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**The Cod Liver Oil Debate**  
**Cod Liver Oil Manufacture    Reply to Dr. Joe Mercola on Cod Liver Oil**  
**The Good Scot Diet    Curds and Whey**

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# The Cod Liver Oil Debate

## Science Validates the Benefits of Our Number One Superfood

By Chris Masterjohn

**F**or centuries, cod liver oil has served as a valuable source of vitamins A and D and omega-3 fatty acids. It was a critical component of Weston Price's program for reversing tooth decay and many practitioners in his day used it to treat eye diseases, rickets, and infections. Along with many other physicians, Dr. Price recommended cod liver oil to promote growth and general health in infants and children. Clinical trials proved that cod liver oil use in adults reduced absenteeism and saved millions of dollars worth of productivity for American industry.

Recently, however, cod liver oil has come under attack. After issuing a series of newsletters criticizing the use of cod liver oil because of its vitamin A content, Dr. John Cannell, through the Vitamin D Council, wrote a commentary entitled "Cod Liver Oil, Vitamin A Toxicity, Frequent Respiratory Infections, and the Vitamin D Deficiency Epidemic" published in the November, 2008 issue of the *Journal of Otology, Rhinology, & Laryngology*.<sup>1</sup> Cannell and co-authors claim that vitamin A intakes above the most minimal levels increase mortality rates, increase vulnerability to infections, cause osteoporosis, and antagonize the beneficial effects of vitamin D.

Cannell concluded that neither children nor adults should use cod liver oil or multivitamins containing true (pre-formed) vitamin A. Sixteen scientists signed on to the paper as co-authors, although this does not mean that each one endorsed every statement in the paper. Cannell quoted this paper extensively and expanded his arguments against vitamin A in his December newsletter,<sup>2</sup> while Dr. Joseph Mercola repeated Cannell's claims on his web site in two articles published this winter.<sup>3,4</sup>

What the scientific literature shows, however, is that vitamins A and D work as partners rather than antagonists. While there is no solid evidence linking vitamin A to increases in mortality or higher rates of infection, vitamin A does cause adverse effects such as bone loss when it is not provided with its molecular partner, vitamin D. Since cod liver oil provides both partners together, it developed a long and successful history as an important therapeutic and prophylactic supplement. Many modern cod liver oils are deficient in vitamin D and should be avoided, but those providing adequate vitamin D continue to provide an important natural food source of the fat-soluble vitamins.

#### THE ORIGINS OF COD LIVER OIL

Hippocrates first recorded the medicinal use of fish oils, and the first century naturalist Pliny the Elder recorded the use of dolphin liver oil as a remedy for chronic skin eruptions.<sup>5</sup> In 1848, the British physician John Hughes Bennett observed that cod liver oil had been used from time im-

memorial by the fishing populations of Scotland, Sweden, and Norway for its general medicinal and strengthening properties.<sup>6</sup> For centuries before producing the oil itself, the British used the blackish residue left behind by barreled cod livers as a balm.<sup>7</sup> In 1766, a Manchester Infirmary began prescribing ingestion of the oil for rheumatism after a patient cured herself of the disease on two occasions by ingesting her topical treatment.<sup>5</sup> The infirmary thereafter used fifty to sixty gallons of cod liver oil per year,<sup>6</sup> and after comparing its use to that of a placebo in a number of individual patients, the physician Percival added it to the British Pharmacopoeia in 1771.<sup>5</sup>

Physicians used cod liver oil to treat the vitamin D deficiency disease rickets at least as far back as 1799, and by the 1820s use of cod liver oil for this purpose was widespread in Germany, Holland and the Netherlands. During the same century, its use expanded to include the treatment of eye diseases and tuberculosis.<sup>5</sup> Research between 1920 and 1940 further expanded the use of cod liver oil to prevent or treat measles, industrial absenteeism, and puerperal fever, a fatal infection occurring in women just after giving birth. The advent of sulfa antibiotics and later penicillin mostly eliminated the interest in cod liver oil as an anti-infective agent, but a number of trials conducted before 1940 provided solid evidence of its efficacy. Cod liver oil reduced measles mortality by more than one-half and reduced industrial absenteeism by up to two-thirds in clinical trials. As a prophylactic, it reduced the incidence of puerperal fever by two-thirds, and as

Physicians used cod liver oil to treat the vitamin D deficiency disease rickets at least as far back as 1799, and by the 1820s use of cod liver oil for this purpose was widespread in Germany, Holland and the Netherlands.

#### ARTICLE SUMMARY

- Mankind has consumed marine liver oils for thousands of years and cod liver oil for at least hundreds of years.
- Several trials conducted before 1940 found that the vitamin A in cod liver oil had powerful anti-infective power, which popularized the oil as a prophylactic and led to its use as a treatment against puerperal fever, measles, and industrial absenteeism.
- Vitamins A and D cooperate with one another. They are not antagonists, but large doses of one may cause harm when not accompanied by the other.
- There is no evidence that vitamin A increases mortality.
- Over a quarter of Americans consume less than half the RDA of vitamin A, which is 3,000 IU per day for adult males. Price's tooth decay reversal program would have provided over 10,000 IU per day. Sub-optimal intakes of vitamin A may be related to asthma, kidney stones, fatty liver disease, oxidative stress, and susceptibility to environmental toxins.
- During the winter or year-round for people with dark skin, some extra vitamin D from fatty fish or supplements may be necessary for some people.
- High-vitamin cod liver oil is a very useful source of vitamins A and D and omega-3 fatty acids.

They concluded that while vitamin D was necessary for the calcification of bones and teeth, it did not share the anti-infective properties of vitamin A and it would therefore be dangerous to replace traditional cod liver oil with the newly developed vitamin D supplements.

a treatment, it reduced mortality from this disease by the same amount.<sup>8</sup>

#### VITAMIN A AS AN ANTI-INFECTIVE

In the 1920s, Edward Mellanby performed a series of experiments at the University of Sheffield showing that vitamin A was the primary anti-infective component of cod liver oil. Mellanby compared the effects of cod liver oil, rich in vitamins A and D, to those of butter, rich in vitamin A only, and to those of olive oil, deficient in both vitamins. Dogs fed butter instead of cod liver oil had soft bones and partially collapsed lungs, but bronchial pneumonia occurred only on the olive oil diet. Mellanby attributed the partial collapse of the lungs to muscular dysfunction induced by vitamin D deficiency and attributed the pneumonia to degeneration of the epithelial lining of the lungs induced by vitamin A deficiency.<sup>9</sup>

When pure vitamin D<sub>2</sub> became commercially available, Mellanby and his colleague Harry Norman Green performed further experiments in rats showing that vitamin A deficiency led to often fatal infections of the tongue, throat, eyes, lungs and gastrointestinal tract in nearly all of the animals. In several hundred vitamin D-deficient rats, by contrast, they observed only two cases of infection. In the vitamin A-deficient rats, moreover, vitamin D supplementation made the infections worse. Green and Mellanby suggested that this was because vitamin D stimulated growth and “thereby made a greater call on the vitamin A stores of the body.” They concluded that while vitamin D was necessary for the calcification of bones and teeth, it did not share the anti-infective properties of vitamin A and it would therefore be dangerous to replace traditional cod liver oil with the newly developed vitamin D supplements. “If a substitute for cod-liver oil is given,” they wrote, “it ought to be at least as powerful as this oil in its content of both vitamins A and D.”<sup>9</sup>

#### VITAMINS A AND D AS MOLECULAR PARTNERS

Mellanby was correct when he noted that vitamin D increases the need for vitamin A, but he was probably wrong about the mechanism. Beginning in the 1930s and continuing through the 1960s, research accumulated showing that vitamins A and D each protected against the

toxicity of the other.<sup>18,19,20,21</sup> This observation held true even when the vitamins were injected into the animals rather than provided in the diet, showing that they did not protect against each other’s toxicity by competing for intestinal absorption.<sup>22</sup>

To explain the earliest observations of this phenomenon, the German researcher F. Thoenes proposed in 1935 that vitamins A and D cooperated with each other to perform certain functions and that vitamin D caused toxicity by inducing a relative deficiency of vitamin A.<sup>23</sup> This concept gained further support in 1998 when Aburto and Britton showed that even moderate doses of vitamin D lower blood levels and liver stores of vitamin A in broiler chickens whether they are provided in the diet or by exposure to ultraviolet light.<sup>24</sup>

Developments in molecular biology over the last several decades have shown that vitamins A and D carry out most of their actions by binding to specific receptors that will bring them into contact with DNA inside the nucleus of a cell, in order to alter the expression of genes by turning them on or off or by turning them up or down. The receptors for these vitamins, together with those for thyroid hormones, steroid hormones, and other important signaling molecules, are part of a common family of nuclear receptors that interact with one another. Vitamin A is especially involved in these interactions—it not only carries out its own signaling, but forms an essential partnership with most other nuclear hormones, which allows them to carry out their functions. Recent research, described in more detail in the sidebar on page 22, has shown that vitamin D can only effectively control the expression of genes in the presence of vitamin A.

Since vitamin A is required as a signaling partner with vitamin D, vitamin D will increase the turnover of vitamin A. If vitamin A is provided in excess, the results are generally beneficial. Excess vitamin A is stored in the liver. However, when the liver’s storage capacity is exceeded, the overload of vitamin A causes the cells to burst, damaging the liver and releasing storage forms of vitamin A into the systemic circulation that do not belong there. By increasing the utilization of vitamin A, vitamin D can help prevent vitamin A toxicity.

If vitamin A is in short supply, on the other hand, the results can be detrimental. By “stealing” all of the vitamin A needed to use for vitamin D-specific functions, the body will not have enough vitamin A left to support the many other functions for which it is needed—this may partially explain the toxic effects of excess vitamin D.

Vitamin A toxicity is likely due in part to the damage done to liver cells and the release of their contents, including storage forms of vitamin A, into the blood. It may also be the case that there is a natural balance between the many different signaling roles played by vitamin A when all of its signaling partners are present, but that when one of them—such as vitamin D—is absent, this natural balance is thrown off. Thus when vitamin D is provided in adequate amounts, vitamin A does not accumulate excessively in the liver and this natural balance is maintained, but when vitamin D is in short supply, high doses of vitamin

A will damage the liver and contribute to an imbalance of cell signaling.

If vitamin D is present in excess, extra vitamin A is needed to fulfill those other functions, while if vitamin D is in short supply, the natural balance of functions in which vitamin A engages may be thrown off.

The current controversies over osteoporosis present a perfect example of how critically important it is to take into account the interactions between these two vitamins. A number of studies have shown that high intakes of vitamin A are associated with reduced bone mineral density and increased risk of hip fracture, but these studies have been conducted in populations with vitamin D intakes as low as 100 IU per day. The only study that mentioned cod liver oil as a source of vitamin A in its population found high levels of vitamin A to be associated with a *decreased* risk of fracture.<sup>25</sup> It may be the case that vitamin A contributes to osteoporosis when vitamin D is deficient, but protects against osteoporosis when vitamin D is adequate.

A review published in 2005 concluded that physicians should explicitly warn their elderly patients to avoid intakes of vitamin A greater than the RDA.<sup>26</sup> A large-scale, placebo-controlled trial published in 2006 found that 400 IU of vitamin D plus 1,000 milligrams of calcium increased the risk of kidney stones by 17 percent.<sup>27</sup> Kidney stones can be induced by feeding animals vitamin A-deficient diets,<sup>9</sup> and prevented in animals by feeding

#### DOES VITAMIN A INCREASE THE RISK OF INFECTIONS?

Cannell cites an analysis in his journal article and December newsletter as showing that vitamin A supplements decrease lower respiratory infections “in children with low intake of retinol [vitamin A], as occurs in the Third World” but that “it appears to increase the risk and/or worsen the clinical course in normal children.”<sup>1,2</sup> By the time Mercola published the claim, “normal children” became any children living in a developed country. “Unlike third world countries where vitamin A supplementation appears to decrease infections,” Mercola wrote, “vitamin A supplementation in developed countries like the U.S. actually increases infections.”<sup>3</sup>

The original analysis did not present any findings that separated children into low and normal intakes of vitamin A and did not include any studies conducted in developed countries like the United States.<sup>10</sup> It was a meta-analysis that pooled the results of nine studies conducted in India, Ecuador, Indonesia, Brazil, Ghana, Mexico, and the Republic of Congo. Several of these studies have suggested that vitamin A may reduce the incidence of respiratory infection in malnourished children but increase it in well-nourished children. None of them, however, present evidence that the effect of vitamin A depends on vitamin A status or that vitamin A is helpful in the third world but harmful in the developed world.

