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**NEWS RELEASE**

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FOR IMMEDIATE RELEASE

### **THIS IS YOUR BRAIN ON FATTY ACIDS**

--Scientists discover lipid may be vital to learning

Saturated fats have a deservedly bad reputation, but Johns Hopkins scientists have discovered that a sticky lipid occurring naturally at high levels in the brain may help us memorize grandma's recipe for cinnamon buns, as well as recall how, decades ago, she served them up steaming from the oven.

The Hopkins team, reporting Oct. 29 in *Neuron*, reveals how palmitate, a fatty acid, marks certain brain proteins - NMDA receptors - that need to be activated for long-term memory and learning to take place. The fatty substance directs the receptors to specific locations in the outer membrane of brain cells, which continually strengthen and weaken their connections with each other, sculpting and resculpting new memory circuits.

Moreover, the researchers report, this fatty modification is a reversible process, with some sort of on-off switch, offering possibilities for manipulating it to enhance or even, perhaps, erase memory.

"Before now, no one knew that NMDA receptors change in response to the addition of palmitate," says Richard Huganir, Ph.D., professor and director of the Solomon H. Snyder Department of Neuroscience at Johns Hopkins.

Scientists have known that a brain signaling chemical called glutamate normally activates NMDA receptors, allowing two neurons to communicate with one another. However, they were less certain what allowed this receptor to assemble properly, or what caused it to make its way to the synapse, the specialized part of nerve cells where communication takes place.

The discovery emerged from work with live neurons in a dish, to which the scientists first fed radioactive palmitate, then separated out the NMDA receptors. By tracking radioactivity on X-ray film, they were able to determine that the fat had attached to the NMDA receptors.

Next, the scientists put both normal and altered NMDA receptors into non-brain cells that don't normally manufacture their own NMDA receptors. By tracking the radioactive fat, they were able to determine where on the NMDA receptor the fat had attached.

Results showed that the NMDA receptor undergoes "dual palmitoylation," in two different regions, each of which plays a distinct role in controlling the fate of the receptor in neurons. When the fat attaches

to the first region, it stabilizes the receptor on the surface of neurons. When the fat attaches to the second region, the receptors accumulate inside neurons, perhaps awaiting a signal to send them to synapses. The researchers suspect

that this could be part of a quality control measure, assuring that all the Lego-like protein subunits of the receptor are put together properly.

"It is rapidly becoming clear that palmitate regulates not only NMDA receptors, but also other brain proteins at work during signaling across synapses," says Gareth Thomas, Ph.D., a Howard Hughes Medical Institute postdoctoral fellow at Hopkins.

The researchers suspect that if palmitoylation fails, the result would be learning and memory impairment because if NMDA receptors don't make their way to the synapses - the specialized contact points between cells across which chemical messages flow - then communication between neurons is compromised.

"This new modification of the NMDA receptor deepens our molecular understanding of how synapses are regulated and how memories might be formed. It also reveals new potential drug targets, such as the enzymes that add or remove the palmitate," Hugarir says. "If we could shift the balance of the palmitoylation, then perhaps we could affect and enhance learning and memory."

This study was supported by research grants from the National Institute of Mental Health and the Howard Hughes Medical Institute.

Authors on the paper are Takashi Hayashi, Gareth Thomas and Richard Hugarir of Johns Hopkins.

On the Web:

The Solomon H. Snyder Department of Neuroscience at Johns Hopkins:

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<http://www.jpeds.com/article/PIIS0022347609008853/abstract?rss=yes>

### **Lactobacillus GG Improves Recovery in Infants with Blood in the Stools and Presumptive Allergic Colitis Compared with Extensively Hydrolyzed Formula Alone**

Maria Elisabetta Baldassarre, MD, Nicola Laforgia, MD, Margherita Fanelli, MSc, Annamaria Laneve, MD, Roberto Grosso, MD, Carlos Lifschitz, MD

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Corrected Proof

#### ESSENCE OF ARTICLE

"Fecal calprotectin is elevated in infants with hematochezia and possible allergic colitis. EHCF + LGG resulted in significant improvement of hematochezia and fecal calprotectin compared with the EHCF alone."

#### ARTICLE

Objectives

To determine the benefits of *Lactobacillus rhamnosus* GG (LGG) in an extensively hydrolyzed casein formula (EHCF) in improving hematochezia and fecal calprotectin over EHCF alone.

#### Study design

Fecal calprotectin was compared in 30 infants with hematochezia and 4 weeks after milk elimination with that of a healthy group. We also compared fecal calprotectin and hematochezia on 26 formula-fed infants randomly assigned to EHCF with LGG (Nutramigen LGG) (EHCF + LGG) or without (Nutramigen) (EHCF – LGG) and on 4 breastfed infants whose mothers eliminated dairy.

