

# Vitamins A, B, C, D, E – What About Vitamin F?

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## STORY AT-A-GLANCE

- › In the early 20th century, Casimir Funk, a Polish chemist, came up with the term “vitamine” – a compound that contains “amine,” which is Latin for nitrogen
- › After Funk discovered vitamins, nutrition scientist Elmer McCollum revealed an “accessory” substance in certain fats that was needed for rats to grow; this substance was called vitamin A, for accessory
- › McCollum and others named a nutrient vitamin B, for beriberi, while the different B vitamins were eventually numbered in the order they were discovered
- › Vitamins were then named alphabetically until vitamin E; next came vitamin K, which is necessary for blood coagulation – or koagulation, as it was written in a German journal; rather than naming it vitamin F, the K abbreviation stuck
- › Vitamin F did end up making a comeback, as it was used to name the essential fatty acids (EFAs) alpha-linolenic acid (ALA) and linoleic acid (LA)

Have you ever wondered what happened to vitamin F? We have vitamins A through E, and vitamin K, but vitamin F seems long forgotten. Getting to the bottom of the mystery requires digging into the history of vitamins, including how they came to be and the strategies used in naming them.

While it's easy to take the knowledge of water- and fat-soluble vitamins for granted, it wasn't until 1912 that the idea of vitamins came to be, setting the stage for more in-depth studies into these important nutritional compounds.

## **Nutrition Discoveries Came Before Vitamins**

Humans have long had intrinsic knowledge that the foods they eat are tied to their health. In 1772, the discovery of nitrogen led to experiments on the element in food, followed by the discovery of an “animal substance” called protein in 1839. National Geographic reported:<sup>1</sup>

*“For decades, historian Kenneth Carpenter writes, protein was considered the sole nutrient for human health despite emerging knowledge that fruits, vegetables, and milk eased conditions like scurvy and rickets. While these afflictions were common among those with limited diets, researchers still blamed other factors, like infections, tainted food, or even sea air.”*

Around this time, it was recognized that beriberi, a disease now known to be caused by a vitamin B1 (thiamine) deficiency, may have a dietary link. Not only were poor people more likely to suffer from it than wealthier people, but those in prison who were fed white rice often developed the condition.

In the early 20th century, Casimir Funk, a Polish chemist, soon began to conduct experiments on pigeons, which revealed that those fed white rice grew ill. Their condition was reversed, however, when they ate rice bran and yeast. He suggested a “vitamine” – a compound that contains “amine,” which is Latin for nitrogen – was missing in the white rice diet, causing the pigeons to become sick. National Geographic continued:<sup>2</sup>

*“The discovery of vitamins sent a shockwave through the scientific community, suggesting that diseases might be caused by nutritional deficiencies – and cured by adequate amounts of the newly discovered compounds. ‘A monotonous diet ought to be avoided,’ Funk declared. Researchers rushed to isolate other micronutrients associated with diseases like rickets, scurvy, goiters, and more.”*

## **Vitamins Were Named Alphabetically – Until This**

After Funk discovered vitamins, nutrition scientist Elmer McCollum revealed an “accessory” substance in certain fats that was needed for rats to grow. This substance was called vitamin A, for accessory. From there, McCollum and others named Funk’s rice bran nutrient vitamin B, for beriberi, while the different B vitamins were eventually numbered in the order they were discovered. As National Geographic noted:<sup>3</sup>

*“The ‘e’ used in Funk’s new term was eventually dropped after scientists recognized that not all the compounds were nitrogen-containing amines. But the custom of naming vitamins alphabetically in order of discovery continued.*

*Today, four fat-soluble vitamins (A, D, E, and K) and nine water-soluble vitamins (Vitamin C and the eight B vitamins—B1 [thiamin], B2 [riboflavin], B3 [niacin], B5 [pantothenic acid], B6 [pyridoxine], B7 [biotin], B9 [folate], and B12 [cobalamin] — are considered essential to human growth and health.”*

After vitamin E was discovered, Carl Peter Henrik Dam, a Danish biochemist, bucked the system with vitamin K, which is necessary for blood coagulation — or koagulation, as it was written in a German journal in which his research was published. Rather than naming it vitamin F, the K abbreviation stuck.

