Irish Medical Journal
Established 1867

Issue: Ir Med J; Vol 113; No. 5; P79

Covid-19, Cocooning and Vitamin D Intake Requirements

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*In Response to Article Entitled 'Optimisation of Vitamin D Status for Enhanced Immuno-Protection against Covid-19' by D.M McCartney et al - **Ir Med J; Vol 113; No. 4; P58***

Summary and Rationale for this Communication

The purpose of this report is to clarify what constitutes best practice on vitamin D supplement use, particularly among older adults, who are at highest risk of Covid-19. On Friday 3rd April, three reports were published on how vitamin D may protect against Covid-19. Two reports are aligned with national and international guidelines on vitamin intake requirements for health: one looked at the importance of vitamin D adequacy in protecting children from respiratory illness but included important advice cautioning against high dose vitamin D; the other is from The Irish Longitudinal Study on Ageing (TILDA) that looked at specific 'at risk' groups for vitamin D deficiency in those over 50 years in a representative sample from the 26 counties. TILDA provides a strong evidence base for intervening in older adults with supplemental vitamin D (10 µg to 20 µg daily). A third report advises that every adult should take high doses of vitamin D (20 µg to 50 µg daily) in order to protect against Covid-19. The authors make no mention about other sources of vitamin D in adults. This creates confusion at a time when there is widespread fear and anxiety about the Covid-19 pandemic. The following provides a review of the evidence and summarises best practice regarding vitamin D nutrition to protect against Covid-19.

Introduction

On Friday 3rd of April, three new reports on how vitamin D might protect against Covid-19 were published in Ireland. The significance of vitamin D status during the Covid-19 pandemic is two-fold: (1) there is an important link between vitamin D status and risk of infections (viral and bacterial); and (2) "cocooning" will diminish an important source of vitamin D intake – namely, skin production following exposure to sunlight.

What is wrong with recommending high-dose vitamin D supplements for all adults?

McCartney *et al* highlight the importance of addressing low vitamin D status in older adults in order to protect this at-risk group for Covid-19. They advise the blanket implementation of high dose vitamin D supplementation (20 µg to 50 µg daily) for all older adults, regardless of their status[3]. This recommendation is extended to the entire adult population in Ireland advocating that certain healthy persons be urgently supplemented – such as healthcare workers, vegans, vegetarians, the obese, those with darker skin – without specifying age or considering conditions, such as pregnancy[3]. People living with diabetes or compromised immune function are also targeted with this advice, without regard for individuals' circumstances or medications[3]. McCartney *et al* do not provide evidence from randomised controlled trials on the benefits of such high daily intakes of supplemental vitamin D[3].

Not included are recent deliberations on vitamin D intake requirements for healthy adults from internationally recognised scientific authorities/bodies, such as: EFSA for the EU[4], SACN for the UK[5], NNR for the Nordic counties[6], and IOM for US and Canada[7].

There is unanimity among these authorities/bodies, that the average vitamin D intake requirement for healthy adults in those with "minimal or no sunlight exposure" is 10 µg daily and for the frail elderly is 20 µg daily.

Vitamin D myth "More is Better" is not evidence-based and may be harmful

Population-based recommendations on vitamin D supplementation must be shown to be both effective and safe. Regarding efficacy of high dose vitamin D supplementation, several randomised controlled trials involving large numbers of participants on high-dose vitamin D therapy have not shown any benefit (such as VITAL, VIDA, D2D, VDAART). Some high dose vitamin D studies, where the primary endpoint was prevention of fracture or prevention of falls, have shown harm: more fractures[8] and more falls[9-11]. A high dose vitamin D trial in infants showed that the secondary outcome - the rate of repeat pneumonia - was significantly higher in the vitamin D therapy group[12]. McCartney *et al* [3] refer to a meta-analysis using individual participant data from trials where the endpoint was prevention of respiratory tract infection; the prevention of infection was most evident in those who were vitamin D deficient (25OHD below 25 nmol/L)[13]. SACN in the UK, using a detailed modelling analysis, showed that 10 µg vitamin D daily in those with "minimal or no sunlight exposure" was sufficient to ensure adequate vitamin D status (25OHD >25 nmol/L) in the vast majority of individuals.

While harmful effects of high dose vitamin D may manifest as more fractures, more falls, and maybe even more infections, McCartney *et al*[3] have focussed on the interpretation of vitamin D excess as manifesting with hypercalcaemia only at extremely high vitamin D status. Hypercalcemia may occur at much lower 25OHD thresholds than the authors quote in their paper[3], particularly in children[14]. The statement that whole-body sunlight exposure for 10-15 minutes is equivalent to an oral vitamin D intake of 250-625 µg (10,000 to 25,000 IU) requires the citation of the primary source. When the IOM set a tolerable upper vitamin D intake at 100 µg daily, they stated that this was a 10-fold multiple of the average total intake requirement for healthy adults and was not a recommended intake[15]. Prescribing high dose vitamin D is the domain of clinical practice; it has no place as public health policy.