#### Results

Fecal calprotectin in those with hematochezia was significantly higher than in comparisons (mean  $\pm$  SD  $325.89 \pm 152.31$  vs  $131.97 \pm 37.98$   $\mu\text{g/g}$  stool,  $t = 6.79$ ,  $P < .0001$ ). At 4 weeks, fecal calprotectin decreased to 50% of baseline but was still significantly higher than in comparisons ( $157.5 \pm 149.13$  vs  $93.72 \pm 36.65$   $\mu\text{g/g}$ ,  $P = .03$ ). Fecal calprotectin mean decrease was significantly larger among EHCF + LGG compared with EHCF – LGG ( $-214.5 \pm 107.93$  vs  $-112.7 \pm 105.27$   $\mu\text{g/g}$ ,  $t = 2.43$ ,  $P = .02$ ). At 4 weeks, none of the EHCF + LGG had blood in stools, and 5/14 on EHCF – LGG did ( $P = .002$ ).

#### Conclusion

Fecal calprotectin is elevated in infants with hematochezia and possible allergic colitis. EHCF + LGG resulted in significant improvement of hematochezia and fecal calprotectin compared with the EHCF alone.

CFU, Colony-forming units, CMAC, Cow's milk allergic colitis, s-CMAC, Suspected cow's milk allergic colitis, EHCF, Extensively hydrolyzed casein formula, LGG, *Lactobacillus* GG

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**Impact of genistein on maturation of mouse oocytes, fertilization, and fetal development.**

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ESSENCE OF ARTICLE

“An earlier study by our group showed that GNT has cytotoxic effects on mouse blastocysts and is associated with defects in their subsequent development in vitro. Here, we further investigate the effects of GNT on oocyte maturation, and subsequent pre- and postimplantation development, both in vitro and in vivo. GNT induced a significant reduction in the rate of oocyte maturation, fertilization, and in vitro embryo development. Treatment of oocytes with GNT during in vitro maturation (IVM) led to increased resorption of postimplantation embryos, and decreased placental and fetal weights. With the aid of an in vivo mouse model, we showed that consumption of drinking water containing GNT led to decreased oocyte maturation and in vitro fertilization, as well as early embryonic developmental injury”

ARTICLE

Genistein (GNT), a natural isoflavone compound found in soy products, affects diverse cell functions, including proliferation, differentiation and cell death. An earlier study by our group showed that GNT has cytotoxic effects on mouse blastocysts and is associated with defects in their subsequent development in vitro. Here, we further investigate the effects of GNT on oocyte maturation, and subsequent pre- and postimplantation development, both in vitro and in vivo. GNT induced a significant reduction in the rate of oocyte maturation, fertilization, and in vitro embryo development. Treatment of oocytes with GNT during in vitro maturation (IVM) led to increased resorption of postimplantation embryos, and decreased placental and fetal weights. With the aid of an in vivo mouse model, we showed that consumption of drinking water containing GNT led to decreased oocyte maturation and in vitro fertilization, as well as early embryonic developmental injury. Moreover, our findings support a degree of selective inhibition of retinoic acid receptors in blastocysts treated with GNT during oocyte maturation. To our knowledge, this is the first study investigating the impact of GNT on maturation of mouse oocytes, fertilization, and sequential embryonic development.

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Reprod Toxicol. 2009 Nov;28(3):342-53. Epub 2009 Apr 19.

**Genistein and ethinyl estradiol dietary exposure in multigenerational and chronic studies induce similar proliferative lesions in mammary gland of male Sprague-Dawley rats.**

Latendresse JR, Bucci TJ, Olson G, Mellick P, Weis CC, Thorn B, Newbold RR, Delclos KB.

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#### ESSENCE OF ARTICLE

“ Results substantiate and extend previous reports that mammary gland hyperplasia in the male rat is one of the most sensitive markers of estrogenic endocrine disruption.”

#### ARTICLE

Genistein and ethinyl estradiol (EE(2)) were examined in multigenerational reproductive and 2-yr chronic toxicity studies with different exposure durations across generations F(0) through F(4). Sprague-Dawley rats were exposed to genistein (0, 5, 100, or 500 ppm) or EE(2) (0, 2, 10, or 50 ppb). Effects in the male mammary gland are described here. In the multigeneration studies, mammary hyperplasia was induced by both compounds; the chronic studies had a lower incidence, without proportionate neoplasia. Sexual dimorphism (predominant tubuloalveolar growth in females and lobuloalveolar in males) was retained without feminization in high dose genistein or EE(2). In the continuously exposed generations, mammary hyperplasia was sustained but not amplified, appeared morphologically similar across all generations, and was not carried over into unexposed offspring of previously exposed generations. The hyperplasia in male rats was similar whether induced by genistein or EE(2). Results substantiate and extend previous reports that mammary gland hyperplasia in the male rat is one of the most sensitive markers of estrogenic endocrine disruption.