## **Essential Fatty Acids Are Sometimes Called Vitamin F**

Vitamin F did end up making a comeback, as it was used to name the essential fatty acids (EFAs) alpha-linolenic acid (ALA) and **linoleic acid** (LA).<sup>4</sup> However, EFAs are needed in substantial amounts, not trace amounts, which meant they didn’t meet the criteria to be called vitamins. For the record, Britannica defines vitamins as “any of several organic substances that are necessary in small quantities for normal health and growth in higher forms of animal life.”<sup>5</sup>

“Scientists discovered ALA and LA in the 1920s and mistook them for a vitamin they called vitamin F. The label stuck even though they were later found to be fats,” Cleveland Clinic reported.<sup>6</sup> As explained by Nils Hoem, Ph.D., — a research scientist with Aker Biomarine, the largest krill oil company in the world — the plant-based omega-3 fats ALA

and LA are both polyunsaturated fats (PUFAs) that are considered essential in conventional medicine.<sup>7</sup>

However, the amount of LA that many people consume in ultraprocessed foods has increased dramatically since its discovery. History shows that our lopsided consumption of ALAs began in the early 1900s, when people were discouraged from eating natural animal fats such as butter and lard.<sup>8</sup> This led to a significant increase – more than two-fold – in the intake of LA, largely from vegetable oils.<sup>9</sup>

LA is an 18-carbon molecule. ALA also has 18 carbons. Since your body cannot make these fats, you must get them from your diet. That said, since LA is found in nearly every food, it's virtually impossible to become deficient in LA. In fact, most people consume far too much LA, as it's abundant in most ultraprocessed foods.

Others, such as the omega-3s EPA and DHA, which have 20 and 22 carbons respectively, can be synthesized in your body, provided you have enough available delta-6-desaturase, an enzyme responsible for their conversion.

The problem is that there's competitive inhibition for that enzyme, so when you have 10-fold (1,000%) more omega-6 in your system, as many people do, then the delta-6-desaturase will be used to convert the omega-6 into arachidonic acid, instead of converting the ALA into EPA.

Since processed foods are loaded with omega-6 fats, it radically skews the omega-3 to omega-6 ratio and inhibits your body's innate ability to synthesize beneficial EPA and DHA. Again, when you have large quantities of LA in your diet, it inhibits the enzyme, delta-6 desaturase, that converts ALA into EPA and then DHA.

So, it's important to lower your LA intake as much as possible so your body can more easily convert any plant-based omega-3, found in flax, hemp and chia seeds, into the animal-based omega-3 fats EPA and DHA.

This competition for delta-6 becomes a moot point if you reduce your LA intake to only 1% to 2% of daily calories. But most people consume 20% to 25% of their calories in the

form of LA, which means they have stored up this fat in their cells.

Restricting LA intake will balance out your omega-3s naturally, but increasing your intake of animal-based omega-3s is also important, as it can essentially push the omega-6 out of your membranes.

## What About Vitamins G, H, I and J?

Other compounds once held the titles of the now-defunct vitamins G, H and J, although it seems I didn't make the cut. According to The Globe and Mail:<sup>10</sup>

*"Vitamin G is an obsolete name for riboflavin (now B2). H was the original name for biotin (now B7). There is no record of a historical vitamin I. Vitamin J has been associated with either riboflavin or the non-essential substance catechol, and M is an obsolete name for folic acid (B9).*

*Substances formerly referred to as vitamins L (anthranilic acid), N (thioctic or alpha-lipoic acid), O (carnitine), and P (flavonoids) are other examples of nutrients that do not meet the modern definition of a vitamin."*

More recently, vitamin G has been used to stand for "green space," which is closely linked to physical and mental health and longevity.<sup>11</sup>

## Vitamin Deficiencies Are Common

Despite widespread knowledge about the importance of vitamins for human health, many people are lacking in a variety of these compounds. Even at a subclinical level, being deficient in vitamins and minerals can cause a range of symptoms, ranging from fatigue and irritability to heart palpitations and pain.<sup>12</sup> Common vitamin deficiencies include:

