screened, a high incidence of vitamin D deficiency was found in women of African, Middle Eastern, Asian, Maori, Samoan, and Pacific Island ethnicity.
10. In an earlier case study (1998) of the characteristics of 18 children aged 3 to 36 months hospitalised with vitamin D deficiency rickets in Auckland, the majority (67%) were of Indian ethnicity (Blok 2000).
11. Similarly, in an Australian study, 25 of 31 mothers (81%) with children who were diagnosed with vitamin D deficiency rickets (defined as vitamin D_3 levels < 25 nmol/L), were also severely vitamin D deficient when screened (Nozza and Rodda 2001).
12. While these Australasian studies may suggest vitamin D deficiency rickets is emerging as a public health issue, the incidence and prevalence of vitamin D

deficiency rickets in New Zealand remains unknown. This necessitates keeping a watching brief of the epidemiology of rickets in New Zealand.

Antenatal Vitamin D Screening Policy

13. In a consensus statement developed by Australian and New Zealand Bone Mineral Society, Endocrine Society of Australia and the Osteoporosis Society of Australia, it was recommended all pregnant women living in Australia and New Zealand, especially those who are veiled or dark-skinned, be screened for vitamin D during their first trimester of pregnancy. Additionally, it was recommended pregnant women be treated with 75 to 125 µg (3000 to 5000 IU) of vitamin D daily if found to be moderately or severely deficient (Munns et al 2006).

14. Both of these sets of antenatal vitamin D screening recommendations, however, were informed by observational evidence gathered by Thomson et al (2004), and Wharton and Bishop (2003), and not experimental evidence (i.e. randomised controlled trials) of screening effectiveness. Population-level recommendations to screen antenatally for vitamin D should not be issued without high quality evidence from randomised-controlled trials that screening reduces morbidity (or mortality) (National Health and Disability Commission 2003).

15. In recently updated guidelines, the National Institute for Health and Clinical Excellence (2008) recommended all pregnant women be informed at their booking appointment about the importance for their own and their baby's health of maintaining adequate vitamin D stores during pregnancy and whilst breastfeeding. This is consistent with current Ministry of Health nutrition policy advice for pregnant and breastfeeding women (Ministry of Health 2006). Furthermore, it was recommended that women, especially those at high-risk for deficiency, choose to take a 10 µg supplement of vitamin D per day. However, there is no 10 µg (400 IU) registered vitamin D tablet currently subsidised by the Pharmaceutical Management Agency (PHARMAC) in New Zealand.

16. It should also be noted that taking a vitamin D supplement instead of screening for deficiency may be the most cost-effective option for achieving optimal vitamin D status (Scragg 2009). Assuming most pregnant women are at least vitamin D insufficient, especially during the winter and spring months, offering a vitamin D supplement is less costly than offering population vitamin D screening.

Risk Factors for Vitamin D Deficiency

17. Individuals who are regularly exposed to sunlight are less dependent on dietary sources of vitamin D. According to the Australian and New Zealand Bone and Mineral Society (2005), the amount of sun exposure required to synthesize adequate vitamin D levels depends upon a number of risk factors including: season, time of day, latitude, skin pigmentation, clothing coverage, sun block, age, and physical activity (See Appendix, Table 2).

18. Pregnant women at risk for vitamin D deficiency include those with reduced sunlight skin exposure due to (Royal Australian and New Zealand College of Obstetricians and Gynaecologists. 2008):

    a. veiling

    b. regular use of sunscreen, and

    c. dark skin pigmentation.

19. A recent Auckland study whose aim was to determine the prevalence of and risk factors for vitamin D deficiency in children aged 3 to 36 months, found vitamin D deficiency (defined as 25-OHD <27.5 nmol/l) present in 46 of 353 children (10%) (Grant et al 2009). Furthermore, an increased risk of vitamin D deficiency was associated with (in descending order of magnitude of effect): winter or spring season, Pacific ethnicity, not receiving any infant or follow-on formula, not currently receiving vitamin supplements, or living in a more crowded household.

20. Results of the 1997 National Nutrition Survey[1], whose aim was to measure vitamin D status and its determinants in adults aged 15 years and older, found the determinants of vitamin D status for women were: age, ethnicity, obesity, latitude and season (Rockell et al 2006). As these determinants apply to pregnant women, spring to summer differences in vitamin D was 31 nmol/L (99% CI; 28-34). Maori (38 nmol/L, 99% CI; 35-42) and Pacific Island (33 nmol/L, 99% CI; 29-38) women had lower vitamin D status than New Zealand Europeans and Others (49 nmol/L, 99% CI; 47-51). Obese women had lower vitamin D status than normal-weight women by 6 nmol/L (99% CI; 3-10). And women living in the South Island had a mean vitamin D status that was 6 nmol/L (99% CI; 3-9) lower than women living in the North Island.

Vitamin D status and inequalities

21. Skin pigmentation is one of many factors which influences the rate at which vitamin D is synthesized, and which may also drive inequalities in vitamin D status related to ethnicity. Dark-pigmented skin reduces absorption of ultraviolet B radiation (UVB) and therefore requires longer periods of sun exposure than light skin to make the same amount of vitamin D. This has implications for lowered vitamin D status for individuals who are Pacific, Maori, or Asian and other pregnant women with dark-pigmented skin.