Older adults are at particular risk of Covid-19 and inadequate vitamin D status

Covid-19 presents a much higher risk of serious illness and mortality in older adults, who are also much more likely than other age groups to have inadequate vitamin D status. The role of vitamin D in supporting normal immune function links the importance of adequate vitamin D status as a protective factor in the Covid-19 pandemic. Laird *et al* from TILDA on 3rd April 2020 reported about vitamin D status in the elderly and Covid-19 concerns[1]. TILDA is a nationally representative population-based study of older adults that included 5,895 subjects, who have had vitamin D status measured[16]. In the winter months, TILDA reported that vitamin D deficiency (25OHD <30 nmol/L) is evident in nearly 50% of frail elderly and in about 18% in late middle age. In summertime, vitamin D deficiency was still common at 31% in the frail elderly but was lower at about 9% in late middle age.

In this recent report, TILDA addresses the high risk of Covid-19 among older adults in Ireland and recommends that frail housebound elderly need 20 µg of supplemental vitamin D daily, while healthy late-middle-aged-to-elderly need 10 µg of supplemental vitamin D daily during the winter months[1]. TILDA's recommendations are aligned with national and international scientific recommendations.

Vitamin D needs of infants and children and protection against Covid-19

On 3rd April, Molloy *et al* published advice about vitamin D and Covid-19 in children[2]. They noted the link between respiratory illness and vitamin D deficiency in the young. For this reason, Molloy *et al* advised that vitamin D deficiency should be avoided in children[2]. They also counselled against using high doses of vitamin D, because high dose vitamin D is not proven to be beneficial in critical illness in infants[2]. Molloy *et al* have previously published on vitamin D status

in children in Ireland[17,18]. In Irish infants, they have shown the importance of adequate vitamin D status in prevention of respiratory infections[19,20]; they have also shown that 5 µg vitamin D daily is an effective dose for the prevention of vitamin D deficiency in infants[21]. It should be noted that the national infant supplementation policy in place in Ireland since 2010, recommends supplementation of 5 µg vitamin D daily. Parenthetically, it should also be noted that due to recent legislative changes, which doubled the amount of vitamin D in infant formula in February 2020, the national vitamin D supplementation programme now only targets breast-fed infants in order to prevent excessive vitamin D intakes in formula-fed infants[22].

How to ensure adequate intake of vitamin D in healthy adults

The daily 10 µg vitamin D intake requirement for healthy adults does not indicate a need for widespread supplementation. The concept of total vitamin D intake, not just supplemental intake, must be considered before advocating vitamin D supplementation. Two separate sources contribute to vitamin D supply in Ireland: skin exposure to ambient ultraviolet radiation from sunlight during the months April through October; and oral intake of vitamin D from natural foods, fortified foods, and supplements. While sunlight exposure is the major determinant of vitamin D status in the healthy Irish population, there is no safe level of sunlight exposure that prevents skin cancer. For this reason, persons are advised against intentional sunlight exposure, but inadvertent sunlight exposure due to outdoor activity still makes a significant contribution to vitamin D supply. Regarding sunscreen usage, contrary to expectation, studies in Ireland have shown that sunscreen users have higher vitamin D status[23,24] – indicating that sunscreen use is a surrogate for outdoor activity. Ireland is just coming into this annual seasonal period where vitamin D levels are boosted by sunlight exposure in all age groups in Ireland[23,25,26].

However, healthy adults who are "cocooning" may miss out on this annual vitamin D boost. Their intake requirement of 10 µg vitamin D daily can be met through food intake due to the increased range of vitamin D fortified foodstuffs available in Ireland - including most ready-to-eat breakfast cereals, some milks and yogurts, and more recently the emergence of vitamin D fortified bread and processed cheese. There are only a few natural food sources of vitamin D, with oily fish being the richest source. Vitamin D status in all age groups has improved immensely since 1980, following the availability of food fortification and low dose supplements[27-34]. Vitamin D status continues to improve to the extent that there is now concern about healthy adults and patients self-medicating with high dose vitamin D[33].

If those who are "cocooning" avoid fortified foods, then the additional intake of a vitamin D supplement providing 10 µg to 20 µg daily ensures vitamin D intake is more than adequate. Such supplements are more appropriate during winter (October to March) when skin synthesis from sunlight is impossible in Ireland (Table 1).