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#### **High intakes of choline and betaine reduce breast cancer mortality in a population-based study**

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#### ESSENCE OF ARTICLE

” It suggests that high intake of these nutrients may be a promising strategy to prevent the development of breast cancer and to reduce its mortality.”

#### ARTICLE

Choline and betaine provide methyl groups for one-carbon metabolism. Humans obtain these nutrients from a wide range of foods. Betaine can also be synthesized endogenously from its precursor, choline. Although animal studies have implied a causal relationship between choline deficiency and carcinogenesis, the role of these two nutrients in human carcinogenesis and tumor progression is not well understood. We investigated the associations of dietary intakes of choline and betaine and breast cancer risk and mortality in the population-based Long Island Breast Cancer Study Project. Among the 1508 case-group women, 308 (20.2%) deaths occurred, among whom 164 (53.2%) died of breast cancer by December 31, 2005. There was an indication that a higher intake of free choline was associated with reduced risk of breast cancer (Ptrend=0.04). Higher intakes of betaine, phosphocholine, and free choline were associated with reduced all-cause as well as breast cancer-specific mortality in a dose-dependent fashion. We also explored associations of polymorphisms of three key choline- and betaine-metabolizing genes and breast cancer mortality. The betaine-homocysteine methyltransferase gene (BHMT) rs3733890 polymorphism was associated with reduced breast cancer-specific mortality (hazard ratio, 0.64; 95% confidence interval, 0.42–0.97). Our study supports the important roles of choline and betaine in breast carcinogenesis. It suggests that high intake of these nutrients may be a promising strategy to prevent the development of breast cancer and to reduce its mortality.—Xu, X., Gammon, M. D., Zeisal, S. H., Bradshaw, P. T., Wetmur, J. G., Teitelbaum, S. L., Neugut, A. I., Santella, R. M., Chen, J. High intakes of choline and betaine reduce breast cancer mortality in a population-based study.

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<http://www.whfoods.com/genpage.php?tname=foodspice&dbid=92>

#### Eggs

#### ESSENCE OF ARTICLE

“Practical Tip: Foods that are good sources of choline should be frequent contributors to your healthy way of eating. Two large eggs provide 252 milligrams of choline (all in yolk), a little less than half the recommended daily supply, and also contain 630 milligrams (yes, milligrams not micrograms) of phosphatidylcholine. Although most sources just report the free choline at 252 micrograms, it is the phosphatidylcholine that is the most common form in which choline is incorporated into cell membrane phospholipids.”

#### ARTICLE

Eggs are available year round to provide not only delicious meals on their own but as an essential ingredient for the many baked goods and sauces that would never be the same without them.

Composed of a yellow yolk and translucent white surrounded by a protective shell, the incredible nature of the egg is partially found in their unique food chemistry which allows them help in coagulation, foaming, emulsification and browning.

This chart graphically details the %DV that a serving of Eggs provides for each of the nutrients of which it is a good, very good, or excellent source according to our Food Rating System. Additional information about the amount of these nutrients provided by Eggs can be found in the Food Rating System Chart. A link that takes you to the In-Depth Nutritional Profile for Eggs, featuring information over 80 nutrients, can be found under the Food Rating System Chart.

- Health Benefits
- Description
- History
- How to Select and Store
- How to Enjoy
- Individual Concerns
- Nutritional Profile
- References

#### Health Benefits

Eggs are a good source of low-cost high-quality protein, providing 5.5 grams of protein (11.1% of the daily value for protein) in one egg for a caloric cost of only 68 calories. The structure of humans and animals is built on protein. We rely on animal and vegetable protein for our supply of amino acids, and then our bodies rearrange the nitrogen to create the pattern of amino acids we require.

#### Boost Brain Health with Eggs' Choline

Another health benefit of eggs is their contribution to the diet as a source of choline. Although our bodies can produce some choline, we cannot make enough to make up for an inadequate supply in our diets, and choline deficiency can also cause deficiency of another B vitamin critically important for health, folic acid.

Choline is definitely a nutrient needed in good supply for good health. Choline is a key component of many fat-containing structures in cell membranes, whose flexibility and integrity depend on adequate supplies of choline. Two fat-like molecules in the brain, phosphatidylcholine and sphingomyelin, account for an unusually high percentage of the brain's total mass, so choline is particularly important for brain function and health.

In addition, choline is a highly important molecule in a cellular process called methylation. Many important chemical events in the body are made possible by methylation, in which methyl groups are transferred from one place to another. For example, genes in the body can be switched on or turned off in this way, and cells use methylation to send messages back and forth. Choline, which contains three methyl groups, is highly active in this process.

Choline is also a key component of acetylcholine. A neurotransmitter that carries messages from and to nerves, acetylcholine is the body's primary chemical means of sending messages between nerves and muscles.