An Ecuadorian study of four hundred children under the age of three found that weekly supplements delivering roughly half the RDA for vitamin A reduced the risk of lower respiratory infections among underweight and stunted children but raised the risk among children of normal weight and height.<sup>11</sup> An Indonesian study of over 1400 children under the age of four found that three massive doses of vitamin A given over the course of a year, likewise delivering roughly half the RDA, increased lower respiratory illnesses in children of normal height but not in stunted children.<sup>12</sup> Although both of these studies measured blood levels of vitamin A, neither of them reported the effect of vitamin A to be dependent on vitamin A status. They were conducted in areas where deficiencies of protein, energy, and multiple vitamins and minerals are common. A child’s status of protein, zinc, vitamin D, and other nutrients will affect his or her metabolism of vitamin A. Growth status itself could affect the metabolism of vitamin A, and adequate growth could deplete other nutrients needed for vitamin A to function properly.

It would also be a mistake to look at lower respiratory infections alone. A number of studies included in the meta-analysis showed vitamin A to have no effect on respiratory infections while nevertheless reducing severe diarrhea by over 20 percent,<sup>13</sup> gastrointestinal-associated mortality by over a third,<sup>14</sup> infection-associated mortality by half,<sup>15</sup> and measles incidence by 95 percent.<sup>16,17</sup> The general picture that emerges from the scientific literature is not that vitamin A is helpful only in very small amounts and harmful in larger amounts. The picture that emerges indicates that vitamin A consistently reduces mortality from severe infectious diseases but has a more complicated relationship to lower respiratory infections that we still do not completely understand.

them extra vitamin A.<sup>28</sup> Research in the 1930s found that over 90 percent of people with kidney stones were deficient in vitamin A.<sup>29</sup> Kidney stones can be induced in animals by feeding doses of vitamin D that are insufficient to cause abnormally high calcium levels,<sup>30</sup> suggesting that they are the first and most sensitive marker of vitamin D toxicity. Vitamin A is capable of completely protecting against vitamin D-induced kidney calcification.<sup>24</sup> Perhaps such a small amount of vitamin D increased the risk of kidney stones in this elderly population because its members were being advised to avoid vitamin A.

#### ARE VITAMIN A INTAKES EXCESSIVE?

One of the co-authors of the Cannell paper conducted a study, which has not yet been published, showing that four percent of obese Wisconsin adults had blood markers indicating their livers were overloaded with vitamin A.<sup>1</sup> Vitamin D mobilizes vitamin A from the liver and increases its utilization,<sup>24</sup> so vitamin A overload is most likely to occur in people with low vitamin D status. At least half of all Americans and over 80 percent of African Americans have low vitamin D levels.<sup>41</sup> Morbidly obese patients

are three times more likely to have low vitamin D levels than non-obese controls.<sup>42</sup> Thus, finding markers indicating vitamin A overload is more likely to reflect the poor vitamin D status of most Americans and the exceptionally poor vitamin D status of obese Americans than it is to reflect a supposed excess of vitamin A in the standard American diet.

Vitamin A deficiency has been associated with a number of prevalent diseases, including childhood asthma,<sup>43,44</sup> kidney stones formed spontaneously from calcium phosphate,<sup>9</sup> and fatty liver disease.<sup>45</sup> Vitamin A in doses above those needed to prevent deficiency protects against oxidative stress,<sup>46</sup> kidney stones formed from dietary oxalate,<sup>28</sup> and exposure to environmental toxins.<sup>47</sup>

The vitamin A RDA is 3,000 IU for adult

#### GETTING TECHNICAL WITH VITAMINS A AND D

Vitamins A and D are both precursors to nuclear hormones, which are molecules that bind to receptors, travel into the nucleus, bind to DNA of specific target genes, and control the expression of those genes. Vitamin A is activated in a two-step process in which it is converted first from retinol into retinaldehyde and then from retinaldehyde into all-*trans* retinoic acid (ATRA). Similarly, vitamin D is activated in a two-step process in which it is converted first from cholecalciferol to calcidiol and then from calcidiol to calcitriol. Retinoic acid binds to several types of retinoic acid receptors (RARs) while calcitriol binds to the vitamin D receptor (VDR).<sup>31</sup>

In order to bind to DNA and control gene expression, RARs and the VDR must partner up with another receptor called the retinoid X receptor (RXR). These partners bind to each other to form a two-unit receptor complex called a dimer. Since the two receptors that form the dimer are different from one another, the complex is called a heterodimer and the process of binding together is called heterodimerization. The RXR heterodimerizes with many other nuclear receptors as well, such as the thyroid hormone receptor and the steroid hormone receptors. The heterodimers then travel to the nucleus, bind to DNA, and recruit either coactivators that help a gene start making a protein or corepressors that stop the gene from making a protein.<sup>31</sup>

Researchers agree ATRA must bind RAR and calcitriol must bind VDR for this process to begin, but they debate whether the RXR is simply a "silent partner" or whether it too must be bound by a hormone. A second derivative of vitamin A called 9-*cis*-retinoic acid (9CRA) is the hormone that binds to and activates the RXR in test tube studies, but some scientists have claimed that 9CRA does not exist in the live animal. In 1992, Heyman and colleagues isolated 9CRA from animal tissues,<sup>32</sup> while other researchers using different techniques more recently were unable to find any.<sup>33,34</sup> Large doses of vitamin A produce high tissue concentrations of 9-*cis*-4-*oxo*-13,14-dihydro-retinoic acid, a probable breakdown product of 9CRA.<sup>35</sup> Hormones that bind to the heterodimeric partners of the RXR such as activated vitamin D,<sup>24</sup> which binds the VDR, and clofibrate, which binds to PPAR- $\alpha$ ,<sup>36</sup> decrease levels of vitamin A stored in the liver. Rosiglitazone, which binds to PPAR- $\gamma$ , another RXR heterodimeric partner, ramps up the activation of retinol to ATRA.<sup>37</sup> ATRA spontaneously converts to 9CRA when exposed to the endoplasmic reticulum, one of the organelles present within every cell.<sup>38</sup> Taken together, these findings suggest that vitamin D and other signaling compounds whose receptors heterodimerize with the RXR mobilize stored vitamin A from the liver and increase its conversion to 9CRA so that it can be used in cooperative signaling processes.

In 2006, researchers from Spain showed that 9CRA must bind to the RXR in order for the calcitriol-VDR-RXR complex to bind to DNA and control gene expression.<sup>39</sup> More recently, the same group showed that when calcitriol binds to the VDR, it recruits corepressors that will cause it to suppress the expression of its target genes, but when 9CRA binds to the complex, the corepressors are released, allowing it to activate the expression of its target genes.<sup>40</sup>

In plain English, this means that vitamins A and D are not antagonists but actually cooperate with one another to carry out their functions.

males and just over 2,300 IU for adult females. These values are based on studies conducted in the general population, which is now recognized to be largely deficient in vitamin D. Most traditional diets likely supplied more vitamin A than the current RDA. The Greenland Inuit diet in 1953 supplied an average of 30,000 IU per day.<sup>48</sup> Other traditional diets where most of the vitamin A came from dairy products likely provided lower levels. Price used three-quarters of a teaspoon of high-vitamin cod liver oil per day and alternated between muscle meats and organ meats in the stews he used for his tooth decay reversal program. Together with whole milk, butter, and carotenes from vegetables, his program probably provided over 10,000 IU of vitamin A per day, although this was to growing children who were recovering from deficiency.

Regardless of whether or not the ideal intake of vitamin A is much higher than the RDA, over a quarter of Americans consume less than half the RDA.<sup>49</sup> If people eating diets this low in vitamin A begin supplementing with vitamin D rather than cod liver oil, the danger of such a low

intake of vitamin A may be greatly increased.

#### COD LIVER OIL SUPPLIES A BALANCE

Cod liver oil should not be seen as a cure-all or as a universal supplement, but neither should cod liver oil be avoided out of fear. It is a valuable and convenient way to obtain vitamins A and D together with omega-3 fatty acids—all nutrients most Americans require in greater levels than they currently obtain through their diets.

Does cod liver oil contain the ideal ratio of vitamins A and D? It is possible that there is an ideal dietary ratio of the two vitamins, but this is not necessarily the case. The body highly regulates its conversion of each vitamin to the active form, and is capable of storing the portion it chooses not to activate at any given time. It is more likely that there is a broad range of acceptable dietary ratios and that harm comes when one or the other vitamin is in unusually short supply.

If there is an ideal ratio, it will vary from person to person and from season to season. People with darker skin may need extra vitamin D from fatty fish or vitamin D supplements year round, and others may need extra vitamin D only in the winter. People should use recommendations as guidelines to help them experiment and find the amount of cod liver oil that works best for them, knowing that it has been a safe and valuable health-promoting food that for centuries has nourished both young and old.



#### VITAMIN A AND INCREASED MORTALITY

Cannell cited a meta-analysis in his journal article and December newsletter showing that “vitamin A supplements” increased the total mortality rate by 16 percent.<sup>1,2</sup> While a typical meta-analysis pools together the results of many different studies, this one examined the effects of a large number of antioxidants, and only one section dealt with vitamin A. By the time Mercola published the claim on his web site, “vitamin A supplements” had been expanded to include “vitamin A supplements in cod liver oil.”<sup>3</sup> The original meta-analysis, however, obtained this figure by pooling together the results of only two studies on vitamin A given alone,<sup>50</sup> neither of which even mentioned cod liver oil.

The first study was a double-blind intervention trial in which researchers administered either 25,000 IU of vitamin A or a placebo to over 2,000 subjects at moderate risk for skin cancer for over four years.<sup>51</sup> Vitamin A supplementation did not affect the risk of basal cell carcinoma, but it reduced the occurrence of squamous cell carcinoma by over 25 percent. The median age of the subjects was 63 and over two thirds of them were male; consequently, the majority of the subjects died by the end of the study. After 55 months, 35 percent in the vitamin A group and 36 percent in the placebo group were still alive. The authors did not claim that vitamin A had any effect on mortality.

In the other study the researchers provided either a single dose of 200,000 IU of vitamin A or a placebo to just over 100 elderly nursing home residents.<sup>52</sup> They then observed the incidence of respiratory infections over the following 90 days. Vitamin A had no effect. Four patients in the vitamin A group died while only two patients died in the placebo group. The patients in the vitamin A group, however, were on average five years older than those in the placebo group and thus much more likely to die of old age. The authors did not claim that vitamin A had any effect on mortality.

Meta-analyses can often help us see the big picture by examining the totality of the evidence. By pooling together huge amounts of data they often achieve the statistical power necessary to verify associations between different factors that smaller studies would miss. But they also have drawbacks. Studies may be lumped together when they differ in quality or were performed in different contexts. Much of the background information on each study can be lost. In this case, citing a meta-analysis simply serves to obscure the basic facts about two small studies that offered no useful information about the effect of vitamin A on mortality at all.

## POTENTIAL DANGERS OF VITAMIN D

Dr. John Cannell of the Vitamin D Council argues that humans do not begin storing vitamin D in fat and muscle tissue until blood levels of 25-hydroxyvitamin D (also known as calcidiol and abbreviated 25(OH)D) reach 50 nanograms per milliliter (ng/mL) and that below this amount the enzyme that converts vitamin D to calcidiol for storage in the blood suffers from chronic “starvation.”<sup>1</sup> On his Vitamin D Council web site, Cannell now recommends blood levels of calcidiol between 50 and 80 ng/mL<sup>53</sup> and supplementation of 1,000 IU for every 25 pounds of bodyweight.<sup>2</sup> For someone weighing between 150 and 175 pounds, he thus recommends between 6,000 and 7,000 IU per day from all sources. Cannell and his co-authors consider vitamin D to be perfectly safe for most people in amounts up to 10,000 IU per day—even while simultaneously recommending people avoid supplementing with vitamin A.<sup>1</sup> In reality, however, these amounts of vitamin D could be dangerous when combined with low intakes of vitamins A and K<sub>2</sub> as occurs in the general population.

