Vitamin D supplementation: are multivitamins sufficient?

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ABSTRACT

Background Public Health England advises 400 IU/day vitamin D supplementation for children over 1 year. Commercially available children's multivitamin and vitamin D supplements were surveyed to determine the vitamin D content.

Methods Multivitamins and vitamin D supplements marketed at children <12 years and sold by nine UK supermarkets and health supplement retailers were surveyed. Vitamin D content was determined from manufacturer's websites and product packaging.

Results 67 multivitamins were surveyed, containing 0–800 IU/day vitamin D. Only 25%–36%, depending on the child's age, provided ≥400 IU/day vitamin D. Supplements containing only vitamin D or labelled as for 'healthy bones' typically had higher vitamin D content (57%–67% contained ≥400 IU/day).

Conclusions Few multivitamin products supply the recommended 400 IU/day vitamin D. Clinicians need to be aware of this when recommending vitamin D supplementation and advise parents/carers to choose a product that contains ≥400 IU/day vitamin D.

What is already known?

- Vitamin D deficiency can lead to rickets, osteomalacia and hypocalcaemia. These are preventable with vitamin D supplementation.
- Public Health England recommends vitamin D supplementation with 400 IU/day year round for ages 1–4 years and during autumn and winter for individuals over 4 years.

What this study adds?

- There is a huge choice of children's multivitamin and vitamin D supplements.
- Only a quarter to a third of multivitamins marketed for children provide the recommended 400 IU/day vitamin D.

INTRODUCTION

Biochemically, low levels of 25-hydroxyvitamin D are common in children in the UK, particularly during winter months when there is limited ultraviolet B radiation to allow endogenous vitamin D synthesis.[1] Vitamin D deficiency can lead to rickets and hypocalcaemia. The incidence of these clinical outcomes has increased in the UK in recent years, in part reflecting greater cultural diversity due to increased susceptibility in black, Asian and minority ethnic groups.[2] Importantly, rickets and hypocalcaemia due to vitamin D deficiency are preventable with supplementation.[3]

Based on the findings of the Scientific Advisory Committee on Nutrition report on vitamin D and health, in 2016 Public Health England (PHE) recommended that all children aged 1–4 years take a daily supplement containing 400 IU (10 µg) vitamin D. Adults and children over 4 years are advised to take a 400 IU vitamin D supplement during autumn and winter, with year round supplementation in individuals with limited sun exposure or dark skin pigmentation. PHE suggests that infants under 1 year, who are not consuming at least 500 mL/day of infant formula milk, should have a supplement containing 340–400 IU/day vitamin D.[4] The Global Consensus Recommendation on Prevention and Management of Rickets more simply suggests supplementation with 400 IU/day vitamin D for all infants from birth and insuring an intake of at least 600 IU from 12 months in at-risk groups.[5]

The Healthy Start scheme provides free multivitamins to low-income families, but this product contains only 300 IU/day vitamin D and raises the question of how many other children's multivitamins sold in the UK contain less than the recommended 400 IU vitamin D. We therefore undertook a survey of the vitamin D content of commercially available children's multivitamins and vitamin D supplements in the UK.

METHODS

We surveyed multivitamin products aimed at children under 12 years of age using the websites for nine supermarkets (Asda, Morrisons, Ocado, Sainsburys and Tesco) and high street retailers of health-related products (Boots, Holland & Barrett, Lloyds Pharmacy and Superdrug). A product was considered a multivitamin if the packaging included the word multivitamin or a derivative of this or if more than one vitamin (A, B, C, D or E) were named. We also surveyed supplements labelled as a vitamin D supplement or suggested to support healthy bones. We established the recommended age range and daily vitamin D intake provided by each product using the manufacturer's website or by viewing the product in a high street store. Data were collected during the week beginning 17 September 2018. In determining the daily vitamin D provided by a supplement, if a dose range was advised (eg, 1–2/day), we recorded the highest amount.