### Eggs' Choline Reduces Inflammation

People whose diets supplied the highest average intake of choline (found in egg yolk and soybeans), and its metabolite betaine (found naturally in vegetables such as beets and spinach), have levels of inflammatory markers at least 20% lower than subjects with the lowest average intakes, report Greek researchers in the American Journal of Clinical Nutrition (Detopoulou P, Panagiotakos DB, et al.)

Compared to those whose diets contained <250 mg/day of choline, subjects whose diets supplied >310 mg of choline daily had, on average:

- 22% lower concentrations of C-reactive protein
- 26% lower concentrations of interleukin-6
- 6% lower concentrations of tumor necrosis factor alpha

Compared to those consuming <260 mg/day of betaine, subjects whose diets provided >360 mg per day of betaine had, on average:

- 10% lower concentrations of homocysteine
- 19% lower concentrations of C-reactive protein
- 12% lower concentrations of tumor necrosis factor alpha

Each of these markers of chronic inflammation has been linked to a wide range of conditions including heart disease, osteoporosis, cognitive decline and Alzheimer's, and type-2 diabetes.

In an accompanying editorial in the American Journal of Clinical Nutrition entitled, "Is there a new component of the Mediterranean diet that reduces inflammation?," Steven Zeisel from the University of North Carolina at Chapel Hill noted that choline and betaine work together in the cellular process of methylation, which is not only responsible for the removal of homocysteine, but is involved in turning off the promoter regions of genes involved in inflammation.

"Exposure to oxidative stress is a potent trigger for inflammation. Betaine is formed from choline within the mitochondria, and this oxidation contributes to mitochondrial redox status," Zeisel continued.

"If the association between choline and betaine and inflammation can be confirmed in studies of other populations, an interesting new dietary approach may be available for reducing chronic diseases associated with inflammation," he concluded.

Recommended daily intakes of choline were set in 1998 at 550 milligrams per day for men and 425 milligrams a day for women. No RDI has been set for betaine, which, since it is a metabolite of choline, is not considered an essential nutrient.

Practical Tip: Egg yolks are the richest source of choline, followed by soybeans. Spinach, beets and whole wheat products are primary sources of betaine. (Olthof MR, van Vliet T, et al. J Nutr)

Eggs -- An Easy Answer for Americans' Unmet Need for Choline

More than 90% of Americans are choline-deficient. An assessment American's dietary choline intake by Iowa State University researchers (Jensen H, Batres-Marquez S, et al., FASEB Journal) revealed that for older children, men, women and pregnant women, intake is dramatically below Adequate Intake (AI) levels, with only 10% or less of all these groups getting even close to recommended amounts of choline.

This finding is especially concerning in pregnant women because choline is necessary for brain and memory development in the fetus. (Shaw GM, Carmichael SL, Am J Epidemiol; Zeisel SH, Annu Rev Nutr) The National Academy of Sciences recommends higher daily intake of choline for pregnant and breastfeeding women (550 mg and 450 mg, respectively).

Older adults are also at high risk of choline deficiency. Research presented by Debra Keast, PhD, at the 31st National Nutrient Data Bank Conference, Washington, DC, revealed that choline intake decreases with age, with adults ages 71 and older typically consuming an average of about 264 milligrams per day, roughly half the AI for choline (550 mg/day for men, 425 mg/day for women).

And even getting the recommended AI for choline may not meet the needs of approximately 20% of men. Research published in the American Journal of Clinical Nutrition (Fischer LM, deCosta KA, et al.) found that when 26 men were given a diet providing 550 mg/day of choline, 6 of the men developed fatty liver or muscle damage (signs of choline insufficiency).

In addition to the 26 men, 16 premenopausal and 15 postmenopausal women took part in this study. All participants were fed a diet supplying 550 mg/day of choline for 10 days followed by a diet containing less than 50 mg/day of choline for up to another 42 days.

When deprived of dietary choline, 77% of the men, 80% of the postmenopausal women, and 44% of the premenopausal women developed fatty liver or muscle damage. (Premenopausal women, while harmed, were not as sorely affected because choline can be made by our bodies from the de novo synthesis of phosphatidylcholine, which is up-regulated by estrogen.)

Practical Tip: Foods that are good sources of choline should be frequent contributors to your healthy way of eating. Two large eggs provide 252 milligrams of choline (all in yolk), a little less than half the recommended daily supply, and also contain 630 milligrams (yes, milligrams not micrograms) of phosphatidylcholine. Although most sources just report the free choline at 252 micrograms, it is the phosphatidylcholine that is the most common form in which choline is incorporated into cell membrane phospholipids.

Other rich sources of choline (per 100 grams / 3 ounces of food) include beef liver (355 mg), dried soy beans (116 mg), wheat germ (152 mg), cod (83 mg), chicken (70 mg), and salmon (65 mg).