Cannell and colleagues cite two studies in their journal article justifying the statement that storage of vitamin D begins at 50 ng/mL.<sup>54,55</sup> The first of these was a preliminary report published in 2007, while the second was a much more thorough and consequently more accurate report published in 2008.<sup>56</sup> The final report concluded that vitamin D is completely converted to calcidiol when serum calcidiol levels are below 35 ng/mL and inputs from diet and sunshine combined are below 2000 IU per day.<sup>55</sup> Above these levels, the conversion of vitamin D to calcidiol drops to an average of 43 percent and much of the remaining vitamin D is stored in body tissues, most likely in adipose tissue. The vitamin D appears to be released from storage as blood levels of calcidiol decline. The authors observed that other studies have shown calcium absorption to be maximized and serum parathyroid hormone (PTH, a promoter of bone resorption) to be maximally suppressed at calcidiol levels of 30-34 ng/mL, in close agreement with their own study.

In support of the contention that daily vitamin D intakes of up to 10,000 IU are perfectly safe for most people, Cannell and colleagues cite a risk assessment published in 2007 that used abnormally high blood and urine calcium levels as its indicator of potential toxicity.<sup>57</sup> Clinical vitamin D toxicity, according to these authors, occurs when calcidiol levels exceed 600 ng/mL and is accompanied by pain, conjunctivitis, anorexia, fever, chills, thirst, vomiting and weight loss. If clinical vitamin D toxicity is the only concern, 10,000 IU of vitamin D per day is likely to be harmless. Evidence suggests, however, that vitamin D can begin causing less acute adverse effects at much lower levels when intakes of vitamins A and K<sub>2</sub> are inadequate. This is of especial concern because over one quarter of Americans already consume less than half the RDA for vitamin A,<sup>49</sup> and blood markers for inadequate vitamin K<sub>2</sub> status are universally present in the general population.<sup>58</sup>

A recent double-blind, placebo-controlled study found that 400 IU of vitamin D and 1,000 mg of calcium increased the risk of kidney stones by 17 percent.<sup>27</sup> As described on page 21 of the main text, the vitamin D may have contributed to stone formation by increasing the demand for vitamin A in an elderly population counseled to avoid intakes of vitamin A above the RDA. A 2001 study found that males in South India with calcidiol levels over 89 ng/mL had three times the risk of heart disease as those with lower calcidiol levels.<sup>59</sup> Vitamin D increases the demand for vitamin K<sub>2</sub> as well as vitamin A, and deficiency of vitamin K<sub>2</sub> contributes to calcification of all of the soft tissues, including the kidneys, causing kidney stones, and the arteries and aortic valves, leading to heart disease.<sup>60,61</sup> If the association between calcidiol levels and heart disease represents true causation, which it certainly could, it suggests that calcidiol levels begin contributing to soft tissue calcification at levels much lower than 89 ng/mL, at least in the absence of adequate levels of its partner vitamins, A and K<sub>2</sub>.

In the third National Health and Nutrition Examination Survey, calcidiol levels of 35 ng/mL were associated with high bone mineral density (BMD) among all ages and races. In adults over 50, however, the association above this point was remarkably inconsistent. In whites, it kept increasing until 50 ng/mL and leveled off thereafter. In Mexican Americans, it began declining after about 40 ng/mL. In blacks, BMD began declining after 35 ng/mL and sharply declining after 50 ng/mL. Whether these differences are due to genetics, differential intakes of other fat-soluble vitamins, differential use of anticoagulants or other drugs that interact with fat-soluble vitamin metabolism, or other unknown factors, we do not know. At this stage of the game, however, it makes much more sense to emphasize the importance of obtaining calcidiol levels between 30 and 40 ng/mL, levels where we have the most solid evidence of benefit and the least indication of harm.

Average blood levels of calcidiol in people with abundant exposure to sunshine range from 40 to 65 ng/mL.<sup>62</sup> These levels are most likely perfectly safe when intakes of vitamins A and K<sub>2</sub> from organ meats and animal fats are just as abundant as the sunshine. The research cited above, moreover, suggests that vitamin D would be stored in adipose tissue at these levels and released when calcidiol levels drop, as they would during the winter in temperate climates—an added bonus for those who wish to obtain their vitamin D from foods like cod liver oil and fatty fish rather than from supplements during the winter. People with dark skin, however, should be careful to make sure that their calcidiol levels stay above 35 ng/mL year-round and use a supplement if necessary. Maintaining levels of 50-80 ng/mL, on the other hand, might be not only unnecessary, but dangerous in the context of a standard diet deficient in the other fat-soluble vitamins.



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# Update on Cod Liver Oil Manufacture

## Returning to Traditional Production Techniques for the Quintessential Sacred Food

By David Wetzel

**W**hen I began to import cod liver oil, in order to sell it along with the high-vitamin butter oil I was manufacturing, I felt it imperative to go to Iceland and Norway to visit the various cod liver oil factories there. At that time, most cod liver oil in America was imported from Scandinavia, with a small amount coming from China. What I learned is described in an article published in the Fall, 2005 issue of *Wise Traditions* and posted at [westonaprice.org](http://westonaprice.org).

To summarize my findings, all the factories were engaged in industrial processing of cod liver oil, which involved alkali refining, bleaching, winterization and deodorization. Each of these steps, especially the deodorization, removes some of the precious fat-soluble vitamins, especially vitamin D. The resulting products can be divided into four categories.

First is a fully cleaned and deodorized product with nothing added back in. Products with very low levels of vitamin A with virtually no vitamin D are of this type. To obtain meaningful levels of vitamins A and D from these products would require consuming many tablespoonfuls—a practice that is not only difficult to achieve, especially for children, but poses the danger of supplying an excess of polyunsaturated fatty acids.

The second type is a non-deodorized product with a fair amount of natural vitamin A and D left in. According to the company website, Garden of Life cod liver oil falls in this category. It contains 500-1500 IU vitamin A per gram (2500-7500 IU per teaspoon) and 100-175 IU vitamin D per gram (500-875 IU per teaspoon).

The third type is the fully cleaned and deodorized cod liver oil with synthetic vitamins added back in. Most of the cod liver oils on the market fall into this category. (You'll need to check with the individual manufacturer to verify whether their cod liver oil falls in this category.) These vary in dose from about 1100 to 4600 IU vitamin A per teaspoon and 180 to 460 IU vitamin D per teaspoon. One company, Nordic Naturals, now adds supplemental vitamin D to their Nordic Naturals Vitamin D brand, to compensate for the vitamin D removed during processing.

The final category is the fully cleaned and deodorized product with natural vitamins added back in. This is the so-called high-vitamin cod liver oil, standardized at 2340 IU vitamin A per gram (11,700 IU per teaspoon) and 234 IU vitamin D (1170 IU per teaspoon). This is the type of cod liver oil I imported into the U.S. and sold under the Blue Ice label; it is also sold by Radiant Life and Dr. Ron's UltraPure.

#### HANDWRITING ON THE WALL

With only one factory still engaging in the relatively expensive process of adding natural vitamins back into processed cod liver oil, it was

easy to see the handwriting on the wall. The odds that this factory would soon fall in with the others and start adding synthetic vitamins instead of natural ones were great. I was also concerned that we had no cod liver oil manufacture in the U.S. What would happen if FDA found some reason to prohibit imports? And finally, I was offended by the industrialization of a sacred food. I now fully understand that today's fish oil industry has committed the same crime to a historically sacred food as the dairy industry has committed on milk.

As predicted, the factory in question ceased using natural vitamins early this year. When my current stock runs out, this relatively natural high-vitamin cod liver oil will no longer be available.

#### RETURN TO OLD METHODS

Fortunately, I had anticipated this eventuality several years ago when I began contemplating manufacturing cod liver oil myself. I wanted to produce a cod liver oil that contained only natural vitamins and, if possible, do it without the industrial alkali and deodorizing treatments. I also wanted to produce cod liver oil in the traditional way, which is by fermentation. I had read that in Roman times, long before refrigeration, fish guts were placed in a barrel with sea water and allowed to ferment. What came out the bottom of the barrel was a watery fermented fish sauce called *garam*, widely used as a seasoning (probably the precursor of Worcestershire sauce). The oil floated to the top and was collected carefully.

With only one factory still engaging in the relatively expensive process of adding natural vitamins back into processed cod liver oil, it was easy to see the handwriting on the wall.

#### COD LIVER OIL IN BRITAIN

"The British desperately needed not only food but cod-liver oil. They had a history of being great cod-liver oil enthusiasts. For centuries before it was refined for ingestion, a blackish residue from livers left in barrels was used as a balm, as it still is in West Africa. In the 1780's British medicine decided that cod-liver oil was a remedy for rheumatism, then a catchall diagnosis for aches and pains.

"During the nineteenth century, it was used to treat tuberculosis, malnutrition, and other poverty-related diseases. Between the wars, cod-liver oil became a major business in Hull and was used both for livestock and humans. During World War II, the British Ministry of Food, concerned about the effect of a tightened food supply on health, provided free cod-liver oil for pregnant and breast-feeding women, children under five, and adults over forty.

"School nurses forcefully administered spoonfuls of the vile-tasting liquid, while adults were often given it with orange juice. All this oil came from Iceland, where it contributed to a secondary Icelandic trade that remained and prospered after the war.

"The British government, believing that the oil had produced the healthiest children England had ever seen, despite bombings and rationing, continued the program until 1971. It was finally discontinued because people refused to take the oil. Icelanders, however, still take it, as do many Americans."

Source: Mark Kurlansky, *Cod: A Biography of the Fish that Changed the World*, pages 154-155.

This fermented fish oil was undoubtedly the civilized world's first health elixir, reserved for the soldiers and nobility. It is said that the soldiers refused to march without their daily ration of liquidum.

South Sea Islanders put great store in shark liver oil—enduring considerable danger to procure the sharks even though other, less-dangerous-to-catch seafood was plentiful. To prepare the oil, they put the livers inside the leathery stomachs of the shark and hung them in the trees for several months. As it ferments, the oil gradually comes out of the livers and fills the hanging stomachs! The yield is about one liter per shark.

A description of traditional European cod liver oil processing is provided by F. Peckel Möller in an article entitled “Cod-Liver Oil and Chemistry,” published in London, 1895. “The primitive method. . . is as follows. As soon as the fishermen reach the Voer [pier], and finish separating the livers and roes, they sell the fish and carry the livers and roes up to their dwellings. In front of these are ranged a number of empty barrels into which the livers and roes are placed, separately of course. The fishermen do not trouble to separate the gall-bladder from the liver, but simply stow away the proceeds of each day's fishing, and repeat the process every time they return from the sea, until a barrel is full, when it is headed up and a fresh one commenced.

This is continued up to the end of the season, when the men return home, taking with them the barrels that they have filled. The first of these, it may be noted, date from January, and the last from the beginning of April, and as on their arrival at their homes the fishermen have many things to arrange and settle, they seldom find time to open their liver barrels before the month of May. By this time the livers are, of course, in an advanced state of putrefaction. The process of disintegration results in the bursting of the walls of the hepatic cells and the escape of a certain proportion of the oil. This rises to the top, and is drawn off.

“Provided that not more than two or three weeks have elapsed from the closing of the barrel . . . to its being opened, and if during that time the weather has not been too mild, the oil is of a light yellow colour, and



Shark stomachs containing shark livers from Tahiti, hanging in the trees to ferment. Photo courtesy Kay Baxter.

is termed raw medicinal oil. As may be supposed, however, very little oil of this quality is obtained. Indeed, as a rule there is so little of it that the fishermen do not take the trouble to collect it separately. Nearly all the barrels yield an oil of a more or less deep yellow to brownish colour: this is drawn off, and the livers are left to undergo further putrefaction. When a sufficient quantity of oil has again risen to the surface, the skimming is repeated, and this process is continued

until the oil becomes a certain shade of brown. The product collected up to this point is known as pale oil. . . . By this time the month of June has generally been reached, and with the warmer weather the putrefaction is considerably accelerated, and the oil now drawn off is of a dark brown colour, and is collected by itself. It is rather misleadingly called light brown oil. . . . When no more can be squeezed out, the remainder is thrown into an iron caldron and heated over an open fire. By this process, the last rests of

#### FROM A 1893 PHYSICIANS' HANDBOOK

*The Cottage Physician*, published 1893 was “prepared by the best physicians and surgeons of modern practice.” It contains an introduction by George W. Post, AM, MD, Professor of the Practice of Medicine in the College of Physicians and Surgeons, Chicago, Illinois.

According to the handbook, “Cod liver oil is obtained from the livers of the common cod fish. There are three varieties according to the mode of extraction, known as pale, light brown and dark brown. . . the pale is the most palatable. . . as a remedy for consumption and other constitutional diseases of an exhausting nature, cod liver oil takes high rank. It is really more of a food than a remedy, its power of producing fat is well known. In scrofulous diseases generally, hip joint diseases, white swelling of the knee, caries of the spine, lumbar and psoas abscesses, rickets, etc., cod liver oil will nearly always do good. It is also useful in skin diseases, some forms of eye troubles and syphilis. Young children who have grown weak from diarrhoea in summer, and who seem unable to assimilate the food given them, can often be saved by rubbing cod liver oil into their skin. The common dose of cod liver oil is from one to two tablepoons, three times daily.”

oil are extracted from the hepatic tissues, which float about in the oil like hard resinous masses. . . . In order to fully carry out the extraction, it is necessary to raise the temperature considerably above the boiling point of water. . . . The oil prepared in this way is very dark, almost black, and with a greenish fluorescence in reflected light. In thin layers and by transmitted light it shows a brown colour, and it is therefore termed brown oil. . . .”

The writer then describes processing methods introduced to Norway in the 1850s by Peter Möller, which resulted in a much purer, consistently light-colored oil made from fresh, not putrefied livers, considerably more palatable in terms of taste and smell. He notes, however, that the “brown oils are actually used to a certain extent for medicinal purposes at the present day.”

After reading this passage, and foreseeing the demise of the last natural cod liver oil from Europe, I was determined to produce a light brown fermented cod liver oil according to the old methods.

## PRODUCTION OF FERMENTED COD LIVER OIL

But how to do this on a large scale? That was the challenge I was facing. It has taken six dedicated years of work to get to the point of offering the fermented cod liver oil to the community. The first challenge was to figure out a way to ferment the livers in large vats; and the second was to find the livers.

The method we have developed processes the cod liver oil through a proprietary non-heating natural lacto-fermentation. The process can take up to six months and is carefully handled throughout the process to ensure the oil is clean and natural. Industrialized fish oils, including cod liver oil, are heavily carbon filtered and heated after rendering or extracting. We have developed a unique cleaning process that does not use carbon filters or heat. Both heat and carbon filters remove flavors, odors, colors and nutrients, and also denature the fragile unsaturated fatty acids such as DHA and EPA.

Our cod liver oil “factory” is a large building in north central Nebraska. We prefer to call it our cod liver oil green house. The building

was built to store potatoes, but was gutted by fire soon after completion. It had been sitting empty all these years and came on the market at just the time we were looking for a facility, and became available to us at virtually no cost. We cleaned it out, washed and painted the walls, painted it and installed a new steel roof. The building currently holds six fermenting vats of just under 10,000 gallons each.

The roof is a solar roof and we use natural sunlight for heat and light—we have lots of sunlight in Nebraska. Our next project is to start sun drying fish eggs in a part of the building.

My other task was to find the livers. The search began several years ago—I picked up the phone and made many cold calls, most of which got me nowhere. People said I was crazy to want to purchase thousands of pounds of cod livers. Finally I met a Russian who took an interest in the project and found the livers for me—in Russia, they know about cod livers.

The first load of 10,000 pounds, which we used for experimental purposes, arrived two years ago. The first load for commercial production—40,000 pounds of frozen cod livers—arrived in a tractor trailer—packed into pallets. Future deliveries will come by railroad!

## TESTING COD LIVER OIL

Our next challenge was to test the oils for nutrient content. Of course, we do the standard tests for pathogens, PCBs and heavy metals. We do this to every batch, and our batches are small, so the number of tests per gallon of product is substantially greater than typically carried out in the industry. The heavy metal levels are “not detectable” and the PCBs meet WHO .090 ppm standards, the limit to which these compounds can be measured.

Measuring nutrient levels turned out to be complicated. When you test industrial cod liver oils to which have been added synthetic vitamins A and D, you get graphs with well defined peaks, indicating the presence of vitamin A or D. But the tests for our fermented cod liver oil came back showing a jagged line, with numerous peaks, no matter which method we used, and these peaks did not always match up with synthetic control peaks. The lab technicians were as surprised as we were. Their explanation was that this natural

We have never found any contaminants in our naturally produced fermented cod liver oil.

oil contains many isomers of vitamins A and D. We have to add the peaks to get some idea of the total. We currently receive a wide range of nutrient values depending on the laboratory test method and interpretation of the analysis.

In general, the test totals are substantially higher for vitamin D than one would find in any industrialized cod liver oil. Whereas the high-vitamin cod liver oil contains almost 12,000 IU vitamin A and 1200 IU vitamin D per teaspoon (five milliliters), the fermented oil contains 4,000 - 9,000 IU vitamin A per teaspoon and 3,000 - 4,000 IU vitamin D. The vitamin levels likely test lower because we are only testing for retinol and palmitate, not for all the other vitamin A isomers.

Anticipating increasingly stringent controls

on supplements, we have decided to label the fermented cod liver oil as a food—which it certainly is. Thus the label will contain a suggested dose and list vitamin A as a percentage of the RDA. There will be no mention of vitamin D on the label.

The suggested dose will be about 2 - 2.5 ml or about 1/2 teaspoon for adults, double for pregnant and nursing women and those under stress, and half that for children. Some practitioners are giving larger doses to treat serious health problems. The experience of Dr. Rosann Volmert (see page 31) indicates that best results are obtained using a combination of fermented cod liver oil and high-vitamin butter oil—a confirmation of Dr. Price's own experience.

Since this product is a fermented one, we surmised that it would contain vitamin K<sub>2</sub> as well as vitamins A and D. What we found was a range of quinones, which include the various forms of K<sub>2</sub>. The fermentation increases the total quinone count by 700-1600 percent compared to readings prior to the fermentation process. We have not identified the specific quinones but I suspect that the K<sub>2</sub> category and Co-enzyme Q family will

## FATHER JOHN'S MEDICINE

Father John O'Brien was an Irish-born priest who came to America before his ordination. He served in Virginia and Newburyport, Massachusetts before coming to the mill city of Lowell in 1848. It was the time of massive Irish immigration with each newcomer seeking employment and a new life. The good pastor understood the balance that was needed for these people who were caught between two worlds, the need to retain their own identity as Irish men and women, and that of identifying themselves as Americans. It was during his pastorship that the Irish became an active and prominent factor in Lowell's population.

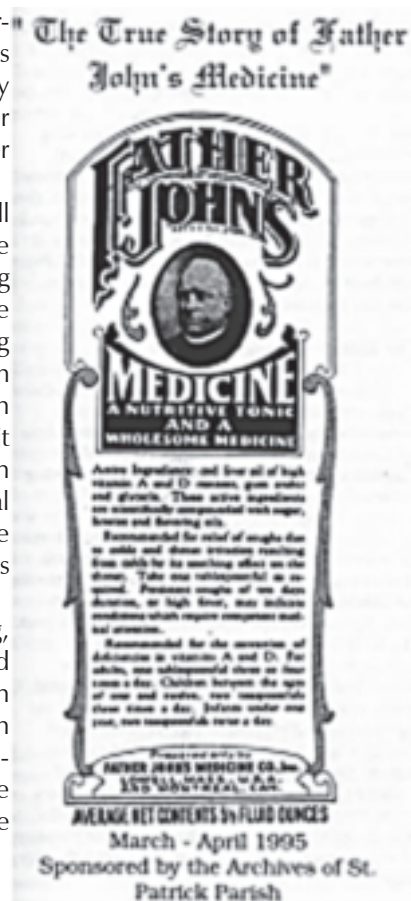
Tradition has it that Father John was taken ill in 1855. He made his way to the pharmacy of Carleton and Hovey on Merrimack Street to get something for relief. He was given a tonic that was composed of cod liver oil, which had a licorice taste. Unlike many other medicines of its time, the prescription contained no alcohol. It worked so well for the priest that he began recommending folks to visit the apothecary and ask for "Father John's Medicine." From this, a legend was born.

Soon the shop was packaging the medicine for sale. Father John was given a small stipend for using his name and picture. It was agreed that anyone Father John sent to the shop personally would not have to pay for the medicine. The pastor was always looking after his flock. For many years the company was overseen by the Donehue family. The generosity of the management to its employees was well known, even so far as keeping workers long past the need to, just so an employee could have a job.

Within 50 years the medicine was known far and wide. Early literature claimed it worked on "consumption, grip, croup, whooping cough, and other diseases of the throat," which it most certainly did. Pamphlets given to customers stated, "All disease is due to a run-down condition of the body, unhealthy tissue, blood poisoned with impurities, and general weakness." Guarantees were made by the manufacturer of its restorative powers. The potion was sold in numerous countries. Pharmacies built huge displays in their windows advertising the product.

The factory building was a model of production. Every process from manufacturing, to bottling, to packaging, to advertising was done in that one spot. Freight cars pulled in back of the building to ship cartons to parts unknown. A second factory was built in Montreal, Canada. In the 1970s the company was sold. The building was made into an elderly housing complex, and the product no longer made its home in Lowell. It continued to be produced by the Oakhurst Company in New York for a number of years. The brown-orange bottle with the trusting face of Father John O'Brien was a sign of assurance to people for 140 years.

Source: <http://library.uml.edu/clh/Fath/Fath1.Html>



## BENEFITS OF FERMENTED COD LIVER OIL AND BUTTER OIL ARE MANY AND VARIED

Rosann Volmert, DO

I am a family practice physician in Pasadena, California. I have been using Green Pasture's fermented cod liver oil and high-vitamin butter oil with my patients for only nine months now, and I have noticed dramatic results. The most dramatic of these is the effect the oils have had on lowering blood pressure in patients with hypertension. This effect has enabled several of my patients to lower their dose of prescription medication, and hopefully eliminate it all together. In addition, I have found that patients have lost weight and lowered their blood sugars without any change in diet or activity. I have also had reports of less stiffness and pain of joints in arthritic and temporomandibular joint dysfunction patients, improvement in eczema, elevated mood in depressed patients, lessening of symptoms of PMS and increased energy and overall well being. I have a very small practice so these testimonials are drawn from a few patients here and there, but they are indicative of tremendous benefits for a large number of people.

All of this has really illustrated for me the huge nutritional deficiency people have been suffering from due to a fear of cholesterol. For many years now a fear of cholesterol-containing foods has kept people from consuming healthy amounts of butter, eggs, cheese, milk, animal fats and many other foods rich in nutritious fats and fat-soluble vitamins. It is no wonder that the vitamin D level is pitifully low in 95 percent of my patients. Due to continued bias against cholesterol-rich foods, I am at times unable to convince my patients to eat more of these foods. However, I have been successful in getting them to take the Green Pasture's oils. This is mainly because they are easy to take, and only small amounts are needed. Using these products has enabled me to give back to my patients the fat-soluble nutrients their bodies have been lacking for some time now, and they are feeling better for it.