RESULTS

A total of 67 multivitamin products made by 24 different manufacturers were identified as being

Table 1 Daily vitamin D provided by multivitamin products for children of different ages

Age of child	Number of products available	Daily vitamin D (IU) supplied, number of products (%)						% providing at least 400 IU/day vitamin D
		<100	100–199	200–299	300–399	400–599	≥600	
Birth	1	0 (0.0)	0 (0.0)	1 (100)	0 (0.0)	0 (0.0)	0 (0.0)	0.0
3 months	4	1 (25.0)	1 (25.0)	1 (25.0)	1 (25.0)	0 (0.0)	0 (0.0)	0.0
6 months	8	0 (0.0)	1 (12.5)	3 (37.5)	2 (25.0)	2 (25.0)	0 (0.0)	25.0
1 year	11	0 (0.0)	2 (18.2)	3 (27.3)	3 (27.3)	3 (27.3)	0 (0.0)	27.3
2 years	14	0 (0.0)	3 (21.4)	3 (21.4)	3 (21.4)	4 (28.6)	1 (7.1)	35.7
3 years	55	0 (0.0)	8 (14.5)	24 (43.6)	10 (18.2)	12 (21.8)	1 (1.8)	23.6
4 years	62	2 (3.2)	7 (11.3)	27 (43.5)	10 (16.1)	15 (24.2)	1 (1.6)	25.8
5 years	61	2 (3.3)	7 (11.5)	27 (44.3)	10 (16.4)	14 (23.0)	1 (1.6)	24.6
6 years	61	2 (3.3)	7 (11.5)	27 (44.3)	8 (13.1)	15 (24.6)	2 (3.3)	27.9
7 years	59	2 (3.4)	7 (11.9)	26 (44.1)	7 (11.9)	14 (23.7)	3 (5.1)	28.8
8 years	56	2 (3.6)	6 (10.7)	25 (44.6)	7 (12.5)	13 (23.2)	3 (5.4)	28.6
9 years	56	2 (3.6)	6 (10.7)	25 (44.6)	7 (12.5)	13 (23.2)	3 (5.4)	28.6
10 years	56	2 (3.6)	6 (10.7)	25 (44.6)	7 (12.5)	13 (23.2)	3 (5.4)	28.6
11 years	56	2 (3.6)	6 (10.7)	24 (42.9)	7 (12.5)	13 (23.2)	4 (7.1)	30.4

sold by the surveyed retailers (online supplementary data table 1). The daily vitamin D dose supplied ranged from 0 IU to 800 IU. Table 1 summarises the number of products available and vitamin D supplied for children of different ages. Only one multivitamin was suitable for use from birth. This supplied 200 IU/day vitamin D. For children less than 6 months of age, only one multivitamin contained more than 340 IU/day vitamin D, but this was only recommended from 4 months of age. For children over 6 months, between 25% and 36% of the available multivitamins provided at least 400 IU/day vitamin D (table 1).

Twenty-four vitamin D/healthy bones products were available (online supplementary data table 2), which supplied 50-1000 IU/day vitamin D per day. Six products were suitable from birth, of which five contained 340–400 IU vitamin D. The vitamin D content of these type of supplements was typically higher than for multivitamins (table 2), although one product labelled as 'for bones and relaxation' supplied only 50 IU/day vitamin D.

DISCUSSION

There is a wide range of both multivitamins and vitamin D supplements available for children in the UK, yet most of these do not provide the recommended 400 IU/day. Multivitamins typically had lower vitamin D content than pure vitamin D supplements or 'healthy bones' products, although some products labelled as 'for bones' contained very low levels of vitamin D.

