NAC (N-acetyl-cysteine)

Summary

NAC (N-acetyl-cysteine) is a supplement used by people with HIV, usually as part of an antioxidant regimen. NAC is usually taken two or three times daily and is available in capsule and tablet forms in some health food stores. NAC is also available by prescription in liquid form from pharmacies.

What is NAC?

NAC is a supplement used by some people living with HIV. NAC stands for N-acetyl-cysteine and is similar to the amino acid cysteine. Taking NAC helps to increase levels of the protective compound glutathione (GSH) in the body.

How does NAC work?

Before explaining how NAC works, we first need to give you some background information about GSH.

GSH is a compound that the body makes using various nutrients including the amino acid cysteine. GSH is the body’s chief protector from the injury caused by harmful substances. Results from a number of studies suggest that in people with HIV the demand by the body for GSH exceeds the supply. Less-than-normal levels of GSH may result in impaired performance by cells of the immune system and perhaps increased sensitivity to the toxic effects of some drugs. When there is not enough cysteine available to make GSH, the body tears down muscles, which are rich in protein, to find the nutrients needed to make GSH. NAC works by acting as a source of cysteine and stimulating the production of GSH.

Why do some people with HIV use NAC?

1. As an antioxidant and to help reduce inflammation

In the late 1980s, researchers found that people with HIV were likely to have higher-than-normal levels of highly active compounds called “free radicals.” These compounds damage cells in much the same way that rust damages a car. Some people with HIV take NAC as part of an antioxidant regimen to help counter the damaging effects of high levels of free radicals. NAC
continues to be studied in clinical trials with HIV-positive participants such as the Maintain study in Canada. Excessive levels of free radicals can also lead to higher-than-normal levels of inflammation. Persistent and elevated levels of inflammation may degrade major organ-systems. A pilot study has found that a supplement of NAC and the amino acid glycine can significantly and quickly reduce excess inflammation in a small group of HIV-positive men. The study had only 10 participants, used very high doses of NAC and lasted for two weeks. Longer and larger studies are required to confirm these results.

2. To maintain GSH and muscle mass

HIV-positive people—whether or not they are taking potent combination anti-HIV therapy (commonly called ART)—can experience a loss of critical sulfur-containing amino acids, such as cysteine and methionine. Supplements of NAC may be able to replace lost cysteine, help maintain protein levels and possibly reduce muscle wasting. Together, all of these potential benefits may explain why one American study found that supplements of NAC—an average of 4 grams daily—prolonged survival for up to three years in the time before ART was widely available. That study was the impetus for the widespread use of NAC by HIV-positive people and so it may be useful to briefly review findings from that study.

In the early 1990s, researchers at Stanford University in California conducted an eight-week randomized, placebo-controlled study of NAC in HIV-positive people. The dose of NAC used was about 4,400 mg daily. After the initial eight weeks, all participants were offered NAC for six months. Researchers collected data on the survival of participants for several years after they stopped using NAC. They found that this supplement significantly increased GSH levels within CD4+ cells. However, NAC did not significantly raise CD4+ cell counts. The data also suggested that people who used NAC were twice as likely to survive over the next two years compared to people who did not ever use NAC. At the time of the study, ART was not available and most participants used AZT (zidovudine, Retrovir) with or without another nuke (nucleoside analogue). Due to the study design, firm conclusions about the effect of NAC on survival in HIV infection cannot be drawn and it is important to note that a large proportion of NAC users did eventually die. However, the trial did heighten interest in the use of antioxidants.

In the time before ART was available, researchers in Montreal also tested whey protein concentrates, which are rich in cysteine, in HIV-positive volunteers and found that they improved weight. In that era a sustained increase in weight was unusual in HIV-positive people.

A small study in the current era has found that NAC taken orally does replenish GSH levels inside cells and also reduces inflammation.

3. To protect the liver and kidneys from the toxicity of drugs

In some people, the pain reliever acetaminophen (Tylenol) can cause injury to the liver and kidneys even when used within normal doses. In hospitals in North America, in cases of overdose with paracetamol or acetaminophen, doctors can sometimes prevent the onset of severe liver injury (and death) by giving NAC intravenously. In theory, since the body uses GSH to protect cells from injury, it is possible that NAC may be protective in cases of poisoning from other drugs. However, NAC has not been tested for this purpose in well-designed clinical trials, so there is no firm data to support such a use in people.

4. Other potential uses

NAC is being studied for the treatment of addiction disorders.

Side effects

At high doses, NAC may cause the following symptoms in some people:

- nausea
- abdominal discomfort
- vomiting
- diarrhea
In lab experiments with cells, high concentrations of NAC can weaken some activities of the immune system. There have been no studies of this in people.

**Drug interactions**

If you are taking antibiotics, NAC should not be taken, as it may weaken their beneficial effects.

**Dosage**

The best dose of NAC for people with HIV is not clear, but reviewing the data from clinical trials in people with HIV may be useful. In the previously mentioned American study, use of about 4 grams per day of NAC was associated with improved survival. However, anecdotal reports suggest that taking such large doses of NAC for prolonged periods can cause abdominal discomfort, nausea, vomiting and diarrhea.

According to results from two German studies, a dose of 3 grams every other day is effective at increasing GSH levels and does not appear to cause toxicity. Alternatively, some people with HIV take smaller doses of NAC, between 500 to 1,000 mg, once or twice daily.

Taking NAC with meals or acidic drinks (orange juice, cola beverages) may reduce nausea.

**Availability**

In drug stores, NAC is available in liquid form with a prescription. Some health food stores sell NAC in capsule form.

**References**


Roederer M, Staal FJ, Osada H et al. CD4 and CD8 T cells with high intracellular glutathione levels are selectively lost as the HIV infection progresses. *International Immunology*. 1991 Sep;3(9):933-7.


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