#### An Egg Breakfast Helps Promote Weight Loss

In a randomized controlled trial, 160 overweight or obese men and women were divided into 2 groups, one of which ate a breakfast including 2 eggs, while the other consumed a bagel breakfast supplying the same amount of calories and weight mass (an important control factor in satiety and weight loss studies). Participants ate their assigned breakfast at least 5 days a week for 8 weeks as part of a low-fat diet with a 1,000 calorie deficit. (Dhurandhar N, Vander Wal J, et al, FASEB Journal)

Compared to those on the bagel breakfast, egg eaters:

- Lost almost twice as much weight -- egg eaters lost an average of 6.0 pounds compared to bagel eaters' 3.5 pound loss.
- Had an 83% greater decrease in waist circumference

- Reported greater improvements in energy

No significant differences were seen between blood levels of total, HDL and LDL cholesterol, and triglycerides in either group, confirming what other studies (Ballesteros MN, Cabrera RM, Am J Clin Nutr) have shown, including a relative risk study presented at the Experimental Biology meeting: healthy people can safely enjoy eggs without increasing their heart attack risk. The relative risk study, a thorough scientific review of the major studies concerning heart disease causation, which was conducted by Washington, DC-based scientific consulting firm, Exponent, found that eggs contribute just 0.6 percent of men's and 0.4 percent of women's coronary heart disease risk.

### Eggs and Heart Health

In addition to its significant effects on brain function and the nervous system, choline also has an impact on cardiovascular health since it is one of the B vitamins that helps convert homocysteine, a molecule that can damage blood vessels, into other benign substances. Eggs are also a good source of vitamin B12, another B vitamin that is of major importance in the process of converting homocysteine into safe molecules.

Eggs are high in cholesterol, and health experts in the past counseled people to therefore avoid this food. (All of the cholesterol in the egg is in the yolk.) However, nutrition experts have now determined people on a low-fat diet can eat one or two eggs a day without measurable changes in their blood cholesterol levels. This information is supported by a statistical analysis of 224 dietary studies carried out over the past 25 years that investigated the relationship between diet and blood cholesterol levels in over 8,000 subjects. What investigators in this study found was that saturated fat in the diet, not dietary cholesterol, is what influences blood cholesterol levels the most.

### Improve Your Cholesterol Profile

Not only have studies shown that eggs do not significantly affect cholesterol levels in most individuals, but the latest research suggests that eating whole eggs may actually result in significant improvement in one's blood lipids (cholesterol) profile-even in persons whose cholesterol levels rise when eating cholesterol-rich foods.

In northern Mexico, an area in which the diet contains a high amount of fat because of its reliance on low-cost meat products and tortillas made with hydrogenated oils, coronary artery disease is common. In a study published in the American Journal of Clinical Nutrition, researchers evaluated the effects of daily consumption of whole eggs on the ratio of LDL (bad) cholesterol to HDL (good) cholesterol, and phenotype (the way an individual's genetic possibilities are actually expressed) in 54 children (8-12 years old) from this region. A month of eating 2 eggs daily, not only did not worsen the children's ratio of LDL:HDL, which remained the same, but the size of their LDL cholesterol increased-a very beneficial change since larger LDL is much less atherogenic (likely to promote atherosclerosis) than the smaller LDL subfractions. Among children who originally had the high-risk LDL phenotype B, 15% shifted to the low-risk LDL phenotype A after just one month of eating whole eggs.

### Helping to Prevent Blood Clots

Eating eggs may help lower risk of a heart attack or stroke by helping to prevent blood clots. A study published in Biological and Pharmaceutical Bulletin demonstrated that proteins in egg yolk are not only potent inhibitors of human platelet aggregation, but also prolong the time it takes for fibrinogen, a protein present in blood, to be converted into fibrin. Fibrin serves as the scaffolding upon which clumps of platelets along with red and white blood cells are deposited to form a blood clot. These anti-clotting egg yolk proteins inhibit clot formation in a dose-dependent manner-the more egg yolks eaten, the more clot preventing action.(That being said, it's still important to only eat the amount of eggs that fits within your own personal Healthiest Way of Eating.)

### Protection against Age-Related Macular Degeneration and Cataracts

Lutein, a carotenoid thought to help prevent age-related macular degeneration and cataracts, may be found in even higher amounts in eggs than in green vegetables such as spinach, which have been considered its major dietary sources, as well as in supplements. Research presented at the annual American Dietetic Association Conference in San Antonio, Texas, in 2003, by Elizabeth Johnson from the Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University also showed that natural lutein esters found in eggs are as or even more bioavailable as the forms of the nutrient offered in purified lutein products. Johnson's trial tested serum lutein concentration in 10 healthy men, before and after daily consumption of 6mg lutein obtained from four different sources: eggs from chickens fed marigold petals (which are high in lutein), spinach (one of the best known sources of dietary lutein), lutein ester supplements (purified lutein) and lutein supplements. Differences in serum lutein levels in response to the various types of doses were observed the day after the first dose: the serum lutein response to egg was significantly greater than the supplements but no higher than the response to the spinach. After nine days of daily lutein dosing, the serum lutein response was significantly greater in the egg phase than either of the supplements or the spinach. The bottom line: this study suggests that eating lutein-rich foods may be a more effective means of boosting lutein concentration in the eye than taking supplements.

