C15:0 Protection Against Heavy Metals? A New Study

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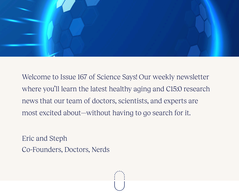

Welcome to Issue 167 of Science Says! Our weekly newsletter where you'll learn the latest healthy aging and C15:0 research news that our team of doctors, scientists, and experts are most excited about--without having to go search for it.

Eric and Steph
Co-Founders, Doctors, Nerds

What Dr. Stephanie Venn-Watson, our co-founder and author of *The Longevity Nutrient* and over 80 peer-reviewed scientific publications, is reading.

HEALTHY AGING

C15:0 As A Goldilocks Protector

Over the past couple of weeks, we shared how real-world studies - robust experimental data support C15:0's causal role in supporting our long-term cardiometabolic health (thanks to using the Bradford Hill criteria for causality).

This week, we're covering a newly published study in *Environmental Pollution* that evaluated heavy metals' negative impact on glucose metabolism - and evidence that a few fatty acids (including C15:0) could help protect metabolic health against heavy metal threats. Let's dive in.

So, what was this study about?

A prior study from Wang et al. showed that higher exposures to heavy metals were associated with an increased risk of developing poor glucose control during pregnancy. As we shared a couple of weeks ago, there is strong scientific evidence that C15:0 protects long-term healthy glucose levels.

In the latest paper, Tang et al. led a prospective cohort study with 665 pregnant women to help answer the following questions related to heavy metals, glucose metabolism, and C15:0:

- Do women with higher heavy metal levels during early pregnancy have a greater risk of developing impaired glucose metabolism later in their pregnancy?
- Do higher levels of C15:0 during mid-pregnancy protect against heavy metal-associated impaired glucose metabolism?

Got it. How was this study conducted?

To elucidate the potential timing of events as they related to C15:0, they measured the following:

- Heavy metals in hair samples during early pregnancy
- Circulating C15:0 levels during mid-pregnancy
- Glucose tolerance tests between 6 to 7 months of pregnancy

Mediation analyses were then run to evaluate whether C15:0 served as a protective "middleman" between metal exposure and impaired metabolism. Go, statistics.

Here's what this team found:

#1: Higher heavy metals → impaired glucose metabolism

Similar to prior studies, Tang et al. found that higher levels of heavy metal exposures during early pregnancy were associated with a higher risk of impaired glucose metabolism during later pregnancy.

Specifically, of the 15 heavy metals measured, they found that women with higher levels of the following five non-essential heavy metals (in order of magnitude) had a higher, dose-dependent associated risk of developing impaired glucose metabolism: silver (Ag), niobium (Nb), nickel (Ni), thallium (Tl), and rubidium (Rb).

#2: Higher C15:0 → protected glucose metabolism

Consistent with a prior prospective cohort study by Zhu et al. showing that higher C15:0 levels were associated with a lower risk of pregnancy-related metabolic perturbations, Tang et al. demonstrated that higher C15:0 levels during mid-pregnancy were associated with a 25% lower risk of developing impaired glucose control during later pregnancy.

Finding #3: Higher C15:0 → protected metabolism in the face of higher heavy metals (well, that's new)

Impressively, the mediation analyses provided evidence that higher C15:0 levels protected women with higher heavy metal levels against heavy-metal-associated impaired glucose metabolism.

Specifically, these analyses supported that higher C15:0 levels provided statistically significant protection against the associated negative glucose-impairing effects of niobium and rubidium.

A plausible explanation for C15:0 protection against heavy metals.

In their discussion, Tang et al. cover how heavy metals, including niobium and rubidium, often exert their negative effects by increasing oxidative stress. This is supported by Chatterjee et al., which showed that rubidium toxicity could be reduced with antioxidants in preclinical models. And in a review by Khalid et al., which covered multiple studies showing that bioaccumulation of niobium nanoparticles in tissues resulted in increased reactive oxygen species and tissue damage in preclinical models.

Understanding that specific heavy metals cause oxidative stress and impair glucose metabolism, the authors propose that the antioxidant effects of specific fatty acids (including C15:0) may explain their protection against heavy metal-driven glucose perturbations. This would align well with studies from Aabis et al. and Wei et al., which demonstrated C15:0's direct protection against oxidative stress in the liver.

In summary, this latest study supports the growing literature that C15:0 protects cells from oxidative stress and supports healthy glucose metabolism - including oxidative stress and associated glucose perturbations caused by heavy metals.

C15:0 as the goldilocks fatty acid

While we focused on C15:0 above, Tang et al. included nine saturated fatty acids in their study. Similar to many other studies, they found that not all saturated fatty acids are equal.

Specifically:

- C6:0, C8:0, C18:0, and C21:0 had no protective associations related to glucose control
- C12:0, C14:0, C15:0, C17:0, and C20:0 had protective associations related to glucose control

As you know from reading *Science Says!*, odd-chain saturated fatty acids (C15:0 and C17:0) are consistently associated with better long-term metabolic health. In experimental studies, C15:0 has had remarkably better direct health-supporting outcomes than C17:0. Further, of all saturated fatty acids, only C15:0 is meeting the criteria of an emerging essential fatty acid.

Hence, C15:0 as the goldilocks fatty acid.

With that, have a fantastic week, everyone!

Dive deeper into the science

READ THESE STUDIES AT DISCOVERC15.COM/RESOURCES

- Wang et al. Exposure to multiple metals in early pregnancy and metabolic perturbations: A prospective cohort study.
- Tang et al. A prospective cohort study on the associations between early-pregnancy hair metal levels, mid-pregnancy fatty acids, and metabolic perturbations.
- Zhu et al. A prospective and longitudinal study of plasma phospholipid saturated fatty acid profile in relation to cardiometabolic markers and the risk of impaired glucose metabolism.
- Chatterjee et al. Studies on the protective effects of ascorbic acid in rubidium toxicity.
- Khalid et al. A comprehensive review of niobium nanoparticles: synthesis, characterization, applications in health sciences, and future challenges.
- Aabis, M, et al. Pentadecanoic acid protects liver function by modulating oxidative stress and ferroptosis pathways in rat.
- Wei et al. Parabacteroides distasonis uses dietary inulin to protect liver function via its metabolite pentadecanoic acid.
- Imamura et al. