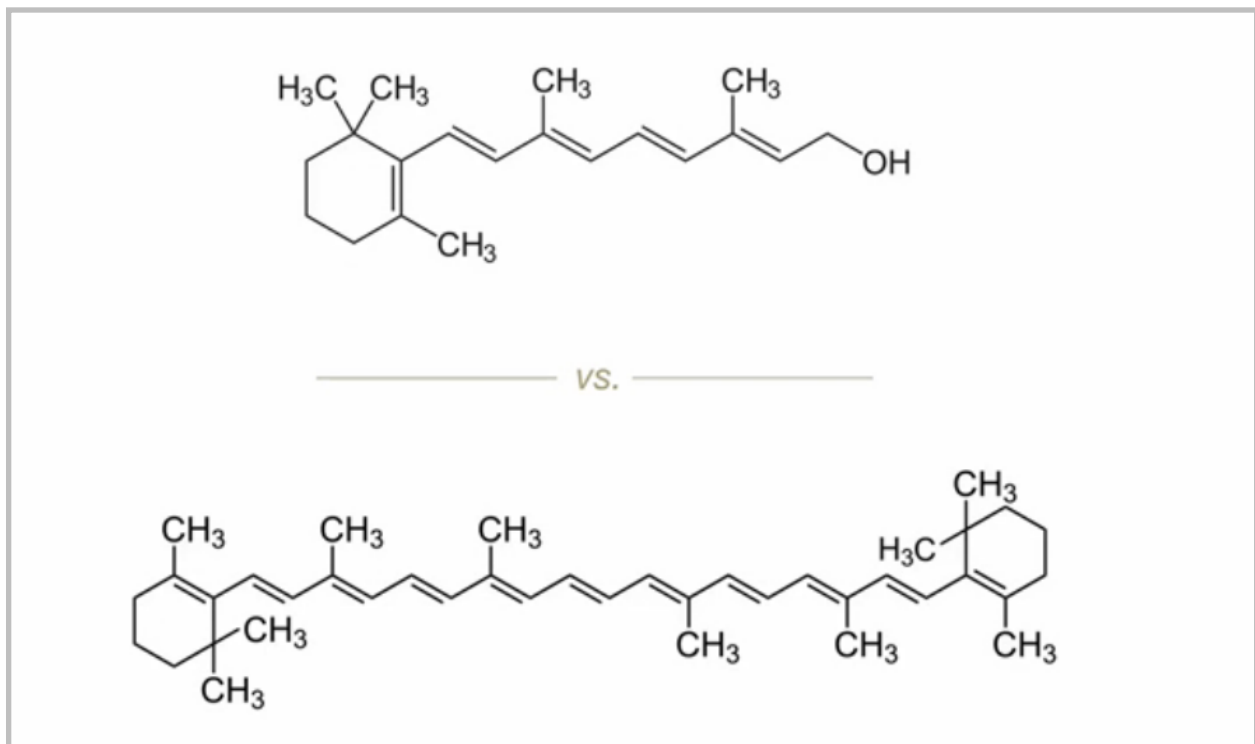


Supplementation: Vitamin A

Hey, everyone. In this presentation, we're going to talk about supplementation with vitamin A. Vitamin A is part of a group of fat-soluble retinoids, which includes retinol, retinoic acid, and retinyl esters. It's critical for vision. It is a component of rhodopsin, a protein that absorbs light in the retina. It's required for assimilation of protein, minerals, and water-soluble vitamins. It supports cell growth and differentiation. It acts as an antioxidant, and it plays a crucial role in reproduction and promotes full-term pregnancy along with proper development of the fetus, particularly with regard to the facial structure.



There are two forms of vitamin A. There is preformed vitamin A, which is retinol and retinyl esters, and this is found almost exclusively in animal foods, particularly in liver and egg yolks. Then there are vitamin A precursors such as beta-carotene and other carotenoids, and these are found primarily in fruits and vegetables. All forms are solubilized into micelles in the intestinal lumen and absorbed by duodenal mucosal cells. Both beta-carotene and retinol require some fat for absorption, and this is true of all of the carotenoids.

Vitamin A must be converted into retinol or retinoic acid in order to be used in the body, and this conversion is extremely inefficient, conversion of beta-carotene or carotenoids into retinol or retinoic acid, I mean. You must eat 19 to 48 times as much beta-carotene to obtain the same level of retinol. Beta-carotene consumption does not increase serum levels of retinol even when

levels are low to begin with. Some evidence shows that up to 50 percent of the population has a genetic profile that prevents the body from converting enough carotenoids into active vitamin A or retinol, and these people must consume animal sources of vitamin A to avoid deficiency. Most Americans no longer consume foods that are rich in preformed vitamin A, however, such as organ meats such as liver.

Recommendations

1 mcg retinol = 19-48 mcg carotenoids

900 RAE for **adult men**

700 RAE for **adult women**

750-770 RAE for **pregnant women**

1200-1300 RAE for **lactating women**

Recommendations for vitamin A are measured in retinol activity equivalents, or RAEs, to reflect the different bioavailability of plant versus animal forms of vitamin A. One microgram of retinol is equal to 19 to 48 mcg of carotenoids, and that's why I said before you had to eat 19 to 48 times as much carotenoids to get the same amount of retinol. The recommended dietary allowance for vitamin A is listed here on this slide for different populations. It's 900 RAE for adult men, 700 RAE for adult women, 750 to 770 RAE for pregnant women, and 1,200 to 1,300 RAE for lactating women. Now keep in mind, as is the case with all nutrients, the RDA is not the amount that has been determined for optimal health. It's the amount that is required to avoid acute deficiency symptoms, so it's the bare minimum, and really for optimal function, we need to be getting more than this.

Most of the body's vitamin A is stored in the liver in the form of retinyl esters. Serum levels of vitamin A do not decline until liver stores are almost completely depleted. Serum retinol levels are considered deficient below 0.7 μg and marginally deficient below 1.1 μg . New research suggests that optimal serum levels are between 1.4 to 2.13 μg , which is higher than is typically recommended or achieved with just the RDA. The average intake for Americans aged two years old and up is only 670 RAE, which falls below the RDA, as you saw on the last slide. What's more, anthropological evidence shows that our ancestors ate much larger amounts of preformed vitamin A than even the most progressive modern recommendations. For example, traditional Inuit consumed as much as 10,500 RAE daily.

Frank vitamin A deficiency is rare in the United States, and it is more common in third-world countries. A long-term, severe deficiency leads to blindness, xerophthalmia, chronic diarrhea, and increased mortality from infections, but symptoms of suboptimal vitamin A status are more common and include poor vision at night, keratosis pilaris or chicken skin, dry skin, dry eyes, frequent infections, acne, eczema, psoriasis, menstrual dysfunction, hypothyroidism, and autoimmune disease. Vitamin A deficiency causes impaired steroid hormone synthesis in rats, and a link has been established between vitamin A deficiency and autoimmune disease. Vitamin A may help balance immune function along with vitamin D in cases of immune dysregulation, and vitamin A is thought to calm down an overactive immune system.

So I'm sure you've heard in the popular media and even in medical literature that too much vitamin A is toxic. Vitamin A is a fat-soluble vitamin, again, which is stored in the liver, and levels can accumulate. Excessive intake of preformed vitamin A in some situations can lead to toxicity symptoms such as headaches, dizziness, nausea, skin irritation, bone and joint pain, liver abnormalities, coma, and even death, although that is almost unheard of. Vitamin A toxicity can also potentially cause birth defects if it is taken in extremely large doses during pregnancy, and that would most likely be from excessive supplementation or pharmaceutical retinoids that are used for certain skin conditions, not dietary intake.



However, there is a big caveat to this concern about the toxicity of vitamin A. Taking vitamin A together with adequate amounts of vitamin D and K2 significantly reduces the toxicity threshold for vitamin A. For example, one study showed that the dose that was necessary to cause toxicity symptoms increased by an extra 175,000 IU per day when vitamin A was paired with vitamin D. Just to put that in perspective, that is the amount of vitamin A that you get in five tablespoons of cod liver oil, not teaspoons. A typical dose of cod liver oil that is recommended is one teaspoon, so we're talking about orders of magnitude higher dose of vitamin A that you'd have to take in order to achieve toxicity when you're taking adequate amounts of vitamin D and K2.

Supplementation with beta-carotene does not cause acute toxicity as far as we've seen, but it is associated with increased risk of lung cancer and cardiovascular disease. You may be aware of some of these studies on long-term antioxidant supplementation with things such as vitamin E and beta-carotene that have shown poor outcomes, including increased risk in overall mortality and then again lung cancer and cardiovascular disease.