Another human study, published in the *Journal of Nutrition*, confirms that lutein is best absorbed from egg yolk—not lutein supplements or even spinach. Egg yolks, although they contain significantly less lutein than spinach, are a much more bioavailable source whose consumption increases lutein concentrations in the blood many-fold higher than spinach.

Although the mechanism by which egg yolk increases lutein bioavailability is not yet known, it is likely due to the fats (cholesterol and choline) found in egg yolk. Lutein, like other carotenoids, is fat-soluble, so cannot be absorbed unless fat is also present. (If this is the case, then to enhance the lutein absorption from spinach and other vegetables rich in this nutrient, we suggest enjoying them with some fat such as extra virgin olive oil). To maximally boost your lutein absorption, you could also combine both eggs and spinach. Whether you prefer your spinach steamed, sautéed or fresh in spinach salad, dress it with a little olive oil and a topping of chopped hard-boiled egg. For a flavorful, quick and easy recipe featuring eggs and spinach, try our Poached Eggs over Spinach and Mushrooms.

#### Eggs Protect Eyesight without Increasing Cholesterol

Two new studies published in the *Journal of Nutrition* add further evidence to the theory that a daily egg-whose yolk is a rich source of vision-protective carotenoids, including not only lutein but also zeaxanthin—may reduce the risk of developing age-related macular degeneration (AMD).

The studies, both conducted at the University of Massachusetts, show that, in addition to keeping hunger at bay longer (eggs' satiety index is 50% that of most breakfast cereals), an egg a day boosts blood levels of both lutein and zeaxanthin, thus reducing the risk of AMD—without increasing cholesterol or triglyceride levels.

In AMD, the macula, the central part of the retina which controls fine vision, deteriorates, greatly limiting eyesight or even resulting in blindness in those afflicted. The leading cause of blindness in people over age 50, AMD afflicts more than 10 million people in the United States, plus an additional 15 to 20 million worldwide.

In the first study, a randomized cross-over trial, Elizabeth Goodrow and her team investigated the effects of eating one egg a day on blood levels of lutein, zeaxanthin, cholesterol and triglycerides in 33 men and women over age 60.

After a no-egg start up week, volunteers ate either an egg or egg substitute daily for 5 weeks, then again ate no eggs for a week before crossing over to the other intervention for a second 5 weeks.

After the 5-week period in which they ate a daily egg, participants' blood levels of lutein and zeaxanthin significantly increased by 26 and 38%, respectively, compared to their levels of these carotenoids after their no-egg week.

And although eggs are well-known for containing cholesterol, participants' blood levels of total cholesterol, LDL cholesterol, HDL cholesterol, and triglycerides were not affected by eating an egg a day.

In the second study, researchers led by Adam Wenzel looked at the effect of a 12-week egg intervention on lutein and zeaxanthin levels in both the blood and the retina of the eye (the macular pigment optical density or MPOD) of 24 women ranging in age from 24 to 59.

The women were randomly assigned to eat 6 eggs every week containing either 331 micrograms (Egg1) or 964 micrograms (Egg2) of lutein and zeaxanthin per yolk, or a placebo (a sugar-filled pill).

No changes in cholesterol levels were seen in the women eating eggs, but in those given the placebo (the sugar pill), increases in total cholesterol and triglycerides were recorded.

Unlike the first study, only blood levels of zeaxanthin, but not lutein, increased in both Egg1 and Egg2 groups; however, carotenoid levels in the retina (MPOD) increased in both egg intervention groups, a result that suggests a daily egg offers protection against AMD.

Although egg yolk contains less lutein and zeaxanthin than some other foods-spinach, for example-when supplied by eggs, these carotenoids appear to be especially well absorbed into the retina. "Increasing egg consumption to 6 eggs per week may be an effective method to increase MPOD," wrote lead study author Wenzel.

So, enjoy a quick and easy, vision-sustaining poached or soft boiled egg for breakfast. Take an egg salad sandwich to work or add a hard boiled egg to your luncheon salad. On the weekend, treat yourself to our Healthy Breakfast Frittata or Egg Crepes filled with veggies, one of the delicious egg recipes featured in *The World's Healthiest Foods Essential Guide*. We suggest choosing organic omega-3-rich eggs if available. Produced by hens fed a diet rich in flaxseed, these eggs are an exceptional source not only of lutein and zeaxanthin, but anti-inflammatory omega-3 essential fatty acids as well.