1. **Vitamin D** — Despite its name, vitamin D is not a regular vitamin. It's a steroid hormone that your body is designed to obtain primarily through sun exposure, not

via your diet. Worldwide, about 1 billion people are deficient in vitamin D, while an estimated 50% have vitamin D insufficiency.<sup>13</sup>

Older Americans tend to have the highest levels of vitamin D deficiency. In the U.S., 61% of older adults are deficient, rising to 90% in Turkey and 96% in India.<sup>14</sup> In 2014, however, older Americans were already so deficient in vitamin D that it was estimated that as many as 100% of them were deficient, in large part due to less time spent outdoors.<sup>15</sup>

Vitamin D is necessary not only for healthy bones but for health throughout the body. As a powerful epigenetic regulator, vitamin D influences that activity of more than 2,500 genes, and vitamin D receptors are present all over the body, including in the intestine, pancreas, prostate and immune system cells.<sup>16</sup> As noted in a systematic review published in *Frontiers in Nutrition*:<sup>17</sup>

*“Previous association studies reported that vitamin D deficiency is also an important risk factor for SARS-CoV-2, weak muscle strength, cardiovascular disease, multiple sclerosis, upper respiratory tract infection, certain cancers, and other disease. In turn, these complications may increase the burden of global disease. Therefore, preventing vitamin D deficiency is a very important and urgent public health issue.”*

I’ve long recommended a vitamin D level of 60 to 80 ng/ml (150-200 nmol/L) for optimal health and disease prevention. A level upward of 100 ng/mL also appears safe and **beneficial for certain conditions, especially cancer**.

However, the only way to gauge whether you might need to supplement, and how much to take, is to get your level tested, ideally twice a year, in the early spring, after the winter, and early fall when your level is at its peak and low point. Vitamin D is best obtained via sensible sun exposure, but supplementation may be necessary for some people.

**2. Vitamin K2** – Known for its role in bone and heart health, vitamin K2 is found in grass fed animal products such as meat, eggs, liver and dairy,<sup>18</sup> as well as in

fermented foods, including sauerkraut, certain cheeses and the fermented soy food natto – items that many Americans do not consume enough of.

Vitamin K2, menaquinone, which is synthesized by intestinal bacteria, works synergistically with calcium, magnesium and vitamin D to build strong, healthy bone. Vitamin K2 directs calcium to your bones and prevents it from being deposited in your soft tissues, organs and joint spaces. Vitamin K2 also activates the protein hormone osteocalcin, produced by osteoblasts, which is needed to bind calcium into the matrix of your bone.

- 3. Vitamin B12** – A water-soluble vitamin also known as cobalamin, vitamin B12 plays a role in numerous biochemical reactions and neurological functions in your body, including DNA synthesis.<sup>19</sup> Your body can't make vitamin B12 on its own, so it must be obtained via your diet or supplementation.

It's been suggested that nearly two-fifths of Americans may have lower than ideal B12 levels, with 9% deficient and 16% below 185 pmol/L, which is considered marginally deficient.<sup>20</sup> While vegetarians and vegans are susceptible since B12 is derived from animal products, even meat eaters may be deficient, as problems with absorption are common.

- 4. Vitamin A** – An estimated 51% of adults are not consuming enough vitamin A,<sup>21</sup> increasing their risk of degenerative diseases like macular degeneration, a leading cause of blindness in the U.S.<sup>22</sup>

Vitamin A is a group of nutrients that falls into two different categories: retinoids found in animal foods and carotenoids found in plant foods. The two are chemically different and provide different health benefits, but both are necessary for optimal health. Plant foods high in beta-carotene include sweet potatoes, carrots, cantaloupe and mangoes.<sup>23</sup> Animal foods rich in vitamin A include liver, egg yolks and grass fed butter.

If you think you may be missing out on important vitamins in your diet, the best way to boost your intake is via organic, whole foods. If you're not eating right, a high-

quality multivitamin may help fill in any gaps, with research suggesting they may improve biomarkers of nutrition compared to placebo.<sup>24,25</sup>

When choosing a multivitamin, be sure to look for a manufacturer that has checks and balances in place to ensure the quality of the product. And remember, since multivitamins contain both water- and fat-soluble vitamins, it's generally recommended to take half your daily dose in the morning, with breakfast, and the other half with your main meal.

## Sources and References

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