Policy Options for Addressing Vitamin D Deficiency Rickets in New Zealand

22. Vitamin D insufficiency is a recognised public health issue worldwide (Whiting et al 2007). The discovery of vitamin D receptors throughout many organs of the body (e.g. brain, heart, breast, skin, and sex organs), is in alignment with many investigations overseas of a causal relationship between vitamin D deficiency and other serious health conditions including: certain cancers (Lappe et al 2007), heart disease (Giovanucci et al 2008; Scragg et al 1990), diabetes (Pittas et al 2007; Scragg et al 1995), osteoporosis (Hitz et al 2007) and multiple sclerosis (Australia and New Zealand Multiple Sclerosis Genetics Consortium 2009).

23. Some researchers argue that the recommended daily requirement for vitamin D is set too low in New Zealand and internationally and should be re-evaluated against new evidence (Yetley et al 2009). Currently, the adequate intake (AI) for vitamin D from birth through to age 50 years, including pregnant or breastfeeding women is 5.0 µg (200 IU) per day (NHMRC 2006). However, the National Health and Medical Research Council has approached the Ministry of Health about working together to commence a rolling programme to review the 2006 recommendations. Randomised-controlled trials which determine the dose of vitamin D required during pregnancy to increase maternal vitamin D to prevent rickets, and the

[1] New data will be available in February 2010 from the recently completed data collection phase of the 2008/09 New Zealand Adult Nutrition Survey.

consideration of the best option(s) for doing so (e.g. food-fortification, supplementation and/or sensible sun exposure[2]) are recommended.

Conclusion

24. In the absence of evidence of screening effectiveness, NSAC does not recommend routine screening for pregnant women for vitamin D deficiency. However, keeping a watching brief of both the incidence of vitamin D deficiency rickets, and research implicating vitamin D deficiency as a causal factor of serious health conditions are recommended.

[2] Any recommendation as a policy approach to increase vitamin D status via sun exposure should take into consideration sun protection messages to prevent skin cancer (New Zealand Cancer Society 2008).

Recommendations

The National Screening Advisory Committee (NSAC) does not recommend routine screening for pregnant women for vitamin D deficiency.

The NSAC recommends that you:

a) **note** that there is as yet no high quality evidence from randomised clinical trials to demonstrate the benefits of routine screening for vitamin D antenatally.

The NSAC recommends that the Ministry of Health:

b) **notes** randomised-controlled trials are required to determine the dose of vitamin D necessary during pregnancy for increasing vitamin D antenatally to prevent childhood rickets

c) **reviews** the recommended daily requirement for vitamin D for pregnant women against new evidence of vitamin D deficiency in New Zealand

d) **considers** the best policy option(s) to ensure antenatal vitamin D sufficiency (e.g. food-fortification, supplementation and/or sensible sun exposure)

e) **considers** that dark-skin pigmentation influences the rate at which vitamin D is synthesized. This may have implications for inequalities in Vitamin D status for Pacific Islander, Maori, Asian and other dark-skinned pregnant women

f) **keeps** a watching brief of the incidence of vitamin D deficiency rickets by ethnicity and

g) **keeps** a watching brief of international research implicating vitamin D deficiency as a causal factor of other serious health conditions.

Appendix

Table 1. Evidence of low vitamin D status in New Zealand, including pregnant women.

Author	Year	Sample size	Age/Sex/Other description	Site	Type	Blood Vitamin D
Blok 2000	1998	10 M 8 F	3 - 36 months vitamin D deficient rickets	Auckland	Case study	100% < 25 nmol/L
Bolland et al 2007	Unspecified 12 month period	1606 F	Postmenapausal	Auckland	Clinical cohort	49% < 50 nmol/L
		378 M	Middle-aged +	Auckland	Clinical cohort	9% < 50 nmol/L
Grant et al 2009	1999-2002	353 M/F	6-23 months	Auckland	Clinical cohort	10% < 27.5 nmol/L
Judkins and Eagleton 2006	Unspecified 12 month period	90 F	Pregnant	Wellington	Clinical cohort	87% < 50 nmol/L 61% < 25 nmol/L
Livesey et al 2007	February to August 2004	82 M 119 F	45 years (median)	Christchurch	Clinical cohort	53% < 50 nmol/L
Rockell et al 2006	December 1996 to November 1997	2946 M/F	15 + years	New Zealand	Cross-sectional survey	48% < 50 nmol/L
Rockell et al 2005	2002	1585 M/F	5-14 years	New Zealand	Cross-sectional survey	31% < 37.5 nmol/L 4% < 17.5 nmol/L

Table 2. Known factors which influence solar-driven vitamin D synthesis in New Zealand.

Factor	**Effect on Vitamin D Synthesis**
Season	Increases summer and autumn, decreases winter and spring
Time of day	Increases between 11:00 am and 4:00 pm
Latitude	Decreases with increasing distance from equator
Skin pigmentation	Decreases with increasing pigmentation
Clothing coverage	Decreases
Sun block	Decreases
Age	Decreases with increasing age
Physical activity	Increases

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