## Description

Eggs are egg-ceptional foods. They are whole foods, prepackaged sources of carbohydrates, protein, fat and micronutrients. Yet, their egg-quisite nutritional value should not be surprising when you remember that an egg contains everything needed for the nourishment of a developing chick.

Eggs are composed of a yellow yolk and translucent white surrounded by a protective shell that can be white or brown, depending upon the breed of the chicken. The shell's color is not related to the quality or nutritional value of the egg itself.

In addition to their wonderful taste and nutritional content, eggs hold an esteemed place in cooking since due to their food chemistry, they serve many unique functions in recipes, including coagulation, foaming, emulsification and browning.

While chickens are not the only animals that lay eggs that are enjoyed in various cuisines, it is the type featured in this article because it is the most highly accessible in North America.

In Latin, the scientific name for chicken is *Gallus domesticus*.

## History

The history of the egg as food runs mostly parallel with the history of people consuming chicken as food. Although it is uncertain when and where it began, the practice of raising chickens for food is ancient and so, subsequently, is the consumption of eggs as food, extending back to the times of early man.

Eggs have always been a symbol of fertility and have been an icon of religious worship. To this day, there is still a lot of folklore surrounding eggs that is enjoyed by different cultures around the world.

One of the most widely held food and holiday associations is that of the Easter egg. How the egg became associated with this holiday seems to have roots that are both biological and cultural. Before more modern techniques of poultry raising, hens laid few eggs during the winter. This meant that Easter, occurring with the advent of spring, coincided with the hen's renewed cycle of laying numerous eggs. Additionally, since eggs were traditionally considered a food of luxury, they were forbidden during Lent, so Christians had to wait until Easter to eat them-another reason eggs became associated with this holiday. Interestingly enough, the custom of painting eggshells has an extensive history and was a popular custom among many ancient civilizations, including the Egyptians, Chinese, Greeks and Persians.

#### How to Select and Store

Oftentimes, in the U.S., eggs are classified according to the USDA grading system and bear a label of AA, A, or B. This grading is an indicator of quality parameters, including freshness, with AA being of the most superior in quality. Eggs are also labeled according to their size-extra large, large, medium and small-which is graded according to a standard.

Yet, you may not see any labeling on the eggs you buy since it is not legally mandatory that they be inspected and graded by these federal standards. This is often the situation when you buy farm fresh eggs from a local purveyor. If this is the case, get to know the seller and his or her reputation and make sure that, as usual, the eggs are kept refrigerated.

Inspect any eggs that you purchase for breaks or cracks. And of course, take care when packing them in your shopping bag for the trip home as they are very fragile.

Store eggs in the refrigerator where they will stay fresh for about one month. Do not wash them as this can remove their protective coating. Keep them in their original carton or in a covered container so that they do not absorb odors or lose any moisture. Do not store them in the refrigerator door since this exposes them to too much heat each time the refrigerator is opened and closed. Make sure to store them with their pointed end facing downward as this will help to prevent the air chamber, and the yolk, from being displaced.

#### How to Enjoy

For some of our favorite recipes, click [Recipes](#).

#### Tips for Preparing Eggs:

In order to prevent any possible contamination to a recipe by a spoiled egg, break each egg separately into a small bowl before combining with the other ingredients.

#### A Few Quick Serving Ideas:

Hard-boiled eggs are fun to eat and easy to pack for on-the-go lunches.

Mix chopped up hard-boiled eggs with fresh lemon juice and olive oil, leeks and dill (and salt and pepper to taste) to make a healthy egg salad.

Instead of Eggs Benedict, make Eggs "Buenodict." Place a poached egg on top of a whole grain English muffin lined with steamed spinach. Top with salsa or any of your favorite seasonings and enjoy.

Say olé to the day with a huevos ranchero breakfast. Add chili peppers to scrambled eggs and serve with black beans and corn tortillas.

## Individual Concerns

### Allergic Reactions to Eggs

Although allergic reactions can occur to virtually any food, research studies on food allergy consistently report more problems with some foods than with others. For example, according to a recent report by the U.S. Centers for Disease Control, 90% of food allergies are associated with 8 food types: hen's eggs, fish, crustacean shellfish, cow's milk, soy foods, peanuts, wheat, and tree nuts. (Crustacean shellfish include shrimp, prawns, lobster, and crab. Tree nuts include almonds, cashews, walnuts, pecans, pistachios, Brazil nuts, hazelnuts, and chestnuts.)

These foods do not need to be eaten in their pure, isolated form in order to trigger an adverse reaction. For example, yogurt made from cow's milk is also a common allergenic food, even though the cow's milk has been processed and fermented in order to make the yogurt. Ice cream made from cow's milk would be an equally good example.

