

# You Are Likely Deficient in Choline

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✓ Fact Checked

December 29, 2022

## STORY AT-A-GLANCE

- › In their 2020 review, the Dietary Guidelines Advisory Committee found that most Americans are deficient in choline
- › Choline is important for development through all stages of life and plays a role in cognition, memory, focus, energy and metabolism
- › Choline deficiency is connected to the development of nonalcoholic fatty liver disease and muscle damage
- › Pregnant and lactating women are at an increased risk of choline deficiency due to increased needs of the developing fetus
- › Beef liver and egg yolks are the richest dietary sources of choline

July 15, 2020, the Dietary Guidelines Advisory Committee (DGAC) published its 2020 report, an independent scientific review on the nutrition and health status of Americans, and there was a concerning finding: Most Americans don't get enough choline, an essential nutrient that's vitally important, but rarely discussed.

Marie Caudill, Ph.D., a registered dietitian who is internationally recognized for her research on choline and folate, says the most alarming find from the report is that the populations who would benefit the most from extra choline — pregnant and lactating women, infants and children — are falling especially short.

In pregnant women, choline deficiency is associated with an increased risk of neural tube

defects. In the general population, getting too little choline can lead to the development of nonalcoholic fatty liver disease and muscle damage.

## What Does Choline Do?

Choline is often lumped in with the B vitamins, but it's not technically a vitamin. It's more of a vitamin-like nutrient.<sup>1</sup> Choline helps support optimal health at all stages of life. It plays a role in healthy fetal development, helps maintain cognition and memory, boosts energy, improves fitness and keeps your liver healthy.

Your brain and nervous system need adequate amounts of choline to help regulate muscle control, mood and memory.<sup>2</sup> Choline is also involved in metabolism. Other roles of choline include:

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**Promoting healthy fetal development<sup>3</sup>** — Choline is required for proper neural tube closure,<sup>4</sup> brain development and healthy vision.<sup>5</sup> Research shows mothers who get sufficient choline impart lifelong memory enhancement to their child due to changes in the development of the hippocampus (memory center) of the child's brain.<sup>6</sup> Choline deficiency also raises your risk of premature birth, low birth weight and preeclampsia.

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**Helping reduce the risk for cardiovascular disease** — According to a study in the journal *ARYA Atherosclerosis*, choline may help prevent cardiovascular disease by converting homocysteine to methionine.<sup>7</sup> Homocysteine is an amino acid that may increase your risk for heart disease and stroke if it accumulates in the blood.<sup>8</sup>

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**Aiding the synthesis of phospholipids**, the most common of which is **phosphatidylcholine, better known as lecithin**, which constitutes between 40% and 50% of your cellular membranes and 70% to 95% of the phospholipids in lipoproteins and bile.<sup>9</sup>

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**Boosting your nervous system health** — Choline is necessary for making acetylcholine, a neurotransmitter involved in healthy muscle, heart and memory performance.<sup>10</sup>

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**Strengthening cell messaging**, by producing cell-messaging compounds.<sup>11</sup>

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**Facilitate fat transport and metabolism** — Choline is needed to carry cholesterol from your liver, and a choline deficiency could result in excess fat and cholesterol buildup.<sup>12</sup>

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**Modulates DNA synthesis**,<sup>13</sup> aiding in the process along with other vitamins, such as folate and B12.

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**Improves cognitive performance** — Researchers found a relationship between high dietary choline and better cognitive performance in a study involving men and women from the Framingham Offspring population.<sup>14</sup> In a group of 1,391 men and women, performance factors were better in those who consumed more choline, adding to evidence your nutrition makes a difference in how your brain ages.

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**Helps manage certain mental disorders** — Research shows that low choline intake is associated with increased **anxiety** levels.<sup>15</sup> This nutrient has been used in treating rapid-cycling bipolar disorder, too. A study published in the journal Biological Psychiatry shows that choline supplementation helped reduce the manic and mood symptoms of people with bipolar disorder.<sup>16</sup>

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**Influences methylation reactions**<sup>17</sup>

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**Aids in healthy mitochondrial function**<sup>18</sup>

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## The Problems With Choline Deficiency

If you don't get enough choline through your diet, it can result in a choline deficiency, which has widespread negative health effects. Because choline is involved in fat metabolism, low levels of the nutrient can result in an overaccumulation of deposits of fat in your liver.<sup>19</sup>

Eventually, this can lead to nonalcoholic fatty liver disease and nonalcoholic steatohepatitis, which currently affect between 25.5% - 31.5% of the U.S. population.<sup>20</sup>