Because Green Pasture's fermented cod liver oils and butter oils contain such a wide variety and potency of fat-soluble nutrients, they not only enhance my patients' lives, but simplify them as well. Patients are able to take much less cod liver oil than with their old brand and eliminate the need for additional supplements, which are lacking in other brands. (I recommend 3 ml or 3/4 teaspoon fermented cod liver oil and 2.5 ml or 1/2 teaspoon butter oil.) When I introduce them to the oils, I ask them to bring in all the supplements they are taking. I show them that with taking this oil combo they can eliminate one-half to two-thirds of their other supplements, and sometimes all of them. Often my patients are taking so many different types of synthetic vitamins, they literally walk in with a big box full of them. The reason they are taking so many is because each bottle usually contains only one or maybe a couple types of synthetic vitamins or nutrients. Obtaining nutrients through natural food sources allows them a more potent and broader range of nutrition, thus eliminating the need for boxes of bottles and huge dosing.

One of the nutrients found in cod liver oil is vitamin D. I found that it took just 2,800 IU of the vitamin D contained in Green Pasture's fermented cod liver oil in combination with the butter oil to raise one patient's serum 25-hydroxy vitamin D level from 12.6 ng/ml to 82.3 ng/ml in just three months. According to the guidelines for supplementing synthetic vitamin D<sub>3</sub> it would have taken 7,000 IU to achieve this and without all the benefits of the many other fat-soluble nutrients found in these oils. What a testament to the power of nutrients in their natural form!

I am finding similar results in other patients. Several have raised their vitamin D levels from the teens or low twenties into the forties within several months using the combination of fermented cod liver oil and high-vitamin butter oil alone, in easy-to-take capsule form, and without any other vitamin D supplementation. Since the patients are also getting substantial amounts of vitamin A with this regimen, it is difficult to conclude that vitamin A interferes with vitamin D assimilation as critics of cod liver oil have claimed.

be important components within the quinone nutrients. The fermented cod liver oil tests at 4-8 mg per gram, compared to the high-vitamin butter oil at 23-25 mg per gram. Quinone testing presents a fertile field for future research.

### TAKING COD LIVER OIL

Most of those who have consumed the fermented cod liver oil report that it is not as fishy tasting as the industrialized varieties. However, because it is a lacto-fermented product, it can leave a slight sting on the back of the throat,

which some find bothersome. It is best to take the oil mixed with a small amount of warm water, swallowing quickly. Adding something acidic such as lemon juice, apple cider vinegar or kombucha may help with the tingling at the back of the throat. Others report good results adding a little honey or maple syrup or "chasing fat with fat" by following the cod liver oil with cream, egg yolk or butter. Another way to minimize the throat-tingle effect is to take it during or after a fatty breakfast.

### NEW PRODUCTS

Our current batch of fermented cod liver oil will come in plain, cinnamon and liquorice flavors, as well as in one-milliliter capsules. In the future we will offer Viking strength (unflavored), Mediterranean (garlic,

## WHAT ABOUT FISH AND KRILL OILS?

Fish oil and krill oil, sold as supplements to provide omega-3 fatty acids, are by-products of the fish and krill meal industries. They are produced in large factories humming with the noise of conveyer belts, grinders, separators, extractors and dryers. We provide two descriptions of fish oil manufacture and one of krill oil manufacture, and let our readers decide whether or not they want to consume these products. Remember that omega-3 fatty acids are very fragile and highly subject to damage when exposed to heat and oxygen.

FISH OIL MANUFACTURE, METHOD ONE: "The bulk of the world's fish meal and oil is today manufactured by the wet pressing method. The main steps of the process are cooking for coagulation of the protein thereby liberating bound water and oil, separation by pressing of the coagulate yielding a solid phase (presscake) containing 60-80% of the oil-free dry matter (protein, bones) and oil, and a liquid phase (press liquor) containing water and the rest of the solids (oil, dissolved and suspended protein, vitamins and minerals). The main part of the sludge in the press liquor is removed by centrifugation in a decanter and the oil is subsequently removed by centrifuge. The stickwater is concentrated in multi-effect evaporators and the concentrate is thoroughly mixed with the presscake, which is then dehydrated usually by two-stage drying. The dried material is milled and stored in bags or in bulk. The oil is stored in tanks. . . . An important prerequisite for efficient [oil] separation is high temperature, implying that the press liquor should be reheated to 90°-95°C before entering the centrifuges. This applies to sludge removal as well as to separation of oil and water. . . Oil polishing, carried out in special separators, is the final refining step done at the factory before the oil is pumped into storage. Polishing is facilitated by using hot water, which extracts impurities from the oil and thus ensures stability during storage. . . . good temperature control is required; the temperature of the feed should be maintained at about 95°C, but not less than 90°C" (*The Production of Fish Meal and Oil*, <http://www.fao.org/DOCREP/003/X6899E/X6899E00.HTM>).

FISH OIL MANUFACTURE, METHOD TWO (We are not making this up!): "Phospholipid-deprived fish oil is obtained by mixing fish oil with water and a monosodium glutamate (MSG) by-product with stirring, fermenting the mixture in the presence of urea, processing the mixture with steam, and centrifuging the mixture to separate water and phospholipids from the fish oil. Further steps are neutralizing the separated fish oil with NaOH [caustic lye], washing and drying the washed fish oil in vacuum; mixing the dehydrated fish oil with powders of earthworm excrement, subjecting the mixture to reaction at least 30 °C or higher for 0.5-1 hour, bleaching the fish oil absorbed into the earthworm excrement powders by use of activated clay, and filtering the bleached fish oil through a filter, and deodorizing the bleached and filtered fish oil under a steam atmosphere in a high vacuum, deodorizing apparatus, cooling and filtering the fish oil and packaging it into a closed vessel. The refined fish oil is significantly improved in acid value and peroxide value" (Method for Manufacturing Refined Fish Oil, <http://www.wipo.int/pctdb/en/wo.jsp?wo=2001042403>).

KRILL OIL MANUFACTURE: Frozen Antarctic krill are crushed and the lipids and proteins are extracted using acetone. Following extraction, the krill proteins and lipids are filtered through an organic solvent-resistant filter under reduced pressure to enable physical separation of lipids and proteins. Excess acetone is evaporated and water is separated from the oil. The oil is subjected to additional filtration and purification to remove impurities and is packaged in a modified nitrogen-containing atmosphere and stored. The notifier provides product specifications for krill oil, including specifications for fatty acids, total phospholipids, esterified astaxanthin, saturated fatty acids, and trans-fat (<0.1 percent). Specifications also include limits on residual acetone (<10 milligrams per kilogram (mg/kg), lead (<0.1 mg/kg), mercury (<0.1 mg/kg), arsenic (<0.1 mg/kg), cadmium (<0.1 mg/kg), pesticides, and microbiological contaminants" (<http://www.cfsan.fda.gov/~rdb/opa-g242.html>).

oregano, pepper oil and unrefined salt), salty cod (unrefined salt) as well as a gel product in several flavors that can be eaten off a spoon. We will also offer a cod liver oil-butter oil combo in gel as well as capsules. The products will be available through Green Pasture Products and also through several distributors, including Radiant Life, Dr. Ron's UltraPure and others in the U.S., as well as in Canada, Australia, New Zealand, the UK and the European Union.

Finally, we will be offering skate liver oil in capsules and possibly liquid. Our Russian supplier swears by the many benefits of skate oil.

We are also exploring different types of packaging. Currently the products are packaged in green glass from China. We are looking into recycled PETE plastic products that do not leach oils, and which are made in the U.S. This keeps our product completely domestic and also cuts down on shipping costs.

Other products in the works: dried fish eggs and an all-natural fish sauce. It's been quite an adventure. Stay tuned! ☺☺



## SOME COD LIVER OIL TESTIMONIALS

After about two weeks taking a one-half teaspoon high vitamin cod liver oil I noticed that my hands were not cracked anymore. I have had dry skin my whole life and in winter they will crack and bleed. My mother is 99 years old and has had skin cancer on her forehead. They have burned it off several times but it always bleeds and never really healed. I got her to take the cod liver oil so she wouldn't get a cold. Incredibly, her forehead has now healed up. WL

Since I started using fermented cod liver oil in my naturopathic practice, I have two completely resolved cases of endometriosis, women experiencing pain-free periods for the first time in their lives, surprisingly within two or three weeks of starting the fermented cod liver oil at a dose of 5 ml per day. Up to this point in my six-year career, I had yet to have any luck whatsoever when it came to endometriosis. I have another very complicated case of endometriosis combined with Wolf-Parkinson's-White-like heart problems and this particular woman experienced twelve to fifteen days of excruciating pain monthly related to the endometriosis. Within six weeks of starting the fermented cod liver oil she is down to three days of pain per month, which she is thrilled about. While her WPW symptoms persist, her endometriosis symptoms are all but a thing of the past. Again, I put her on a dose of 5 ml per day. I have another patient who came to me, a mother in her thirties, who was experiencing hair thinning and had not had a period in over nine months for no apparent reason. Within three weeks of starting the fermented cod liver oil, she had a period again. Laura Margaritis, ND, Hamilton, Ontario, Canada

I have a handful of clients that I have on high vitamin or fermented cod liver oil and when they stop taking it, they have discomfort and pain rather quickly in their arthritic areas, not to mention a return of depression and mood problems. They tell me they won't give up cod liver oil no matter what anyone says to them. . . our bodies don't lie. Anabela Bacchione

I have been using fermented cod liver oil for about eighteen months. I have been checking my vitamin D levels over the last four years and this year I went from 37 to 48, whereas the three years previous I went from 16 to 26 (ten points total, for the three years). During those years I was taking vitamin D in doses from 10,000 to 50,000 IU. The only thing I can attribute the increase to is the fermented cod liver oil. I also have a few customers who swear that the cod liver oil wards off depression, especially in the winter (Minnesota). BS

We've been using high-vitamin cod liver oil and the butter oil for the Weston Price protocol for several years. The biggest changes reported have been improved muscle strength, stamina and immunity. I have also noted improved moods in my family—they are less irritable. I also feel the Weston Price protocol, including bone broths, raw goat milk kefir, etc., helped save my mother's life when she was stricken with severe sepsis several years ago. The frequent drops of cod liver oil and butter oil appeared to increase her strength and improve her ability to absorb and utilize her food. LH

One of my patients, an active but hobbled sixty-five-year-old female, kept complaining of joint pain and stiffness for the past year. Our chiropractic work did wonders to keep her feeling quite well and able to maintain a busy schedule as well as go skiing in Colorado, but she would always return with the same old complaints. After two months on the high vitamin cod liver oil, her complaints of joint pain were gone! Michael J. Kudlas, DC, MA, MEd

My son's acne completely cleared up and he is so happy on cod liver oil that it is the one thing he will consistently take. Also he noticed that his seasonal affective disorder was much better last winter taking the cod liver oil (for his skin) and his grades and general energy were markedly improved over previous winters when he didn't take it. Megan McCoy, MD

At eight months, my one-hundred-percent breast fed daughter had a bad case of eczema and an allergy to egg whites. We tried everything (different soaps, oils, creams etc.) to get rid of the eczema and nothing worked till our homeopathic pediatrician told us to give her 1-2 ml of high-vitamin cod liver oil along with high-vitamin butter oil every day, as well as a teaspoon of coconut oil. Today she is a happy healthy two-year-old who takes 1-2 ml cod liver oil almost every day. She has perfect skin and her allergy to egg whites is gone as well. Her amazing recovery from the eczema and egg allergy inspired me to go back to school and become certified as a nutritional therapy practitioner. Our whole family of five has been taking 1-2 ml of high-vitamin cod liver oil for the past two years. We are all healthy and happy. The children, ages two, four and six, have never had a cavity and are noticeably healthier than the majority of their friends. Shelley Ballantyne, NTP

I am writing for myself and my family with all the changes which have taken place after the consumption of high-vitamin butter oil and cod liver oil and all good fats. First, I was deeply ill, with many local doctors diagnosing me with severe depression and anxiety. I was unable to sleep, digest or eliminate foods in a healthy way; I could not work or take care of myself at all. I was unable to do simple tasks like do the wash or button a shirt, for my coordination was impaired. I would trip often and could not finish a thought or sentence. I was severely paranoid of all things and people. With many medicines, my symptoms became even more severe and intense. I was scared to death, along with my family! I became very suicidal. I should explain that previously I was in the hair salon business and was quite successful, but using many chemicals all day long, five days a week. My diet was filled with wrong foods. I was taking care of a very sick family member daily. Thanks to Dr. Roy Ozanne I learned about good fats and fermented foods. With his help I eliminated all sugars, caffeine, alcohol, white flour, etc., but more importantly, I added cod liver oil and butter oil. Over the course of two years, my body healed itself. I am now able to communicate with all, I am motivated, and I am back to work (not in the hair business!). My children on this diet report that they are able to focus much better than they used to. LMP