Vitamin D deficiency and its clinical consequences are preventable with supplementation,[3 5] yet few children in the UK receive vitamin D supplements,[2] and our findings would suggest that even those who do take a supplement may not receive 400 IU/day. Even fewer dietary supplements are available that supply 600 IU/day vitamin D, as suggested by the Global Consensus Recommendation.[5] In order to achieve the recommended 400 IU/day vitamin D supplement when using many multivitamins, children would have to either take over the recommended daily dose, which may increase the risk of toxicity from other included components, particularly hypervitaminosis A, or take a vitamin D supplement in addition to the multivitamin. The latter approach increases both the cost and complexity of achieving vitamin D repletion. It is possible that some children, particularly those at low risk of deficiency, will achieve vitamin D repletion when taking the lower doses of vitamin D supplied in many of the available food supplements. However, 400 IU/day has been

Table 2 Daily vitamin D provided by vitamin D supplements or dietary supplements labelled as for 'healthy bones'

Age of child	Number of products available	Daily vitamin D (IU) supplied, number of products (%)						% providing at least 400 IU/day vitamin D
		<100	100–199	200–299	300–399	400–599	≥600	
Birth	6	0 (0.0)	0 (0.0)	1 (16.7)	1 (16.7)	4 (66.70)	0 (0.0)	66.7
3 months	7	0 (0.0)	0 (0.0)	1 (14.3)	2 (28.6)	4 (57.1)	0 (0.0)	57.1
6 months	7	0 (0.0)	0 (0.0)	0 (0.0)	3 (42.9)	4 (57.1)	0 (0.0)	57.1
1 year	8	0 (0.0)	0 (0.0)	0 (0.0)	2 (25.0)	6 (75.0)	0 (0.0)	75.0
2 years	8	0 (0.0)	0 (0.0)	0 (0.0)	2 (25.0)	6 (75.0)	0 (0.0)	75.0
3 years	20	1 (5.0)	1 (5.0)	1 (5.0)	2 (10.0)	13 (65.0)	2 (10.0)	75.0
4 years	22	1 (4.5)	1 (4.5)	2 (9.1)	2 (9.1)	13 (59.1)	3 (13.6)	72.7
5 years	21	1 (4.8)	1 (4.8)	2 (9.5)	2 (9.5)	12 (57.1)	3 (14.3)	71.4
6 years	21	1 (4.8)	1 (4.8)	2 (9.5)	2 (9.5)	11 (52.4)	4 (19.0)	71.4
7 years	21	1 (4.8)	1 (4.8)	1 (4.8)	2 (9.5)	12 (57.1)	4 (19.0)	76.2
8 years	20	1 (5.0)	1 (5.0)	1 (5.0)	2 (10.0)	11 (55.0)	4 (20.0)	75.0
9 years	20	1 (5.0)	1 (5.0)	1 (5.0)	2 (10.0)	11 (55.0)	4 (20.0)	75.0
10 years	20	1 (5.0)	1 (5.0)	1 (5.0)	2 (10.0)	11 (55.0)	4 (20.0)	75.0
11 years	20	1 (5.0)	1 (5.0)	1 (5.0)	2 (10.0)	11 (55.0)	4 (20.0)	75.0

shown to prevent rickets and carries minimal risk of toxicity.[5] For high-risk children, supplements with low vitamin D content that could be chosen by the caregiver without knowledge of the recommended dose may not provide sufficient vitamin D to reduce the risk of rickets or hypocalcaemia. Therefore, parents should be encouraged to choose a supplement that does contain 400 IU/day.

Our survey was limited to supplements sold by nine major UK retailers, but included 91 different dietary supplements. Many other supplements are available from online retailers, including products imported from overseas manufacturers and fortified food products. Some of these may contain high doses of vitamin D, but even when only considering those available in high street stores and supermarkets, the choice of supplements might be overwhelming. Furthermore, a number of products gave a dose range (eg, 1–2/day) and often only when consuming the highest dose was 400 IU vitamin D provided. As this was used in this survey to determine whether a product supplied 400 IU/day, children consuming the lower end of the recommended range would not achieve the national recommendation. Furthermore it should also be highlighted that these products are classed as food supplements, and therefore under European Union regulations, the tolerable vitamin D content can range from 20% below to 50% above the amount stated on the label (ie, a product claiming to contain 400 IU could actually contain 320–600 IU).[6]

It has previously been shown that few health professionals recommend vitamin D supplementation for children,[7] which needs to be addressed with professional education. This study indicates that when recommending vitamin D supplementation caregivers need to be encouraged to check that this contains at least 400 IU/day.

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