Food allergy symptoms may sometimes be immediate and specific, and can include skin rash, hives, itching, and eczema; swelling of the lips, tongue, or throat; tingling in the mouth; wheezing or nasal congestion; trouble breathing; and dizziness or lightheadedness. But food allergy symptoms may also be much more general and delayed, and can include fatigue, depression, chronic headache, chronic bowel problems (such as diarrhea or constipation), and insomnia. Because most food allergy symptoms can be caused by a variety of other health problems, it is good practice to seek the help of a healthcare provider when evaluating the role of food allergies in your health.

### Handling of Eggs

Health safety concerns about eggs center on salmonellosis (salmonella-caused food poisoning). Salmonella bacteria from the chicken's intestines may be found even in clean, uncracked eggs. Formerly, these bacteria were found only in eggs with cracked shells. Safe food techniques, like washing the eggs before cracking them, may not protect you from infection. To destroy the bacteria, eggs must be cooked at high enough temperatures for a sufficient length of time to destroy the bacteria. Soft-cooked, sunny-side up or raw eggs carry salmonellosis risk. Hard-boiled, scrambled, or poached eggs do not.

Another reason to avoid consuming raw eggs is that raw egg whites contain a glycoprotein called avidin, which binds to eggs' supply of the B vitamin biotin very tightly, preventing its absorption. Cooking the egg whites changes avidin, making it susceptible to digestion and unable to interfere with the intestinal absorption of biotin.

Dishes and utensils used when preparing eggs should be washed in warm water separately from other kitchenware, and hand-washing with warm, soapy water is essential after handling eggs. Any surfaces that might have potentially come into contact with raw egg should be washed and can be sanitized with a solution of 1 teaspoon chlorine to 1 quart water.

### Nutritional Profile

Our food ranking system also qualified eggs as a very good source of selenium, iodine, and vitamin B2 and a good source of protein, molybdenum, phosphorus, vitamin B5, vitamin B12 and vitamin D.

For an in-depth nutritional profile click here: [Eggs](#).

### In-Depth Nutritional Profile

In addition to the nutrients highlighted in our ratings chart, an in-depth nutritional profile for Eggs is also available. This profile includes information on a full array of nutrients, including carbohydrates, sugar, soluble and insoluble fiber, sodium, vitamins, minerals, fatty acids, amino acids and more.

### Introduction to Food Rating System Chart

In order to better help you identify foods that feature a high concentration of nutrients for the calories they contain, we created a Food Rating System. This system allows us to highlight the foods that are especially rich in particular nutrients. The following chart shows the nutrients for which this food is either an excellent, very good, or good source (below the chart you will find a table that explains these qualifications). If a nutrient is not listed in the chart, it does not necessarily mean that the food doesn't contain it. It simply means that the nutrient is not provided in a sufficient amount or concentration to meet our rating criteria. (To view this food's in-depth nutritional profile that includes values for dozens of nutrients - not just the ones rated as excellent, very good, or good - please use the link below the chart.) To read this chart accurately, you'll need to glance up in the top left corner where you will find the name of the food and the serving size we used to calculate the food's nutrient composition. This serving size will tell you how much of the food you need to eat to obtain the amount of nutrients found in the chart. Now, returning to the chart itself, you can look next to the nutrient name in order to find the nutrient amount it offers, the percent Daily Value (DV%) that this amount represents, the nutrient density that we calculated for this food and nutrient, and the rating we established in our rating system. For most of our nutrient ratings, we adopted the government standards for food labeling that are found in the U.S. Food and Drug Administration's "Reference Values for Nutrition Labeling." Read more background information and details of our rating system.

Egg, whole, boiled

1.00 each

44.00 grams

68.20 calories

Nutrient Amount DV

(%) Nutrient

Density World's Healthiest

Foods Rating

tryptophan	0.07 g	21.9	5.8	very good
selenium	13.55 mcg	19.4	5.1	very good
iodine	23.76 mcg	15.8	4.2	very good
vitamin B2 (riboflavin)	0.23 mg	13.5	3.6	very good
protein	5.54 g	11.1	2.9	good
molybdenum	7.48 mcg	10.0	2.6	good
vitamin B12 (cobalamin)	0.49 mcg	8.2	2.2	good
phosphorus	75.68 mg	7.6	2.0	good

vitamin B5 (pantothenic acid) 0.62 mg 6.2 1.6 good

vitamin D 22.88 IU 5.7 1.5 good

#### World's Healthiest

Foods Rating Rule

excellent DV $\geq$ 75% OR Density $\geq$ 7.6 AND DV $\geq$ 10%

very good DV $\geq$ 50% OR Density $\geq$ 3.4 AND DV $\geq$ 5%

good DV $\geq$ 25% OR Density $\geq$ 1.5 AND DV $\geq$ 2.5%

#### In-Depth Nutritional Profile for Eggs

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