In our clinic we've used Premier Natural Cod liver oil for about five or six years with great success. Our babies born to patients of the clinic in many cases have facial structures Weston Price found in his travels of traditional cultures. They have broad jaws, ears with unattached, slightly elongated lobes, and have great emotional dispositions. Many sleep through the night at a fairly early age, and developmentally are either early or right on target. Many parents have reported that their children do well academically and conditions such as allergies, behavioral disorders are markedly absent in these children. All our patients take two capsules pre-pregnancy and continue this during pregnancy and during lactation along with a diet that includes Chinese medical theories and Weston A. Price principles. In addition, half of those patients also take butter oil pre-pregnancy and during pregnancy and lactation. Adult patients with anxiety or depressive disorders do extremely well with our treatments which, of course, include cod liver oil. Dagmar Ehling, MAc, LAc, DOM(NM), Dipl OM, FABORM

I have had chronic fatigue syndrome for over seventeen years. At first, when I took the fermented cod liver oil, it gave me a headache so I stopped taking it. After I had the flu awhile back, I was left with a symptom where I could not lie down without feeling like I was smothering, even though I could breathe fine. This was accompanied by deep anxiety. The doctor suggested I had a classic symptom of congestive heart failure and suggested an angiogram, but that wasn't really an option for me because I have terrible reactions to drugs. Meanwhile, I found out I had low vitamin D levels (I live north of Seattle, WA) and learned that low vitamin D can cause heart problems. I started taking vitamin D<sub>3</sub> and it helped a bit but I kept needing more to keep the awful smothering symptom away. I was up to 6,000 IU per day of D<sub>3</sub> but kept feeling colder and colder and sleeping more fitfully. Finally, I got to the point where I didn't sleep all night and I knew it was the vitamin D keeping me awake. Fortunately, I had just bought some raw Jersey milk for my husband—not for myself because I thought milk didn't agree with me, but I tasted his and decided to have a glass of my own because it was so good. It calmed my nerves and I was able to sleep. Then I decided to try taking the fermented cod liver oil again because I knew I needed to get vitamin D somehow. The first dose did give me a headache for a short time, but I felt some well being afterwards. So for the past nine days I've been drinking three glasses of raw milk per day with no digestive upset and taking one to one and one-half teaspoons fermented cod liver oil daily. Pain and inflammation seem to be subsiding, my energy is improving, the constant feeling of heat and pressure in my head is gone, and I am so amazed and grateful that the awful smothering feeling is quickly becoming a bad memory. As an added bonus, I no longer feel bothered at all by the gray Pacific Northwest winter days. Given the improvement I have experienced in just a few days, I'm looking forward to seeing what happens as this winter progresses and I keep taking cod liver oil and drinking raw creamy milk! JJ

Finally my vitamin D test results are back, and my vitamin D level has risen from 39 to 46 after taking two bottles of the fermented cod liver oil. Previously I had taken the regular high-vitamin cod liver oil for a year and my vitamin D level stayed at 39 before and after. SH

I come from a family that suffers from arthritis so was concerned when I developed stiff hands and knees in my mid forties. Several months after taking high-vitamin cod liver oil and high-vitamin butter oil, the stiffness disappeared, never to return. SM

Since taking fermented cod liver oil, my libido has returned (after three years' absence), and my periods are not painful now. My hands no longer ache as they did and my skin is clearer. My daughter's fungal rash went away within a couple of weeks after she began taking it. LM

# A Response to Dr. Joe Mercola on Cod Liver Oil

By Sally Fallon Morell, MA

**O**n December 23, 2008, Dr. Joseph Mercola, owner of the popular holistic website [mercola.com](http://mercola.com), issued a statement, “Important Cod Liver Oil Update,” in which he rescinded his long-standing recommendation to take cod liver oil. The Weston A. Price Foundation received dozens of inquiries about this statement and it is for this reason that we have devoted much of this issue to the subject of cod liver oil.

Mercola’s official pronouncement is a strange mixture of true statements and illogical sequela, conflicting reasoning and unexplained omissions. While it is unfortunate that Mercola has joined establishment voices against vitamin A, what concerns us most is not the fact that Dr. Mercola disagrees with us, but that he misrepresents the WAPF message on the importance of vitamin A in the modern diet.

The following is a point-by-point rebuttal, with Mercola’s statements in italics.

For thousands of years, traditional peoples from Northern Europe, the Mediterranean, Russia, North America and the South Seas have valued the oil from cod and other species of fish and shark.

*For years, I have recommended cod liver oil as a dietary supplement to support healthy vitamin D levels. However, based on more recent findings, I am updating my recommendations regarding cod liver oil, as it may not serve you as well as previously believed. My previous recommendation was based on the fact that cod liver oil contains vitamins D and A in addition to healthy omega-3 fats. These vitamins are essential for most everyone who cannot get regular sun exposure year-round.*

It is a true statement that vitamins A and D are essential for “most everyone” but contrary to the implication that follows, we do not get vitamin A from sunlight. Mercola is correct in stating that cod liver oil may not serve us as well as previous believed. That is because most cod liver oil today has had a large part of the vitamin D removed during processing. We warned our readers about this situation in an article on the manufacture of cod liver oil in the Winter 2005 issue of *Wise Traditions*. This is why we recommend only those brands of cod liver oil that contain adequate vitamin D (as well as adequate vitamin A).

*But more recent research has discovered that the ratios of these two vitamins may be of paramount importance in order to extract optimal health benefits, and unfortunately, modern cod liver oil does not supply these vitamins in healthy ratios to each other.*

A detailed explanation of this research was compiled by Chris Masterjohn and published in *Wise Traditions*, Fall, 2005. The Weston A. Price Foundation was the first organization to provide the public with this important information. We noted that most—but not all—cod liver oil does not supply vitamins A and D together in the right ratio. Mercola avoids telling his readers that we can still obtain cod liver oil that contains adequate vitamin D, a fact with which he is surely familiar since he seems familiar with all the other information on cod liver oil posted at [westonaprice.org](http://westonaprice.org).

Basically, adults need about 1000 IU vitamin D daily to avoid vitamin A toxicity. This can be supplied by a dose of a recommended brand of cod liver oil that provides 10,000 IU vitamin A, which is a completely safe dose of natural vitamin A. Our recommended brands of cod liver oil are listed in our shopping guide and posted at [www.westonaprice.org/basicnutrition/cod-liver-oil-menu.html](http://www.westonaprice.org/basicnutrition/cod-liver-oil-menu.html).

#### WHAT YOU NEED TO KNOW ABOUT VITAMINS A AND D IN COD LIVER OIL

*At least 2,000 genes, or nearly 10 percent of your genes, have been identified that are directly influenced by vitamin D, which in turn impact a wide variety of health issues, from preventing the common cold and flu to inhibiting at least sixteen different types of cancer. There's even evidence linking vitamin D to the process of brain detoxification of heavy metals such as mercury.*

*Widespread vitamin D deficiency has also been strongly linked to the childhood epidemics of autism, asthma, and diabetes, both type 1 and 2. Vitamin A, which is essential for your immune system just like vitamin D, is also a precursor to active hormones that regulate the expression of your genes, and they work in tandem. For example, there is evidence that without vitamin D, vitamin A can be ineffective or even toxic. But if you're deficient in vitamin A, vitamin D cannot function properly either.*

These statements are all true. The information about the importance of balance between vitamins A and D comes from our website.

*There are many problems with modern cod liver oil but one of the primary ones is that there is no standard definition of what constitutes cod liver oil. Manufacturers are free to add or subtract as much vitamin A or D as they see fit.*

This is a true statement to which we have alerted our readers in several places on our website. When it comes to cod liver oil, it is important to read the labels!

*In fact cod liver oil was discovered in the sewers of England several hundred years ago by starving children who drank it and scientists noticed they did not get rickets. Cod liver oil is in fact a highly processed food that was never consumed by humans prior to this.*

Reference please?? In fact, for thousands of years, traditional peoples from Northern Europe, the Mediterranean, Russia, North America and the South Seas have valued the oil from cod and other species of fish and shark. Medical research on the benefits of cod liver oil dates back to the 1700s. The notion of cod liver oil running through the sewers of England is ludicrous—if cod liver

oil is a new, highly processed food, how did it get into those English sewers hundreds of years ago? How could it have been manufactured before it was even discovered?

**PRIMARY JUSTIFICATION FOR WHY YOU SHOULD AVOID COD LIVER OIL**

*There have been two recent meta-analyses done. The first one showed that people who took vitamin A supplements in cod liver oil, or in supplements, had an 18 percent increase in death rates.*

Mercola is referring to a meta-analysis by Bjelakovic and others published in the *Journal of the American Medical Association* (2007 Feb 28;297(8):842-57), cited in the Cannell study and discussed in depth on page 23. This analysis looked at selected randomized trials involving adults given beta-carotene, vitamin A, vitamin C, vitamin E and selenium. By manipulating the data in a certain way, the researchers claimed they found an association with supplement consumption, including vitamin A consumption, and increased mortality. Actually, only two of the studies included in the meta-analysis involved vitamin A given alone, neither of which even mentioned cod liver oil. Both were small studies and in neither did the authors claim that vitamin A had any effect on mortality. By referring

to the meta-analysis rather than the individual studies, Cannell was able to avoid mentioning the fact that the two small studies offered no useful information about the effect of vitamin A on mortality.

*The other study showed that unlike third world countries where vitamin A supplementation appears to decrease infections, vitamin A supplementation in developed countries like the U.S. actually increases infections.*

*The researchers believe this is due to massive nutritional deficiencies in the third world because most of their calories are from grains and they simply don't have an opportunity to consume as many fresh fruits, vegetables, butter, eggs and other vitamin A-containing foods that those in the developed world do.*

*In fact current research could not find any vitamin A deficiency at all, but approximately 5 percent had vitamin A toxicity. The converse is*

**A PRELIMINARY LOOK AT THE EFFECTS OF COD LIVER OIL ON VITAMIN D LEVELS**

Nineteen volunteers had their vitamin D levels tested using the home blood test from ZRT Laboratories and reported their vitamin D levels, cod liver oil usage and vitamin D supplementation to the Weston A. Price Foundation. The results are shown below. All volunteers are from northern latitudes and none reported recent sun exposure.

VIT D LEVEL	A/D FROM COD LIVER OIL	CLO TYPE	VITAMIN D SUPPLEMENT	DURATION
23	none	None	0	NA
32	6000/600	Fermented	0	12 mo
34	857/107	Carlsons 1000 mg capsules	2000	3 mo
34	10000/1000	High-Vitamin	0	48 mo
37	10000/1000	High-Vitamin	50,000 IU x 2, before onset of a cold	15 mo
39	2500/250	High-Vitamin	0	60 mo
39	20000/2000	High-Vitamin	0	30 mo
40	800/80	High-Vitamin	0	60 mo
40	6000/600	Fermented	0	12 mo
41	2000/200	Fermented	6000	24 mo
44	10000/1000	High-Vitamin	50,000 IU x 3 before onset of a cold	15 mo
45	2500/250	High-Vitamin	0	60 mo
45	10000/1000	High-Vitamin	0	36 mo
49	17500/1750	High-Vitamin	0	36 mo
53	12000/1200	Fermented	0	36 mo
57	12000/1200	Fermented	0	24 mo
62	20000/2000	High-Vitamin	5000	36 mo
63	20000/2000	High-Vitamin	5000	36 mo
77	5000/500	High-Vitamin	0	60 mo

While these results are merely preliminary, a tentative conclusion is that consumption of cod liver oil containing vitamin A does not interfere with the assimilation of vitamin D. Of the twelve individuals who had vitamin D levels of 40 or above, eight took cod liver oil alone, with no supplemental vitamin D. More carefully controlled studies are needed to provide definitive confirmation of this hypothesis.

