



# New advice on vitamin D supplements and cod liver oil for infants

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## KRONIKK

### GRY HAY

E-mail: gry.hay@helsedirektoratet.no

Gry Hay, Dr.Philos., nutritionist and senior advisor in the Norwegian Directorate of Health. The author has completed the ICMJE form and declares no conflicts of interest.

### LARS FADNES

Lars Fadnes, specialist in general practice, professor at the University of Bergen and member of the Norwegian Nutrition Council.

The author has completed the ICMJE form and declares no conflicts of interest.

### KIRSTEN B. HOLVEN

Kirsten B. Holven, nutritionist, professor of clinical nutrition at the University of Oslo and member of the Norwegian Nutrition Council.

The author has completed the ICMJE form and declares the following conflicts of interest: She has received contributions from Mills, TINE, Amgen, Olympic Seafood, Sanofi and Pronova.

### NINA C. ØVERBY

Nina C. Øverby, professor of nutrition at the University of Agder and member of the Norwegian Nutrition Council.

The author has completed the ICMJE form and declares no conflicts of interest.

### AHMED A. MADAR

Ahmed A. Madar, PhD, nutritionist and researcher at the University of Oslo and member of the Norwegian Nutrition Council.

The author has completed the ICMJE form and declares no conflicts of interest.

### CHRISTINE HENRIKSEN

Christine Henriksen, clinical nutritionist, associate professor of nutrition at the University of Oslo and member of the Norwegian Nutrition Council.

The author has completed the ICMJE form and declares no conflicts of interest.

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Until recently, all parents have been advised to give cod liver oil to their infants. Now, cod liver oil is no longer recommended during the first year of life, but breastfed infants still need vitamin D supplements.

In Norway we have a long tradition for recommending cod liver oil as a source of vitamin D for breastfed infants and as a source of the omega-3 fatty acid docosahexaenoic acid (DHA)

for infants fed on infant formula. In September 2020, the recommendations regarding vitamin D supplements and cod liver oil for infants were changed (1).

Earlier this year, infant formula products were given a higher content of both vitamin D and docosahexaenoic acid as a result of amendments to EU regulations. Infants fed solely on infant formula therefore no longer need any nutrient supplements, and nor should they receive any. Breastfed infants need vitamin D supplements, which they should receive in the form of drops from the age of approximately one week. Infants who are partially breastfed should receive a reduced dose of vitamin D drops, depending on the amount of infant formula.

In infants who are breastfed, cod liver oil leads to an unnecessarily high intake of DHA, but insufficient vitamin D for the youngest infants.

## Recommended intake in infants

Both vitamin D and docosahexaenoic acid are nutrients required for normal development of the infant's brain and nervous system. Vitamin D is also required for calcium absorption, and thereby for formation of the skeleton (2).

Breastmilk contains insufficient vitamin D to cover an infant's needs; only 0.1 µg vitamin D per 100 g of breastmilk (3). The Nordic Nutrition Recommendations specify a daily dose of 10 µg vitamin D for infants from the age of 1–2 weeks (4). Until recently, the Norwegian recommendations have indicated vitamin D supplements for all infants from the age of four weeks (irrespective of whether or not the child was breastfed) in the form of cod liver oil, alternatively as drops. The content of vitamin D in infant formula has been fairly low, so that extra vitamin D has been deemed acceptable also for infants fed with infant formula (5).

Since 2001, the recommendations have indicated gradual introduction of cod liver oil, starting from 2.5 ml per day (containing 5 µg vitamin D) at the age of four weeks and increasing to 5 ml per day (containing 10 µg vitamin D) at the age of six months (5, 6).

In infants who are breastfed, cod liver oil leads to an unnecessarily high intake of DHA, but insufficient vitamin D for the youngest infants

Recommendations on DHA intake for infants has not been included in the Nordic or Norwegian nutrition recommendations, but the European Food Safety Authority (EFSA) considers that 100 mg of DHA per day is sufficient for infants aged 0–24 months (7). The content of DHA in breastmilk is affected by the mother's intake. A fully breastfed infant will receive 100 mg DHA if the mother complies with the recommendation of an intake of 200 mg per day for breastfeeding women (4, 8).

So far, manufacturers have been free to decide whether or not to add docosahexaenoic acid to infant formula (9). The content has been considered low, and cod liver oil has therefore been recommended as a source of DHA for infants who receive infant formula (5).

## New EU regulations

An EU regulation that encompasses infant formula was made applicable in Norway from 22 February 2020 (10). These regulations specify a higher supplementation of vitamin D (0.48–0.72 µg/100 kJ) than their predecessor (0.25–0.65 µg/100 kJ) (9), as well as a mandatory supplement of DHA (4.8–12.0 µg/100 kJ). For infant formula products sold in grocery shops in Norway, the recommended daily vitamin D intake (10 µg per day) is covered by 590–760 ml of infant formula, depending on the product brand. A sufficient intake of DHA (100 mg per day) is covered by 590–760 ml of infant formula, depending on the product brand.

## Estimation of daily intake

Table 1 shows the estimated daily intake of vitamin D and DHA in Norwegian infants who

are breastfed or receive infant formula, as well as the total daily intake with supplements of cod liver oil or vitamin D drops (4, 6, 7, 10).

