

N-Acetyl Cysteine: Depression, Fibromyalgia, IBS,
Cancer Prevention, Detoxification and More *
By Elizabeth Pavka, PhD, RD, LD/N

Sulfur is an essential mineral in the body. You may know it as a “rotten egg smell” or hydrogen sulfide. Various sulfur-containing substances in the body include thiamin (vitamin B-1), biotin (vitamin B-7), alpha lipoic acid, S-adenosyl methionine (SAME), methylsulfonylmethane (MSM), insulin, glutathione, homocysteine, and four amino acids - methionine, cysteine, cystine, and taurine (1).

The focus of this article is cysteine, a non-essential amino acid made from methionine in the liver. In the production of cysteine, methionine is converted to SAME, which is then converted to homocysteine. Finally homocysteine reacts with serine to form cysteine. This process involves several nutrients. Dietary deficiency of methionine, vitamin B-6, vitamin B-12, SAME and folic acid may decrease the production of cysteine. Cystine is an amino acid that contains two cysteine molecules joined together (1).

Cysteine is also found in most high-protein foods including pork, chicken, turkey, duck, luncheon meat, eggs, milk, whey protein, ricotta, cottage cheese, and yogurt, as well as red peppers, garlic, onions, broccoli, Brussels sprouts, oats, granola, wheat germ (1).

N-acetylcysteine (NAC) is formed by replacing a hydrogen atom on cysteine with an acetyl group ($\text{CH}_3 \text{CO}$). Current thinking is that NAC supplements are broken down in the gastro-intestinal tract and then reassembled inside cells. NAC has two primary functions in the body. First, it acts as an antioxidant which protects cells from free radical damage. Much of this function is due to the fact that NAC is a key constituent of glutathione which is composed of three amino acids -- cysteine, glutamic acid, and glycine. Glutathione is found in all human tissues, with the highest concentrations found in the liver and eyes. As a potent antioxidant, glutathione protects tissues from the damaging effects of free radicals. The antioxidant activity of glutathione is attributed specifically to the presence of cysteine in the compound. The second function of NAC supports detoxification especially in the liver (2).

These two functions form the basis for the long list of clinical applications of NAC. Foresman discusses 12: depression; bi-polar affective disorder; schizophrenia; addiction/gambling; neural protection/Alzheimer's; chronic fatigue syndrome/fibromyalgia; irritable bowel syndrome/leaky gut; kidney protection; fertility in men and women; high altitude sickness; bronchitis, COPD, and chronic sinusitis; as well as reduction of homocysteine and Lp(a) (3).

The Thorne Research Monograph on NAC documents nine clinical uses: Sjogren's syndrome; smoking toxicity; influenza; hepatitis C; myoclonus epilepsy; HIV infection; cancer/chemoprevention; acetaminophen (Tylenol®) poisoning; and heavy metal (mercury, lead, copper, gold, silver) chelation (4).

A recent study looked at the use of NAC in the treatment of bi-polar disorder. "Treatment-resistant subthreshold depression is a major problem in bipolar disorder. Both depression and bipolar disorder are complicated by glutathione depletion. Australian researchers hypothesized that treatment with N-acetyl cysteine (NAC), a safe, orally bioavailable precursor of glutathione, may improve the depressive component of bipolar disorder. A randomized, double-blind, multicenter, placebo-controlled study of 75 individuals with bipolar disorder in the maintenance phase were treated with NAC (1 g twice daily) [in addition] to usual medication over 24 weeks, with a 4-week washout. The two primary outcomes were the Montgomery Asberg Depression Rating Scale (MADRS) and time to a mood episode. Secondary outcomes included the Bipolar Depression Rating Scale and 11 other ratings of clinical status, quality of life, and functioning.

"NAC treatment caused a significant improvement on the MADRS and most secondary scales at end point. Benefit was evident by 8 weeks on the Global Assessment of Functioning Scale and Social and Occupational Functioning Assessment Scale and at 20 weeks on the MADRS. Improvements were lost after washout. There was no effect of NAC on time to a mood episode and no significant between-group differences in adverse events. Researchers concluded that NAC appears a safe and effective augmentation strategy for depressive symptoms in bipolar disorder" (5).

In women who are prone to frequent miscarriages, it has been suggested pregnancy could be associated with a state of oxidative stress that could initiate a cascade of changes that may lead to miscarriages. Because NAC is a powerful antioxidant, researchers set out to determine whether it can suppress the oxidative stress in pregnancy and whether it could stop miscarriages in women with unexplained recurrent pregnancy loss (RPL). Eighty patients with a history of RPL were treated with 0.6 grams of NAC plus 500 micrograms/day of folic acid. This group of patients was compared to an aged-matched group of 86 patients treated with 500 micrograms/day of folic acid, but without NAC.

Results of this study done in Egypt indicated that "NAC plus folic acid compared with folic acid alone significantly increased the rate of continuation of a living pregnancy up to and beyond 20 weeks. NAC plus folic acid was associated with a significant increase in the take-home baby rate as compared with folic acid alone and that NAC is well-tolerated and could be a potentially effective treatment in patients with unexplained RPL" (6).

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