*true in the third world where vitamin A toxicity is virtually unheard of, yet vitamin A deficiency is pervasive.*

As discussed on page 21, the analysis cited by Mercola did not even look at vitamin A supplementation in the U.S. but was a meta-analysis that pooled the results of nine studies conducted in India, Ecuador, Indonesia, Brazil, Ghana, Mexico and the Republic of Congo. Several of these studies have suggested that vitamin A may reduce the incidence of respiratory infection in malnourished children but increase it in well-nourished children, but none of them present evidence that the effect of vitamin A depends on vitamin A status or that vitamin A is helpful in the Third World but harmful in the developed world.

A number of studies included in the meta-analysis showed vitamin A to have no effect on respiratory infections while nevertheless reducing severe diarrhea by over 20 percent, gastrointestinal-associated mortality by over a third, infection-associated mortality by half, and measles incidence by 95 percent. The general picture that emerges from the scientific literature is that vitamin A consistently reduces mortality from severe infectious diseases but has a more complicated relationship to lower respiratory infections that we still do not completely understand.

*Additionally new research has shown that vitamin D protects against cancer. But a paradox was found as those with higher vitamin D levels did not seem to have this benefit. A bright Harvard researcher carefully analyzed the data in the study that showed this and found that when he removed the people with high vitamin A and vitamin D levels, those with normal vitamin A levels and high vitamin D levels continued to have reduced risk of colon cancer. So those that did not take vitamin A had the protective effect from higher levels of vitamin D.*

In this report, which was based on data drawn from the Nurses' Healthy Study and published in the *American Journal of Epidemiology*, 2007, total intake of vitamin D from foods and supplements was associated with a lower risk of colon cancer when total vitamin A intakes were below 5,000 IU, but not when total vitamin A intakes were above 5,000 IU. The vitamin D

intakes in this study, however, were very low. Even the 20 percent of people consuming the most vitamin D consumed an average of less than 600 IU. If the participants were receiving a lot of sunshine, the thousands of IU from that source would likely have diluted any effect of the vitamin D, so the strong association at low vitamin A intakes suggests they were not receiving much sunshine. Basic adequacy of vitamin D status would require over three times the highest intakes consumed in the study.

In order to truly indict intakes of over 5,000 IU of vitamin A as excessive, evidence should be provided from a population consuming adequate vitamin D. As soon as someone begins taking vitamin D supplements at the levels recommended by Dr. Mercola and the Vitamin D Council, they are no longer a member of the vitamin D-deficient population studied in the Nurses' Health Study so the results of that study do not apply to them. It must be emphasized, moreover, that correlations never show causation. We can use the observations in this study to hypothesize that high vitamin A intakes antagonize the beneficial effects of vitamin D intakes when vitamin D intakes are very low, but in order to demonstrate this premise, studies must be performed showing that increasing vitamin D intakes or decreasing retinol intakes reduce the risk of colon cancer compared to controls.

*Other research is now showing a connection between high levels of vitamin A and osteoporosis. In fact many Scandinavian countries that regularly supplement with cod liver oil have rampant osteoporosis even though they are getting adequate amounts of oral vitamin D.*

We have thoroughly addressed the problems of osteoporosis in Scandinavian countries in an article published in the Winter 2005 issue of *Wise Traditions*. The vitamin A in this study does not come from cod liver oil but from milk and cereals to which vitamin A is added. In the context of a vitamin D-deficient diet, consumption of high levels of synthetic vitamin A was associated with a higher risk of osteoporosis. Although human and animal evidence strongly suggests that vitamin A can only exert harm against the backdrop of vitamin D deficiency, it also suggests that the body's requirements for vitamin A are even higher than once thought.

Although human and animal evidence strongly suggests that vitamin A can only exert harm against the backdrop of vitamin D deficiency, it also suggests that sufficient levels of vitamin A are even higher than once thought.

*Dr. John Cannell, head of the Vitamin D Council, along with fifteen other researchers, recently released an article “Cod Liver Oil, Vitamin A Toxicity, Frequent Respiratory Infections, and the Vitamin D Deficiency Epidemic” in the November issue of Annals of Otology, Rhinology and Laryngology. In this paper Dr. Cannell raised questions about the efficacy of cod liver oil due to its highly variable and frequently excessive amount of vitamin A. Typically modern cod liver oil contains far less vitamin D than it used to, due to the deodorization process used today which removes much of this essential nutrient.*

Most of this paper is a review of studies showing the benefits of vitamin D in protecting against various illnesses, including respiratory infection. This paper does not present any information whatsoever indicating that cod liver oil is toxic and, in fact, admits that vitamin A can significantly reduce the incidence of acute lower respiratory tract infections in Third World children.

A portion of the review article is an attempt to explain why a 2004 study providing 600 to 700 IU of vitamin D and 3,500 IU of vitamin A in the form of cod liver oil and a multivitamin failed to meaningfully reduce upper respiratory tract infections when studies from the 1930s found that cod liver oil could reduce the incidence of these infections by 30 to 50 percent. The authors of the recent commentary suggested that the older studies were more effective because cod liver oil in the 1930s contained much more vitamin D. They suggested that modern cod liver oil is low in vitamin D because the deodorization process removes the vitamin while manufacturers fortify the oil with only a fraction of the original amount. As an example, they cited cod liver oil made by Nordic Naturals, advertised as containing only “naturally occurring vitamins A and D,” which has only 3 to 60 IU of vitamin D per tablespoon but between 150 and 12,000 times as much vitamin A.

This conclusion is essentially the same as the conclusion reached by the Weston A. Price Foundation and the research of Chris Masterjohn; we have continually pointed out that vitamins A and D work together and that without vitamin D, vitamin A can be ineffective or even toxic. We do not recommend Nordic Naturals regular cod

liver oil or any brand of cod liver oil that is low in vitamin D.

But it is completely inappropriate to conclude from this 2004 study that cod liver oil is toxic because of its vitamin A content. Similar reviews could be put together showing the benefits of vitamin A and cod liver oil in numerous studies—see page 42 for a list of recent studies showing a wide range of benefits from cod liver oil. Obviously the solution is to use the type of cod liver oil that people took in the 1930s, which did not have most of the vitamin D removed by modern processing techniques.

During the first half of the century, cod liver oil was the focus of a worldwide health initiative. Parents were urged to give cod liver oil to their children by doctors, by government officials, by teachers and principals in schools, and even by their ministers in churches. A large portion of adults in America born before the Second World War received cod liver oil as children and this practice contributed to a high level of health, intelligence and physical development in those lucky enough to receive it. In Europe in many countries, children received a daily ration of cod liver oil, especially during the war years. In the UK, for example, the government issued cod liver oil to all growing children until the early 1950s. The cod liver oil used during this period was obviously not toxic, but contributed to the good health of a whole generation of people. Surely the answer is to provide the current generation with the benefits of the same kind of cod liver oil.

*Dr. Cannell and other prominent researchers believe the vitamin A contained in most cod liver oil is excessive, and can reduce the effectiveness of vitamin D by inhibiting the binding of its active form to your DNA, effectively preventing its ability to regulate the expression of your vitamin D-responsive genes.*

According to a comment posted on the Internet, Dr. Veith, the second author of the paper and a prominent vitamin D researcher, does not agree with Cannell’s outright ban of cod liver oil. Dr. Veith is ultimately concerned with the possibility of vitamin A toxicity, but he stated that one teaspoonful per day of cod liver oil is not of concern ([onibasus.com/archives/nn/105447.html](http://onibasus.com/archives/nn/105447.html)).

While Mercola states earlier that vitamins A

During the first half of the century, cod liver oil was the focus of a worldwide health initiative.

If vitamin A in the American diet is adequate for vitamin D activation, why are Cannell and Mercola obliged to recommend such high levels of vitamin D—levels much higher than those found in traditional diets—in order to bring serum vitamin D levels into the normal range?

and D are synergistic, he now states that vitamin A antagonizes the actions of vitamin D. The Vitamin D Council report claims that the vitamin A in cod liver oil is excessive and antagonizes vitamin D by inhibiting the binding of its active form to DNA and thus prevents its ability to regulate the expression of vitamin D-responsive genes.

Vitamins A and D are both precursors to active hormones that regulate the expression of genes. The body possesses certain enzymes that convert each of these in a two-step process to their active forms: vitamin A is converted to retinol and then to active retinoic acid while vitamin D is converted to calcidiol and then to active calcitriol. While directly consuming either retinoic acid or calcitriol would be unnatural, consuming vitamins A and D, together, as in cod liver oil, is perfectly natural. The enzymes involved in these conversions are responsible for producing incredibly powerful hormones and are therefore highly regulated.

In order for vitamin D to activate the expression of its target genes, it must bind to the vitamin D receptor (VDR) and then combine with the retinoid X receptor (RXR), which is activated by a particular form of vitamin A called 9-cis retinoic acid. Researchers from Spain recently showed that vitamin D can only effectively activate target genes when its partner receptor is activated by vitamin A.

*The Weston Price Foundation, of which I am an advisory [honorary] member, holds a contradictory view. They believe vitamin D can only effectively target genes when its “partner receptor” is activated by vitamin A. If vitamin A is absent, certain molecules called co-repressors bind to the receptors and prevent vitamin D from functioning. It is their position that cod liver oil is still a highly recommended supplement.*

Dr. Mercola is no longer a member of the Weston A. Price Foundation honorary board. Research does indeed indicate that vitamin D can only effectively target genes when its partner receptor is activated by vitamin A.

*After reviewing the evidence, I am personally convinced that there is sufficient vitamin A in the current American diet to facilitate sufficient vitamin D activation. This does not appear to be the case in third world countries, where cod liver oil, or some other preformed retinol supplement,*

*would still be useful.*

Please supply us with this evidence. Where does the average American get vitamin A in the modern diet? If vitamin A in the American diet is adequate for vitamin D activation, why are Cannell and Mercola obliged to recommend such high levels of vitamin D—levels much higher than those found in traditional diets—in order to bring serum vitamin D levels into the normal range?

#### *MOST COD LIVER OILS HAVE EXCESSIVE VITAMIN A (PERFORMED RETINOL)*

*However, even the Weston Price Foundation acknowledges that there are dangerous versions of cod liver oil out there, even from some highly reputable companies like Nordic Naturals, which produces a cod liver oil that is clearly excessive in vitamin A as it only has 3 to 60 units of vitamin D per tablespoon but between 150 and 12,000 times as much vitamin A. It’s a delicate balance.*

*Both vitamins are essential to obtain optimal health benefits, however, the ratios can become dangerously unbalanced—much like the omega-3/omega-6 balance, which has become inversed in our modern diet.*

*Nearly all brands of cod liver oil provide a token amount of vitamin D, typically a mere 400 to 1,200 IU of vitamin D per tablespoon but anywhere between 4,000 to 30,000 IU of vitamin A. This is clearly inappropriate. About the lowest ratio I have seen is ten times as much vitamin A as vitamin D but, as I stated above, it can be as high as 12,000 times as much vitamin A.*

*First of all, this is clearly an insufficient amount of vitamin D for even the smallest child. This is in part due to the government recommendations, which are FAR too low to offer any health benefits; the recommended daily dosage being no more than 200 to 600 IU, depending on age. Meanwhile, researchers have since established that the therapeutic dosage is anywhere between 2,000 to 10,000 IU per day, depending on your weight and other factors, such as skin color and level of regular sun exposure. (Some people may require, and can safely take, as much as 20,000 IU daily.)*

A dose of 1000 IU vitamin D daily is adequate to avoid problems with vitamin A in adults. If the ratio of A to D in cod liver oil is 10 to 1,



then it is easy to obtain a safe amount of vitamin A along with an adequate amount of vitamin D.

*Consuming such high amounts of vitamin A as contained in cod liver oil and most multi-vitamins, while not getting nearly enough vitamin D, combined with the fact that most people are deficient in vitamin D to begin with, could potentially cause vitamin A to become toxic.*

We agree with this statement and have consistently warned people not to use multivitamins and not to take brands of cod liver oil that are low in vitamin D.