**Table 1**

Estimated intake of vitamin D and DHA from vitamin D supplements, breastmilk and infant formula in Norwegian infants

	Vitamin D ( $\mu\text{g}$ )	Docosahexaenoic acid (DHA) (mg)
Recommended daily intake (4, 6, 7)	10.0	100
Vitamin D supplements		
Cod liver oil, 2.5 ml	5.0	300
Cod liver oil, 5 ml	10.0	600
Vitamin D drops, 5 drops	10.0	0
Breastmilk (750 ml)		
Breastmilk + 2.5 ml cod liver oil	5.8	458 <sup>1</sup>
Breastmilk + 5 ml cod liver oil	10.8	758
Breastmilk + vitamin D drops	10.8	158
Infant formula (750 ml)		
Infant formula + 2.5 ml cod liver oil	12.8 <sup>2</sup>	128
Infant formula + 5 ml cod liver oil	17.5	428
Infant formula + vitamin D drops	22.8	728
Infant formula + 5 ml cod liver oil	22.8	128

<sup>1</sup>Median content in breastmilk from Norwegian women with infants aged 1.5–3 months (n = 105). (unpublished data, Institute of Marine Research 2017). 5<sup>th</sup>–95<sup>th</sup> percentile: 53–323 mg per 750 ml breastmilk.

<sup>2</sup>Estimated with a content of 1.7  $\mu\text{g}$  vitamin D per 100 ml, in line with the new regulations (10)

As shown by the table, both breastmilk and infant formula (750 ml per day) will provide the intake of DHA that the European Food Safety Authority reports as sufficient (7) – without any supplement of cod liver oil. Infants who receive either breastmilk + vitamin D drops or infant formula with no supplements will have an intake which is closest to the recommended amount.

## Time for new recommendations

Until recently, the Norwegian assessment has been that cod liver oil provides vitamin D to infants who are breastfed and DHA to infants who receive infant formula. In the preparation of the recommendations on infant nutrition in 2001 (5), it was emphasised that Norway had a tradition for giving cod liver oil to infants and that the same, simple recommendation to everybody would reach as many as possible. It was argued that there was no evidence of any harmful effects of cod liver oil. However, the recommended amount of cod liver oil was halved (from 5 ml to 2.5 ml) for the youngest infants because of the high content of omega-3 fatty acids and lack of knowledge of their possible harmful effects. The recommendation from 2001 was extended in 2016 (6).

## Vitamin D

The reduction in the recommended amount of cod liver oil in 2001 meant that breastfed infants would not reach the recommended daily vitamin D intake (10  $\mu\text{g}$ ) before they were six months old. Until now, they have therefore received less vitamin D than recommended during the first six months of life, as shown in Table 1. It has been presumed that the recommendations for vitamin D intake have a wide safety margin.

Infants who receive either breastmilk + vitamin D drops or infant formula with no supplements will have an intake which is closest to the recommended amount

Recent Norwegian data indicate that up to 30 % of infants have an insufficient vitamin D status (11). If breastfed infants receive vitamin D drops with 10 µg vitamin D per day from the age of approximately one week, instead of 2.5 ml cod liver oil with 5 µg vitamin D from the age of four weeks, this will ensure a sufficient vitamin D status for all of them. This advice is in line with the Nordic Nutrition Recommendations (4).

The basis of the new regulations is that infant formula must cover the infant's need for all nutrients, without any supplements. For infants who receive both infant formula and vitamin D supplements, the intake of vitamin D will be considerably higher than recommended, as shown in Table 1. The European Food Safety Authority has defined an upper limit for daily vitamin D intake of 25 µg for infants aged 0–6 months and 35 µg for infants aged 6–12 months (12). Excessive intake of vitamin D leads to a risk of hypercalcaemia, calcium deposits in the kidneys and arteries, and changes to the skeleton and other organs (7). From the age of around six months, other infant foods enriched with vitamin D, such as baby porridge, will also add to the vitamin D intake.

## Fatty acids

Analyses of DHA in breastmilk from Norwegian women (unpublished data, Institute of Marine Research) indicate that the great majority of breastfed infants in Norway receive considerably higher amounts of this fatty acid than what the European Food Safety Authority reports to be sufficient (Table 1). Supplements of cod liver oil will provide infants who are breastfed as well as infants who receive infant formula with a DHA intake which is several times as high as recommended (4–7 times higher, or more if the breastfeeding mother's intake is high). Five millilitres of cod liver oil alone will provide 600 mg of DHA, as well as 400 mg of the omega-3 fatty acid eicosapentaenoic acid (EPA).

Recommendations for nutritional supplements must be adapted to each family in question

Possible negative effects of a high intake of these fatty acids in infants include a reduced conversion of linoleic acid to arachidonic acid and a reduced immune response (13, 14). However, little research has been undertaken on high intake of DHA and EPA in infants (15). On the other hand, there is no evidence that an intake of these fatty acids in excess of the recommendations provides any health benefits (15, 16). An expert group appointed by the European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) has stated that unnecessary amounts of nutrients and other components should be avoided in infants, because they may put a burden on the metabolic and other physiological functions of the infant (17).

Despite purification, cod liver oil contains small amounts of environmental toxins, such as dioxin and dioxin-like polychlorinated biphenyls (PCB) (18). The Norwegian Scientific Committee for Food and Environment has launched efforts to map the intake of these environmental toxins from foods, including cod liver oil, and their possible effects (19).

A breastfeeding woman who follows the nutritional recommendations from the Norwegian Directorate of Health will have a sufficient content of DHA in her breastmilk. If she eats a fully or mainly plant-based diet, she should take supplements that contain vitamin D, vitamin B<sub>12</sub> and iodine, as well as DHA in the form of plant-derived omega-3 (from algae oil). In such cases, the breastfed infant may be given a supplement that contains vitamin D and vitamin B<sub>12</sub> (20).

Recommendations for nutritional supplements must be adapted to each family in question. The time when everybody could receive the same advice is over.

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