I believe, given the statistics on inadequate vitamin A intake for all populations but especially for pregnant women, since they need 700 to 770 RAE just to avoid acute deficiency symptoms, and the average intake is 600, that pregnant and breastfeeding women need more vitamin A, not less, and as you saw, the need for breastfeeding women is even greater than pregnant women. We need to be advising our patients to take more vitamin A, eat more liver and organ meats, and take cod liver oil. Cod liver oil is particularly good because it contains vitamin D, which protects against vitamin A toxicity.



Food sources of vitamin A, preformed retinol, are somewhat limited, as I said. They mostly include liver, and liver can be from beef liver. It could be lamb liver, chicken liver, goose, turkey, or fish liver. All different forms of liver are excellent sources of preformed vitamin A. Four ounces of raw beef liver, for example, will provide 18,000 to 20,000 IU of vitamin A. Four to eight ounces of cooked liver per week provides an adequate dose of vitamin A for most people. However, those who have iron storage diseases such as hemochromatosis or copper overload should not consume liver because it can aggravate those conditions. Note that some patients with mast cell activation disorder or histamine intolerance don't do very well with liver.



Another potential source, if your patients can stomach it, is actual fish liver rather than fish liver oil. You can purchase canned cod liver as a supplemental food. This was consumed regularly in northern European cultures, and it's a good option for patients who don't want to supplement and who want to get all their nutrients from food, or for whatever reason can't or won't consume liver from mammals or fowl.



Pastured egg yolks are a decent source of preformed vitamin A. They're not nearly as high in retinol as liver. One pastured egg yolk is equal to about 800 IU of vitamin A, but they are a great source of vitamin A for children and babies, especially if they won't eat organ meats.

Beta- Carotene



Orange and yellow vegetables are a great source of beta-carotene, which is the vitamin A precursor. Ideally, some beta-carotene is converted into active vitamin A in the body, and carotenoids from foods have some antioxidant effects themselves and benefits independent of their ultimate conversion into vitamin A, but remember that not everyone can make this conversion effectively, and some can't make this conversion at all. Actually, one of the symptoms that you can see in people who don't make the conversion at all is yellowish or orangish skin, especially if they eat a lot of carrots or do a lot of juicing with carrot juice or things like that. Rich food sources of beta-carotene include sweet potato, bell pepper, spinach, carrots, cantaloupe, mango, apricots, broccoli, pumpkin, and squash.



In terms of supplementation, we've talked about cod liver oil several times already. It's an ideal source because it contains both vitamin A and vitamin D, which reduces the toxicity threshold of vitamin A. It's also a good option for those who can't or won't eat organ meats themselves. There are a number of different options out there in terms of cod liver oil. There is a fermented cod liver oil from Green Pasture, which is a good product despite some controversial press that happened, if you may have seen that. I did a lot of research and took a deep dive, and I don't believe that there is any issue with that product, and I think it is still a good product. The one potential caveat is that a lot of patients these days do seem to have some amine intolerance to histamine or tyramine, and although the levels of histamine in fermented cod liver oil are very low or undetectable, it does have a significant amount of tyramine, and that may provoke reactions in some patients. I prefer extra-virgin cod liver oil. This is a relatively new product at the time of this recording from a company called Rosita Real Foods, a very, very high quality, independently tested. It has a very fresh and clean taste and smell. I have an article that we'll link to in the resources section called "An Important Update on Cod Liver

Oil” that goes into a lot of detail about this particular issue, so I recommend extra-virgin cod liver oil from Rosita at a dose of about one teaspoon per day for maintenance.

Ten thousand to 15,000 IU per day of vitamin A is a pretty good target for most adults and pregnant and breastfeeding women who have good vitamin D status, that is, they’re in the range of 25 to 50 ng/mL. They can actually get more than that. They could double that dose, especially while they’re nursing because the requirement, as you saw a few slides back, is higher when nursing. Supplements should be taken with a meal that contains fat for best absorption, and again, make sure that the patient is getting enough vitamin D and vitamin K2 as well. We’re going to be talking about both of those nutrients shortly.

There has been a lot of research. Well, actually, there has been a lot of discussion about what the optimal ratio of vitamin A to D is. There is not very much research, which is part of the problem, but at this point, I think somewhere between a 1:3 to 1:5 ratio of vitamin D to vitamin A is probably optimal along with about 100 to 200 mcg of vitamin K2 at a minimum.

Okay, that’s it for now. See you next time.