*The concern Dr. Cannell and the other researchers have is that vitamin A in cod liver oil is excessive and actually antagonizes vitamin D by inhibiting the binding of its active form to DNA and thus preventing its ability to regulate the expression of vitamin D-responsive genes.*

As stated earlier, vitamin A can be toxic when vitamin D is absent. Vitamin A does not antagonize vitamin D—both are needed for optimal assimilation. It would be amazing if vitamins A and D were antagonistic since they are so often found in the same foods.

*The Weston Price Foundation's strong belief is that vitamin A is not at all toxic but is necessary for optimal vitamin D function. However they believe there is sufficient vitamin A in the diet of most Americans, especially if they are taking a multivitamin.*

If Dr. Mercola is so familiar with all the information on cod liver oil on our website, how can he make this fundamental misrepresentation of Dr. Price's research? Our primary message is that vitamin A levels are far too low in the modern American diet compared to primitive diets. Primitive peoples consumed very high levels of vitamin A from organ meats, insects, fish eggs, fish heads, liver and fish liver oils, as well as from butterfat and egg yolks from grassfed animals. Since most of our animals are raised in confinement today, and many of the vitamin A-rich foods are unacceptable to modern palates, we recommend taking cod liver oil on a daily basis. We have never recommended taking a multivitamin. Likewise, we have never stated that vitamin A is "not at all" toxic.

*In the third world this is not the case and they would likely benefit from vitamin A supplementation.*

Why would the average Westerner have more sources of vitamin A in the diet than people in the Third World? At least in the latter, people who are not literally starving are more likely to eat organ meats, fish heads, insects and other sources of vitamin A. But it is certainly true that children in the Third World have greatly benefitted from vitamin A supplementation. Why would children in the West be any different?

*The Weston Price Foundation does not agree with Dr. Cannell's conclusion that cod liver oil itself may cause vitamin A toxicity, however they also do not recommend taking any cod liver oil that is low in vitamin D. Yet even their recommendations, in my opinion have far too low amounts of vitamin D to be clinically useful. But more importantly it appears that the high amounts of vitamin A may limit the effectiveness of vitamin D even if more is taken in addition to that received in the cod liver oil.*

As shown on page 37, we are seeing good serum D levels in people taking balanced cod liver oil without supplemental vitamin D; Cannell and Mercola are recommending very high levels of vitamin D supplementation to get the same results. We have a genuine concern that such high levels without supporting vitamin A could suppress the immune system and be toxic in other ways. Too much vitamin D can result in calcification of the kidneys, arteries, joints and other soft tissues.

*Although it's still unclear exactly what the balance should be, Dr. Cannell and most of the prominent expert researchers in this area believe that the ratios of these two essential nutrients likely should be reversed from those typically seen in cod liver oil, as you need far greater amounts of vitamin D as opposed to vitamin A.*

Reference please?? If Cannell is unclear what the balance should be, why is he recommending a ratio that is impossible to achieve in traditional diets? It may be possible in primitive diets to obtain an A-to-D ratio of approximately 1:1 from food, but certainly not 1:10. This can only be done with modern supplements.

*After carefully reviewing the arguments on both sides of the issue I am convinced that Dr. Cannell's approach is far more likely to be consistent with producing high levels of health and decreased illness.*

What's needed is a study comparing the health status of individuals taking a balanced cod liver oil and those taking large amounts of vitamin D without cod liver oil, as recommended by Cannell and Mercola. Meanwhile, it would be wise to err on the side of traditional diets, which generally contained higher levels of A than D in terms of International Units.

#### **MY REVISED COD LIVER OIL RECOMMENDATIONS**

*As the prevalence of vitamin A deficiency (which would benefit from cod liver oil) in the U. S. is much lower than the prevalence of subclinical vitamin A toxicity, while most everyone suffers from vitamin D deficiency, I no longer recommend taking cod liver oil for either adults or children. You're likely getting the vitamin A you need if you regularly consume fresh vegetables high in this nutrient, such as sweet potatoes, carrots, cantaloupe, and other colorful fruits and vegetables, and butter especially, if obtained from grass fed cows.*

Here Dr. Mercola repeats the myth that we can obtain adequate vitamin

A from plant foods. We have thoroughly explored this topic and shown that plant foods are a very poor source of vitamin A for humans, especially for babies and children, diabetics, and those suffering from thyroid and digestive disorders. (See <http://www.westonaprice.org/basicnutrition/vitaminasaga.html>.)

*Although you can obtain vitamin D from your diet, it is very difficult, and I believe it is very unnatural. It is my strong belief that we were designed to obtain virtually all of our vitamin D from exposing appropriate areas of our skin to sunshine. If this is not possible, the next best choice would be exposure to UVB rays from safe tanning beds, and if that is not possible then one should resort to a high quality vitamin D<sub>3</sub> supplement.*

Why is it unnatural to get vitamin D from the diet? Is it more unnatural than taking vitamin D pills? What did our ancestors do during the winter months? Mercola was not there to sell them vitamin D pills or tanning beds. Even in the tropics, traditional peoples obtained high amounts of vitamin D from their food.

*As it stands, it is my strong belief that you're simply not getting the appropriate balance of vitamin A to vitamin D from cod liver oil, which is why I believe it is best to avoid it.*

With the right brands of cod liver oil, it is indeed possible to get the right balance of A and D and a myriad of well documented health benefits.

*Please note that this new recommendation does NOT apply to either fish oil or krill oil, as neither of them contain the vitamins A or D, but rather are excellent sources of essential omega-3 fats. EVERYONE still needs a regular high quality source of these absolutely essential and vital nutrients.*

Dr. Mercola sells krill oil. Is this why he recommends it? The omega-3 fatty acids in krill oil are likely to be highly damaged from heat treatment during industrial processing. (See our description on page 32.) In addition, there is a danger from over-dosing on omega-3 fatty acids, which can depress the immune system and potentially lead to cancer. By taking a high-vitamin cod liver oil, you can obtain adequate vitamins A and D without overdosing on omega-3 fatty acids.

*Another potential point of confusion is that beta carotene is not a concern, as that is PRE vitamin A. Your body will simply not over convert beta carotene to excessive levels of vitamin A. So taking beta carotene supplements is not going to interfere with vitamin D.*

Several studies have shown that taking beta-carotene supplements result in higher mortality. The body cannot convert beta-carotenes into adequate levels of vitamin A. To achieve optimum health, we need liberal amounts of preformed vitamin A from foods like liver, seafood, butter, egg yolks and cod liver oil, along with vitamin D from the same types of foods, not from vitamin D pills. ☺☺

#### RECENT STUDIES ON COD LIVER OIL

Numerous recent studies have shown wide ranging benefits from cod liver oil, as indicated by these summaries from articles published between 2000 and 2009.

**PAIN IN RHEUMATOID ARTHRITIS:** Cod liver oil supplements were better than controls in relieving pain and can be used as NSAID-sparing agents in rheumatic arthritis patients (*Rheumatology* (Oxford). 2008 May;47(5):665-9).

**VITAMIN D STATUS AND BONE LOSS:** Inclusion of cod liver oil in the diet appears to attenuate the seasonal variation of vitamin D status in early postmenopausal women at northerly latitudes where quality of sunlight for production of vitamin D is diminished. Cod liver oil can thus protect against greater bone turnover, bone loss and obesity (*Bone*. 2008 May;42(5):996-1003).

**DIABETES-RELATED CARDIOVASCULAR DISORDERS:** Cod liver oil treatment in diabetic rats completely prevented endothelial deficiency and partly corrected several biochemical markers for cardiovascular disorders (*J Pharm Pharmacol*. 2007 Dec;59(12):1629-41).

**MULTIPLE SCLEROSIS:** In Arctic climates, supplemental cod-liver oil during childhood may be protective against multiple sclerosis later in life (*J Neurol*. 2007 Apr;254(4):471-7).

**BREAST CANCER:** Reduced breast cancer risks were associated with increasing sun exposure and cod liver oil use from ages ten to nineteen. "We found strong evidence to support the hypothesis that vitamin D could help prevent breast cancer. However, our results suggest that exposure earlier in life, particularly during breast development, maybe most relevant" (*Cancer Epidemiol Biomarkers Prev*. 2007 Mar;16(3):422-9).

**DEPRESSION:** Regular use of cod liver oil is negatively associated with high levels of depressive symptoms in the general population (*J Affect Disord.* 2007 Aug;101(1-3):245-9).

**WOUND HEALING:** The combination of zinc oxide and cod liver oil was found to be superior to the formulations containing only one active ingredient. This combination was also found to be most efficient in accelerating wound healing when it is retarded by repeated dexamethasone treatment (*Dtsch Tierarztl Wochenschr.* 2006 Sep;113(9):331-4).

**BREAST MILK:** Women using cod liver oil had a significantly higher levels of docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) in their breast milk. "As this may have an impact on the health and development of breast-fed infants in later life, regular maternal cod liver oil intake could be relevant for the infant as well as for the nutritional adequacy of the maternal diet" (*Ann Nutr Metab.* 2006;50(3):270-6).

**PAIN AND JOINT STIFFNESS:** Cod liver oil application allows reduction of the dose of nonsteroidal anti-inflammatory drugs, and improves chief clinical symptoms, reducing pain and morning joint stiffness (*Klin Med Mosk* 2005;83(10):51-7).

**HIP FRACTURE:** Multivitamin or cod liver oil supplementation was associated with a significantly lower risk of any fracture. "We found no evidence to support any skeletal harm associated with increased serum indices of retinol exposure or modest retinol supplementation in this population" (*J Bone Miner Res.* 2005 Jun;20(6):913-20).

**HIGHER BIRTH WEIGHT:** Women who used liquid cod liver oil in early pregnancy gave birth to heavier babies, even after adjusting for the length of gestation and other confounding factors. "Higher birth weight has been associated with a lower risk of diseases later in life and maternal cod liver oil intake might be one of the means for achieving higher birthweight" (*BJOG.* 2005 Apr;112(4):424-9).

**UPPER RESPIRATORY TRACT INFECTIONS IN CHILDREN:** Children supplemented with cod liver oil had a decrease in upper respiratory tract infections and pediatric visits over time (*Ann Otol Rhinol Laryngol.* 2004 Nov;113(11):891-901).

**VITAMIN D STATUS:** In Norway, three mølje meals (consisting of cod liver and fresh cod-liver oil) provided an amount of vitamin D equal to 54 times the recommended daily dose. Subjects with food consumption habits that included frequent mølje meals during the winter sustained satisfactory vitamin D levels in their blood, in spite of the long "vitamin D winter" (*Public Health Nutr.* 2004 Sep;7(6):783-9).

**DIABETES:** Use of cod liver oil in the first year of life was associated with a significantly lower risk of type 1 diabetes. Use of other vitamin D supplements during the first year of life and maternal use of cod liver oil or other vitamin D supplements during pregnancy were not associated with lower risk of type 1 diabetes (*Am J Clin Nutr.* 2003 Dec;78(6):1128-34).

**INTELLIGENCE IN CHILDREN:** Children who were born to mothers who had taken cod liver oil during pregnancy and lactation scored higher on intelligence tests at age four compared with children whose mothers had taken corn oil (*Pediatrics.* 2003 Jan;111(1):e39-44).

**RHEUMATOID ARTHRITIS:** Use of cod liver oil decreased occurrence of morning stiffness, swollen joints and pain intensity in patients suffering from rheumatoid arthritis (*Adv Ther.* 2002 Mar-Apr;19(2):101-7).

**EAR ACHES IN CHILDREN:** Children prone to ear aches (otitis media) receiving cod liver oil plus selenium needed lower amounts of antibiotics during supplementation compared to before supplementation (*Ann Otol Rhinol Laryngol.* 2002 Jul;111(7 Pt 1):642-52).

**DIABETIC NEUROPATHY:** Use of cod liver oil in mice played an important role in the prevention of diabetic nephropathy (*Lipids.* 2002 Apr;37(4):359-66).

**FAT-SOLUBLE VITAMINS IN BREAST MILK:** Maternal use of cod liver oil resulted in higher levels of fat-soluble vitamins in breast milk, especially vitamins E and A. (*Ann Nutr Metab.* 2001;45(6):265-72).