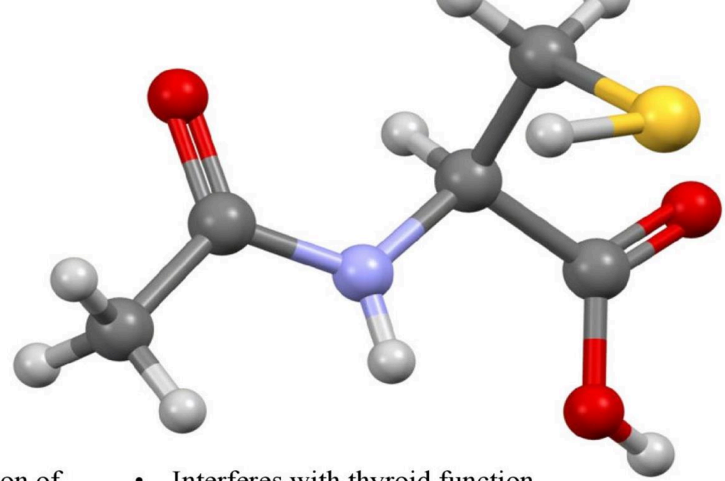
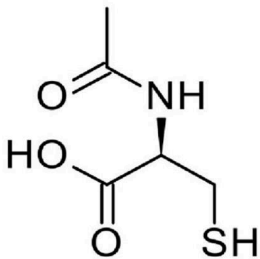


# The Truth About N-Acetylcysteine Anti-Aging or Pro-Inflam-Aging?

by Guy R. Schenker, DC



**N**-ACETYLCYSTEINE (NAC) is a synthetic derivation of the amino acid cysteine. To appreciate the benefits and the damage from NAC supplementation, you must first realize that nearly all of its effects on the progression from immuno-neuro-endocrine stress to chronic inflammation to inflam-aging come from its intracellular conversion, or failure to convert, to glutathione (GSH).



GSH is “the master antioxidant” formed intracellularly by NAC paired with the amino acid glycine. Your key takeaways from this article will be that you need your patients to supplement with NAC and glycine to increase intracellular GSH production and that you should only supplement NAC with glycine.

With its apparent antioxidant and anti-inflammatory properties, NAC has gained extraordinary popularity in alternative medicine and among health food store shoppers and nutritionists. Regrettably, though, pathology models fail to justify NAC supplementation. The irony is that NAC is promoted as an anti-aging antioxidant, but NAC supplementation accelerates the aging process.

All presumptive anti-aging benefits attributed to NAC’s antioxidant effects, including benefits for atherosclerosis, arthritis, and many other inflammatory conditions, only occur after NAC has been converted to glutathione. Any NAC not combined with glycine to produce glutathione can wreak devastation. The facts that “natural cure” lovers refuse to face are that NAC supplementation:

- Suppresses anti-aging gene expression (particularly inhibiting SKN-1-mediated transcription).
- Accelerates the aging process in animal studies.
- Perturbs global gene expression.
- Blocks essential reactive oxygen species (ROS) action in their role as ubiquitous and important signaling molecules that regulate cellular homeostasis, differentiation, proliferation, repair, and aging.

- Interferes with thyroid function.
- Interferes with methionine metabolism.
- Facilitates the overgrowth of yeast and fungal infections.

In a study done to test for the (wishful thinking) benefits of NAC on patients with idiopathic pulmonary fibrosis, researchers had to stop the study because so many patients died.

Across the nutrition industry, NAC hype solely reflects its use in the production of the body’s most important antioxidant, GSH. Its antioxidant activity at the cellular level only offers results to the extent that NAC combines with glycine to increase glutathione.

NAC supplemented without glycine is a weak reducing agent and a poor antioxidant compared with glutathione. Treatment with NAC shows enhanced antioxidant activity and depression of ROS generation but only in association with increases in intracellular GSH levels.

NAC supplementation significantly reduces both thrombin-induced and adenosine diphosphate-induced platelet aggregation. Before conversion, though, it requires glutathione to convey antioxidant and anti-thrombotic benefits. The oxidative stress component of aging urgently calls for glutathione supplementation to decrease free radical oxidative damage and decrease inflam-aging.