Choline deficiency can also lead to liver damage and muscle damage.<sup>21</sup>

Choline deficiency can be even more worrisome for pregnant women and lactating mothers. Choline is essential for proper brain development of a growing fetus. It also helps maintain proper homocysteine concentrations during pregnancy.<sup>22</sup>

According to a study published in the American Journal of Epidemiology, there is an increased risk of neural tube birth defects in babies of women who consume less than 300 mg of choline per day when compared to pregnant women who get at least 500 mg daily.<sup>23</sup>

Because choline will be pulled from the mother's blood to supply adequate amounts to the fetus, pregnant and lactating women have higher choline needs, yet only 5% get enough, according to one study.<sup>24</sup> In addition to pregnant and lactating women, groups at especially high-risk for choline deficiency include:

- **Endurance athletes** — Endurance exercises, like marathons and triathlons, can deplete choline levels. Studies show that supplementing with choline before these types of stressful exercises can help keep the levels of choline in the blood from getting too low.<sup>25,26</sup>
- **People who drink a lot of alcohol** — Excess alcohol consumption can increase your need for more choline while simultaneously increasing your risk of deficiency.<sup>27</sup>
- **Postmenopausal women** — Postmenopausal women have lower estrogen concentrations, which can increase the risk of organ dysfunction in response to a low-choline diet.<sup>28</sup>
- **Vegetarians and vegans** — Animal foods like beef liver, eggs and krill oil are the highest sources of dietary choline. Because vegetarians and vegans have dietary restrictions that eliminate some or all of these choline-rich foods, it can be more difficult to get an adequate amount of the nutrient through diet alone.<sup>29</sup>

## How Much Choline Do You Need?

Your liver makes some choline, but the amount isn't enough to keep you healthy and

prevent the adverse effects of choline deficiency. That's why you need to get adequate amounts through your diet.

The amount of choline you need depends on your age, sex and whether or not you're pregnant or nursing. Here's a general breakdown from the National Institutes of Health:<sup>30</sup>

Age	Male	Female	Pregnant Women	Nursing Women
0 to 6 months	125 mg/day	125 mg/day		
7 to 12 months	150 mg/day	150 mg/day		
1 to 3 years	200 mg/day	200 mg/day		
4 to 8 years	250 mg/day	250 mg/day		
9 to 13 years	375 mg/day	375 mg/day		
14 to 18 years	550 mg/day	400 mg/day	450 mg/day	550 mg/day
19 years and older	550 mg/day	425 mg/day	450 mg/day	550 mg/day

Keep in mind, however, that some people have genetic polymorphisms that increase the need for choline and certain ethnic and racial groups are more likely to be affected.<sup>31</sup>

According to Chris Masterjohn, who has a Ph.D. in nutritional science, eating a diet that's high in (otherwise healthy) saturated fats can also increase your need for choline.<sup>32</sup>

## How to Get More Choline

Grass fed beef liver is the richest dietary source of choline, with 430 mg of choline per 100-gram cooked serving.<sup>33</sup> But liver isn't as much a staple on American plates as the second highest source of choline — eggs. One single egg, which weighs around 50 grams,

contains 169 mg of choline.<sup>34</sup>

Here's the catch, though: Most of that choline, or 139 mg, is found in the yolk.<sup>35</sup> Egg yolks are also rich in lecithin, a fatty acid that's a precursor for choline. That means if you're still following the outdated and totally misguided advice to eat only the egg whites, you're missing out on a lot of the egg's nutrition.

Krill oil, which comes from krill, a crustacean mainly eaten by whales, penguins and other aquatic creatures, is also a rich source of choline. A 2011 study published in the journal *Lipids* found 69 choline-containing phospholipids in krill oil.<sup>36</sup>

Of those phospholipids, 60 were phosphatidylcholine substances, which protect against liver disease (including hepatitis and cirrhosis in alcoholics), reduce digestive tract inflammation and lessen symptoms associated with inflammatory conditions such as ulcerative colitis and irritable bowel syndrome.<sup>37</sup> Other dietary sources of choline include:<sup>38</sup>

Grass fed beef liver	Organic pasture raised chicken
Atlantic cod	Alaskan salmon
Kidney beans	Quinoa
Brussels sprouts	Broccoli
Shitake mushroom	Cauliflower

According to the DGAC, most multi-vitamin supplements don't contain sufficient amounts of choline. You can find supplements that contain only choline, but it's always best to try to get what you need through a healthy diet.

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