Regulation of vitamin D in supplements and the importance of evidence-based guidance

The wide tolerances around the actual amount of vitamin D provided in food supplements *versus* the amounts declared on the label, needs to be considered. Under EU food law, such tolerances around declared labelled values allow for actual levels of vitamin D to be 50% higher than the labelled value and 20% below[35]. This means that supplements, which are labelled to provide 50 µg vitamin D daily, may provide up to 75 µg daily and will not be lower than 40 µg daily. These margins are set to protect consumers from getting less than they pay for, but in the case of high dose supplements this is skewed towards exposing consumers to even higher intakes.

Like every commercial entity, sustainability of the food industry depends on how well companies respond to consumer demands. A simple Google search "food protecting against Covid-19" yielded 9,830,000,000 results in 0.57 seconds[36], indicating the high level of fear and anxiety around this new disease, which the world does not have a vaccine to protect against or effective treatment for severe cases. This underlines the importance of ensuring population-based guidance linking vitamin supplements to health concerns, are strongly evidence-based and do not pose any harm. Recommendations on high dose vitamin D supplements to protect against Covid-19 will inevitably lead to a demand for supplements providing up to 50 µg vitamin D daily, to which the supplement industry will respond. These high levels will not be easily regulated by food law because no maximum safe levels have been set for vitamin D (or any other vitamin) in supplements[39].

The EU has a rigorous process in place for regulating nutrition and health claims on food and food supplements. No claims have been authorised in the EU for a reduction in risk of infectious diseases through vitamin D intake. While a general claim has been authorised in the EU that low amounts of vitamin D (0.75 µg) supports normal immune function, it should be noted that this claim is also authorised for low amounts of several other nutrients[40], including some where inadequate intakes have been reported among older adults.

What is safe and effective advice about vitamin D during the Covid-19 pandemic?

The recommendation that people who have a low vitamin D status be supplemented is welcome, especially for those who are "cocooning" due to Covid-19 pandemic - but there is no evidence that high dose vitamin D is beneficial. As outlined by the TILDA report, this concern about the elderly could be safely met by supplemental vitamin D intake of 10 µg to 20 µg daily. The vitamin D needs of all other adults can be met through dietary intake of vitamin D fortified foods and natural food sources (such as oily fish). For those consumers who need to take a supplement, they should be advised to choose one that provides between 5 µg to 10 µg vitamin D daily. This advice is summarised in Table 1.

Table 1. *Covid-19: Guidelines on Vitamin D Requirements and Need for Supplementation*

A. Foods That Provide Vitamin D in Amounts for Average Portions that are Eaten

Food	**Serving**	**Vitamin D (µg*)**
Natural Food Sources		
Salmon	100 g (1 palm of hand)	8
Trout	100 g (1 palm of hand)	10
Mackerel	100 g (1 palm of hand)	8.6
Tuna	100 g (1 palm of hand)	3
Sardines	100 g (1 palm of hand)	5
Eggs	1 egg	2
Fortified Food sources**		
Milk with added vitamin D	200 mL glass	4
Cereal with added vitamin D	30-40 g (1 bowl)	1.5 to 2.9
Yogurt with added vitamin D	125 g pot	0.8 to 5.0
Cheese with added vitamin D	One cheese string	1.3

**This is the unit for declaring amounts of vitamin D that must be used under EU food law*
***Check nutrition labelling as the types of foods fortified and the amounts of vitamin D added are continuously changing*

B. Vitamin D Supplement Advice for Different Adult Population Sub-Groups

1. **Frail elderly adults (>70 years):** Depending on whether they eat vitamin D rich foods listed above, a vitamin D supplement providing 10 µg to 20 µg vitamin D is needed every day.
2. **Healthy adults who are housebound due to "cocooning":** Depending on whether they eat vitamin D rich foods listed above, a supplement providing 10 µg vitamin D is the best choice for adults who want to supplement their diet during "cocooning".
3. **Healthy adults who can be outdoors:** From November to March sunlight in Ireland cannot stimulate human skin to make any vitamin D. A supplement providing 5 µg to 10 µg vitamin D is the best choice for adults, who want to supplement their diet during these months.

Sources of information for these Guidelines: (1) FSAI 2019 Healthy Eating, Food Safety and Food Legislation, available at https://www.fsai.ie/science_and_health/healthy_eating.html and (2) Laird E, Kenny RA. Vitamin D deficiency in Ireland – implications for COVID-19. Results from the Irish Longitudinal Study on Ageing (TILDA), 2020. https://tilda.tcd.ie/publications/reports/pdf/Report_Covid19VitaminD.pdf

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