According to *Australian Eggs* website,

> Choline is used by the body for metabolic processes such as liver function, normal brain development, nerve function and muscle movement. It's particularly important during pregnancy to support foetal brain development. [1]

What is choline and how does it relate to eggs and our health?

Choline is found in lecithin, which is a phospholipid. Phospholipids are important components of cell membranes. Food sources include brassicas, tofu, soy and quinoa with the highest concentration found in eggs, fish, beef, chicken and crustaceans.

Whilst we can manufacture some choline, additional dietary choline is essential.

There is an increasing awareness of the importance of gut flora and its role in health. [2] [3] [4] [5]

Microbes in the intestines are essential for the breakdown of complex carbohydrates, the production of short chain fatty acids and synthesis of vitamins. More than 1000 different species have been identified. Despite the vast number of bacteria species and people, there are only two types of bacteriological ecosystems in the gut (enterotypes) – those dominated by *Prevotella* genus bacteria and those by *Bacteroides* genera. Both *Bacteroides* and *Prevotella* belong to Bacteroidetes phylum. Enterotypes were strongly associated with long-term diets, particularly protein and animal fat (*Bacteroides*) versus carbohydrates (*Prevotella*). Microbiome composition changed within 24 hours of initiating a high-fat/low-fiber or low-fat/high-fiber diet. However, it takes a longer period of time to change the enterotype from one state to the other. [6]

Bacteria are responsible for producing short-chain fatty acids (acetate, propionate, and butyrate) by the fermentation of dietary fiber. Short chain fatty acids increase intestinal pH (becomes more acidic), are important in maintaining the integrity of the lining of the intestine and prevents growth of dangerous pathogens. Short-chain fatty acids that are consumed do not have these benefits as they are digested.

Gluten-free diets also have a significantly detrimental effect on the intestinal microflora and immune function in healthy people. The level of beneficial organisms are reduced,

detrimental organisms are increased along with an increase in health risks. It is estimated that approximately 2-3% of the population have a need for a gluten-free diet. [7]

Choline is converted by our gut bacteria into trimethylamine (TMA) which is then converted into trimethylamine N-oxide – $(CH_3)_3NO$ – in our liver. Trimethylamine N-oxide (TMAO) is implicated in a number of detrimental outcomes.

> Recent human studies have established that the levels of TMAO in serum are positively correlated with impaired renal function, colorectal cancer, and cardiovascular disease (CVD). TMAO exacerbates atherosclerosis […].
>
> In addition, TMAO exacerbates impaired glucose tolerance, obstructs hepatic insulin signaling, and promotes adipose tissue inflammation of mice maintained on a high-fat high-sugar diet. [8]

The choline in foods, such as eggs, can be turned by gut bacteria into TMA. However, it is only produced by the bacteria that are prevalent in high-fat, low-fibre animal-based diets.

Carnitine is similar in structure to choline and the major food source is red meat. Unlike choline, which is an essential nutrient, we have no need to consume carnitine. It is also found in dietary supplements and carnitine-energy drinks. [9]

The production of TMA is absent or greatly reduced in vegans. Feeding people steak or eggs can cause an increase in TMAO within a day.

> Egg consumption has consistently been shown to be associated with an increase in prostate cancer. [10]

According to a 2011 study, “men who consumed 2.5 or more eggs per week had an 81%

increased risk of lethal prostate cancer compared with men who consumed less than 0.5 eggs per week." [11]

Another study compared quintiles of food intakes of a number of food items. A quintile is obtained by dividing the sample participants into five groups based on the value of the variable being studied. The first quintile is the lowest 20% of the sample. The average of the lowest 20% of egg consumption was 0.4 eggs / week and the average of the highest quintile was 5.5 eggs/week. The risk of prostate cancer progression for the fifth quintile was more than twice that of the first quintile. [12]

	Quintile 1	Quintile 5	Hazard Ratio
Median egg intake (servings/week)	0.4	5.5	2.02
Median processed red meat intake (servings/week)	0	5	1.3
Median poultry intake (servings/week)	1	5 0	1.55

According to the paper, "a plausible mechanism that may explain our observed association between eggs and prostate cancer progression is high dietary choline. Egg consumption is a determinant of plasma choline, and higher plasma choline was recently reported to be associated with a greater risk of prostate cancer."

The myth that choline in eggs is a healthy dietary choice cannot be sustained.

Related articles

CSIRO Healthy Diet Score and Egg Consumption in Australia
Eggs are Not OK
Eggs and the Questionable Benefits of Choline

Footnotes

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