Even for the elderly, intracellular glutathione production can be increased to a remarkable level by supplementing with NAC and glycine. The endogenous production of glutathione can also be enhanced by other adaptogens that induce the production of glutathione. These inducers include alpha lipoic acid, carnosine, and quercetin.

Direct supplementation with glutathione is nearly worthless. First, very little of it is absorbed by the gut. Even more critically, glutathione does not efficiently pass through cell membranes; it must be synthesized within the cells. Therefore, your therapeutic target is to induce synthesis of glutathione, either by supplying the precursors of glycine and NAC, or by supplying the three

**“NAC supplementation significantly reduces both thrombin-induced and adenosine diphosphate-induced platelet aggregation.”**

inducers previously mentioned. Supplementation of liposomal glutathione does increase its intestinal absorption, but the benefits are minimal since glutathione does not efficiently pass into the cells and, thus, is largely ineffective clinically.

In a study of glycine and NAC supplementation in glutathione synthesis, elderly subjects (age 60 to 75 years old) compared to younger subjects (age 30 to 40 years old) showed at baseline 70% lower intracellular glutathione and 36% higher oxidized glutathione. The lower rate of glutathione synthesis in the elderly subjects at baseline was associated with significantly higher markers of oxidative damage (ROS metabolites, F2-isoprostanes, and lipid peroxides).

After only 14 days of supplementation with glycine and NAC, elderly subjects showed a 50% reduction in lipid peroxides and had F2-isoprostane levels even lower than those in the younger control group. Over those 14 days, elderly subjects showed a 95% increase in intracellular glutathione concentration.

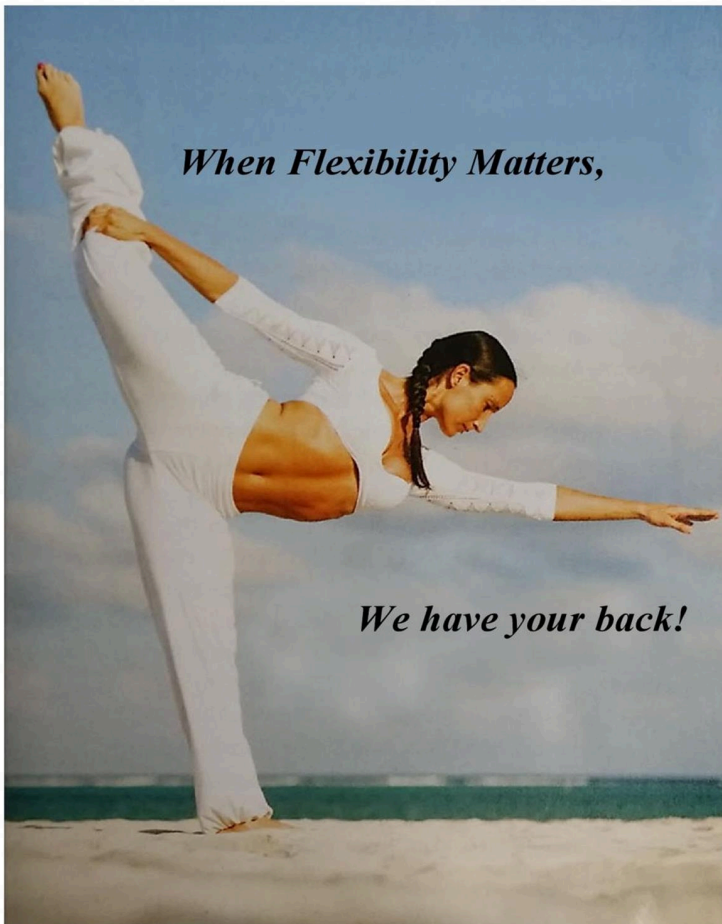
Another 14-day study was done on glycine and NAC supplementation in type 2 diabetics compared to non-diabetic controls. At baseline, type 2 diabetics had 103%, 160%, and 76% higher concentrations of plasma glucose, insulin, and free fatty acids, respectively, and 425% higher insulin resistance. Just 14 days of supplementation, significantly lowered fasting insulin by 19%, FFA by 25%, and insulin resistance by 22%. The improved fatty acid oxidation made muscle function more efficient and had the additional benefit of weight loss of abdominal adipose.

