N-acetylcysteine and glycine supplementation in HIV patients rapidly improves Glutathione levels, mitochondrial function, muscle strength, insulin resistance, inflammation, and lowers body fat

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• Mitochondria are tiny engines in every cell of our body, which burn fat and sugar to generate life-giving energy

**Mitochondria = Energy = Life**

• Mitochondria malfunction in HIV, and are unable to burn (oxidize) fat, and *we do not know why*

• HIV patients are also at high risk of having:
  - *muscle weakness*
  - *more belly fat*
  - *insulin resistance with prediabetes*
  - *inflammation (harmful tissue irritation)*
  - *Could these defects be happening due to mitochondrial malfunction?*

• Mitochondria require plentiful supply of an important antioxidant protein called Glutathione (GSH) to work efficiently, but GSH levels are very low in HIV, and *we do not know why.*
Why We Did this Study

To find out:

• What is the reason for Glutathione deficiency in HIV?
• Is it possible to correct Glutathione deficiency?
• Can mitochondria be improved?
• Is it possible to:
  ➢ increase muscle strength?
  ➢ lower belly fat and belly size?
  ➢ improve insulin resistance (prediabetes)?
  ➢ lower inflammation (harmful tissue irritation)?
In 8 HIV infected men, we measured:

- blood levels of Glutathione
- mitochondrial function
- muscle strength
- insulin resistance
- inflammation
What We Found

HIV patients have very low levels of Glutathione

AND

Very low levels of Glutathione building blocks cysteine and glycine
Since cysteine and glycine levels were low, we provided these by mouth to participants for 2-weeks as N-acetylcysteine and Glycine (NAC-Gly)
The effect of NAC-Gly supplementation in HIV
Glutathione levels improve

**Historical CON**

**HIV pre**

**HIV post**

**p<0.05**

Mitochondrial fat burning capacity improves

![Bar chart showing mitochondrial fat burning capacity improvement between Non-HIV, HIV Pre, and HIV Post groups. The chart indicates a significant improvement in HIV Post compared to HIV Pre with p<0.001.]

Muscle strength improves

Body weight, body fat and belly size improve

3.5 lb. loss in total body fat and up to 1” decrease in waist circumference

Insulin works better

HIV: GSH deficient

C-reactive protein (CRP)

55% decline
CRP is a marker of heart disease

19% decline

Harmful inflammation becomes less

What Our Results Mean and Why this Matters

• Although these are results from a pilot study, **this matters** because mitochondrial decline, muscle weakness, excess belly fat, insulin resistance and inflammation, are all serious complications of HIV infection. *We do not know why these problems occur, or how to correct them.*

• **Our results mean that we can now understand why these problems may be occurring, and how to correct them.**

• N-acetylcysteine and glycine supplementation could play a helpful role in improving the health of PLWH.

• We recently completed a second pilot study with a longer 12-weeks of supplementation, which confirms and extends these findings. Collectively, these studies support the need for a large randomized clinical trial with a placebo group.
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