The Overlooked Compound That Saves Lives

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LUNG DISEASE DEFENSE

Chronic obstructive pulmonary disease (COPD), which includes chronic bronchitis and chronic emphysema, is a rapidly growing problem with global impact. COPD is the result of years of oxidative damage to delicate lung tissue, with resultant chronic inflammatory changes. The disease is worsened by air pollution and cigarette smoking, but is by no means limited to people with those exposures. Over time, victims’ damaged airways may become colonized with dangerous bacteria, leading to chronic infection and still more inflammation in a vicious cycle. Current treatment consists mainly of anti-inflammatory steroids and lung-opening medications used in asthma, with the addition of antibiotics when infection threatens.

With its ability to reduce oxidative stress and simultaneously quash chronic inflammatory changes, NAC is emerging as a game-changing therapy in COPD. A randomized pilot study of adults with acute exacerbation of chronic bronchitis and positive bacterial culture in the sputum demonstrated that 600 mg of NAC twice daily led to a near doubling of the rate of bacterial eradication compared with standard therapy, while reducing the number and duration of acute exacerbations and improving quality of life. NAC treatment of patients with moderate-to-severe COPD improved their physical performance on lung function tests, especially after exercise.

Patients with advanced COPD frequently require low-dose oxygen therapy because of their lung damage. In many cases, however, oxidative stress induced by the disease has already rendered them glutathione deficient, so they have diminished protection against ongoing oxidation. NAC administration at doses of 1,200-1,800 mg/day along with low-dose oxygen powerfully counteracts this oxidative stress. At doses of 1,800 mg per day, it has been shown to completely prevent further protein oxidation. A dose of 600 mg twice daily over a 2-month period rapidly reduced exhaled hydrogen peroxide, a measure of oxidative burden in COPD sufferers.

In one study utilizing a dose of just 600 mg per day for 10 weeks, NAC disrupted the molecular relationship between oxidative stress and inflammation, protecting lung tissue. When NAC is added to inhaled corticosteroids, still further reductions in inflammatory parameters are found.

Emphysema can be the unfortunate endpoint of advanced COPD, with lung tissue breaking down and losing much of its ability to exchange oxygen and carbon dioxide. Animal studies show that NAC attenuates COPD-related lung damage and emphysema by supporting expression of important protective genes in the cells lining the lung.

Another devastating chronic lung condition called idiopathic pulmonary fibrosis (IPF) also involves increased oxidative burden and a deficiency of glutathione in lung tissue and fluids. This progressive disease has a poor prognosis, even when treated with standard corticosteroids and powerful prescription anti-inflammatory drugs. The median survival is only about 3 years regardless of therapy.

Oral NAC supplements now offer a ray of hope for IPF sufferers. NAC significantly increases lung glutathione levels in both animal and human studies of IPF. Given as an aerosol treatment, NAC may delay disease progression, and at doses of 600 mg three times daily preserves lung vital capacity and gas exchange better than standard therapy alone.

In summary, evidence suggests that NAC may offer benefits at doses of 600 mg 2-3 times daily for people who have, or are at risk for, chronic lung conditions such as COPD and IPF (idiopathic pulmonary fibrosis).

REDUCE EXERCISE-INDUCED OXIDATIVE STRESS

Health-conscious people know that regular moderate exercise is vital to maintaining the integrity of the human body. Of course, everything has its price, and the rapid increase in metabolic activity during exercise produces some unwanted side effects. These include an increase in oxidative stress that can overwhelm the body’s antioxidant defense mechanisms and lead to tissue
NAC, with its powerful antioxidant and gene-regulating powers, is an excellent means of maintaining good exercise performance and limiting the damage caused by oxidative stress in the process. Supplementation with NAC (2,000 mg daily for 3 days, followed by 800 mg prior to exercise) in strenuously exercising adults lowered key interleukin levels to undetectable amounts and abolished the exercise-induced TNF-alpha response. And in patients with severe COPD, NAC supplementation improved exercise endurance time by 25% compared with placebo, while significantly reducing levels of oxidative molecules released by stimulated immune cells. NAC supplementation also dramatically curtailed production of oxidized proteins in this group of highly oxidant-stressed chronically ill patients.

In vigorously exercising men, 1,800 mg per day of NAC prevented the expected decline in intracellular antioxidant levels and increased activity of the enzyme responsible for recycling and restoring glutathione to normal levels, protecting cells from oxidative stress. And in mice, NAC supplementation significantly protected brain tissue against exercise-induced oxidative changes. NAC also preserves normal levels of vital lymphocytes, which can decline after vigorous exercise.

Regular supplementation with NAC at up to 1,800-2,000 mg per day may be an effective means of optimizing exercise performance while minimizing the effects of exercise-induced metabolic stress.

**BRING GLUCOSE LEVELS UNDER CONTROL**

Oxidative stress and inflammation are closely linked to insulin resistance and rising blood glucose levels. These effects are not limited to those with diabetes, but in fact are found even in obese, non-diabetic people and those with metabolic syndrome. There are multiple steps in the cascade of events leading from oxidation to damaged insulin receptors and insulin resistance, so it makes sense to seek a supplement that can target many of those steps independently. NAC is emerging as one such multi-targeted supplement.

Over time, chronic high blood sugar initiates a downward spiral by helping generate advanced glycation end-products (AGEs) that then impair normal responses to insulin, perpetuating elevated sugar levels. NAC reverses those effects in laboratory models. Increasing blood sugar levels in laboratory animals triggers a pro-inflammatory response in fat tissue—also effectively reduced by NAC. In an experiment that recreates a common human dietary trend, rats were given a diet high in the sweetener fructose, which produced increased blood pressure, plasma insulin levels, and triglyceride levels. Yet all of these dangerous physiological alterations were inhibited by NAC.