In a study similar to the one previously mentioned, an elderly group showed 76% lower GSH at baseline than the younger adults, while plasma oxidative end-product concentrations were 845% higher and F2-isoprostane concentration 318% higher than the younger group. Glycine and NAC supplementation yielded a 200% increase in cellular concentrations of glutathione and a 74% decrease in concentrations of oxidative stress end products.

**“The respiratory quotient showed much more efficient fat burning, resulting in less dependence on sugar metabolism”.**

Compared to fasting young adults, older adults had abnormal mitochondrial fuel oxidation. They showed 54% lower mitochondrial fatty acid oxidation and 51% higher mitochondrial glucose oxidation. Glycine and NAC supplementation corrected mitochondrial fatty acid and glucose oxidation without affecting energy expenditure. The respiratory quotient showed much more efficient fat burning, resulting in less dependence on sugar metabolism.

Compared to younger subjects, older adults showed extreme elevation of many pro-inflammatory cytokines at baseline, IL-6 was 934% higher, TNF- $\alpha$  was 116% higher, C-reactive protein (CRP) 88% higher, and endothelial function biomarkers of inflammation were as much as 175% higher.



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Elderly subjects had fasting glucose 15% higher and insulin 469% higher, as well as insulin resistance 571% higher than in younger controls. Plasma concentrations of DNA damage markers were higher by 348%. Glycine and NAC supplementation lowered IL-6 by 77%, TNF- $\alpha$  by 57%, and CRP by 49%, and decreased insulin by 55% and insulin resistance by 59%.

Older adults had significantly impaired cognitive scores, along with lower fasting plasma BDNF (brain-derived neurotrophic factor). Older adults also showed declining physical function with slower gate speed, lower grip strength, and decreased performance on the six-minute rapid-walk test.

### “Glycine and NAC supplementation resulted in significant improvement in both cognitive performance and physical function tests”.

Glycine and NAC supplementation resulted in significant improvement in both cognitive performance and physical function tests. All measured cognitive functional assessments improved. The slower gate speed improved enough to match the younger control group, and hand grip strength and six-minute rapid walk test performance significantly improved.

With the improvements in respiratory quotient (fat burning versus sugar burning in the mitochondria), there was a signifi-

cant reduction in total body fat and waist circumference, showing preferred fat loss in the abdomen, which is an indication of improved insulin sensitivity.

These researchers did a follow-up on mice to see if glycine and NAC supplementation could increase lifespan. Compared to the placebo, they found that mice supplemented with glycine and NAC lived 24% longer than control mice, improved/corrected impaired glutathione synthesis, glutathione deficiency, oxidative stress, mitochondrial dysfunction, abnormal mitophagy, nutrient-sensing, and genomic damage.

No supplementation even compares to what you will achieve with glycine and NAC, along with the inducers alpha lipoic acid, carnosine, and quercetin, to produce intracellular glutathione in defense against inflam-aging.



Dr. Guy Schenker, a Pennsylvania chiropractor since 1978, developed the Nutri-Spec System of Clinical Nutrition, which eschews symptom-based nutrition in favor of individualized metabolic therapy. Nutri-Spec offers a Stage of Life Diphasic Nutrition Plan (SOLID DNP), empowering each patient to live stronger longer. Reach us at 800-736-4320, email [NutriSpec@Nutri-Spec.net](mailto:NutriSpec@Nutri-Spec.net), or visit [www.nutri-spec.net](http://www.nutri-spec.net).

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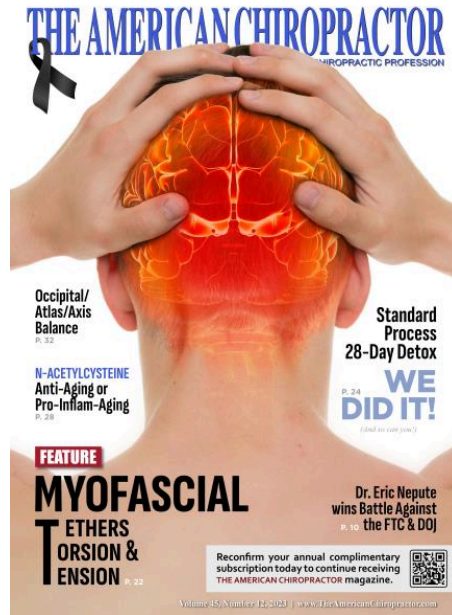
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