Human studies of NAC to improve insulin sensitivity have recently appeared, especially in a group of people typically very difficult to treat. Profound insulin resistance is seen in women with polycystic ovary syndrome (PCOS), along with a variety of other metabolic disturbances. One study showed that NAC at 1,200 mg per day along with 1,600 mg of the amino acid arginine promoted a trend toward normal ovulatory cycles and substantially improved insulin sensitivity. A short-term study showed that 1,800 mg of NAC daily helped improve insulin sensitivity in women with PCOS.

Virtually all Americans consume too many calories and are at risk for at least some degree of insulin resistance. Daily supplementation with NAC at 1,200 to 1,800 mg per day may help to reduce the impact and slow the damage wrought by AGEs.

**CANCER PREVENTION**

The strong and growing links between oxidative stress, inflammation, and cancer make NAC a natural go-to compound for cancer chemoprevention. True to form, NAC has multiple anti-cancer activities acting at multiple targets to provide layers of cancer protection against a large variety of cancer types. NAC induces programmed cell death (apoptosis) in multiple types of human cancer cells. In human gastric cancer cells, NAC not only induces apoptosis, but also stops DNA synthesis, preventing cancer cells from replicating. In melanoma cells, NAC inhibits NF-kB, preventing expression of signaling molecules needed by the cancer cell to grow. NAC inactivates and promotes destruction of c-Src, a chemical control molecule that is overproduced in many human cancers, providing a completely unique means of slowing or stopping tumor development. Finally, NAC protects DNA from breakage induced by ionizing radiation, but does not prevent cell destruction by radiation. That's a vital finding because it means that NAC might allow radiation therapy to effectively kill cancer cells while minimizing the risk of so-called secondary cancers that could otherwise arise as side effects of the radiation.

Animal studies strengthen the case for NAC still further. NAC protects mice from cigarette smoke-induced lung cancers and other lung changes, a finding with enormous implications not only for current smokers but for ex-smokers and people exposed to second-hand smoke. NAC protects rats from chemically-induced liver cancers immediately following tumor initiation. This
early interference with cancer development bodes well for NAC as a chemopreventive agent in the many human toxin-related cancers.

Human studies are similarly encouraging, even in the most challenging patient groups such as smokers. A randomized, double-blind chemoprevention trial of NAC 600 mg twice daily for 6 months vs. placebo in otherwise healthy smokers showed a significant reduction in formation of damaged or oxidized DNA segments, telltale early markers of cancer development in lung fluid. The same study also demonstrated reductions in abnormal, pre-cancerous cell changes in the mouths of supplemented smokers. These effects support the scientists’ conclusion that NAC can reduce tobacco smoke carcinogenicity in humans.

Colon cancer is another malignancy with strong links to oxidative stress and inflammation. Preliminary studies in humans show a 40% reduction in colorectal polyps in patients given 600 mg per day of NAC, compared with controls. In a group of people with a previous history of pre-cancerous colonic polyps, 800 mg per day of NAC for 12 weeks significantly reduced the proliferative index, indicating a decreased risk of colon cancer.

Supplementing with 600-1,200 mg per day of NAC appears to be an entirely appropriate means of adding to your general cancer-prevention strategy.

**GASTRITIS, ULCERS, CANCER, AND HELICOBACTER PYLORI**

*Helicobacter pylori* is a bacterium that colonizes various regions of the stomach and upper part of the small intestine. *H. pylori* infection produces major oxidative stress on tissues already vulnerable to extremes of pH and other chemical challenges, and the resulting inflammation produces pain and promotes development of gastric and esophageal cancers. NAC is an obvious candidate for fighting *H. pylori* infections, both because of its powerful ability to interfere with the oxidant-inflammation connection, and also because of its potential to break down some of the gastric mucous layer beneath which the organism hides.

NAC fights *H. pylori* in at least two ways. It markedly inhibits growth of *H. pylori* both in culture dishes and in live mice, helping to reduce the total load of organisms present. But NAC also powerfully regulates gene expression in stomach lining cells, reducing hydrogen peroxide production induced by *H. pylori*, and decreasing activation of NF-κB and subsequent release of inflammatory cytokines. In human trials NAC improves eradication rates of *H. pylori* produced by standard treatment with antacids and antibiotics, when given at doses of 1,200 mg per day.

People who have gastritis or gastroesophageal reflux disease (GERD) may be infected with *H. pylori* and may benefit from supplementation with 1,200 mg per day of NAC, especially during co-treatment with drugs to eradicate the organism.

**SUMMARY**

N-acetyl cysteine is a broad-spectrum compound traditionally under-utilized in conventional medicine. A burst of new clinical research reveals that NAC exerts dual effects, functioning both as a powerful antioxidant that replenishes cellular antioxidant systems (glutathione in particular) and also as a potent modulator of gene expression, regulating inflammation at multiple, fundamental levels. It has been shown to be an effective intervention against influenza, chronic lung diseases, cancers, insulin resistance, and gastritis caused by *H. pylori*. NAC’s further value is shown in its ability to mitigate otherwise inevitable metabolic and immunological disturbances caused by exercise.

*If you have any questions on the scientific content of this article, please call a Life Extension® Health Advisor at 1-866-864-3027.*

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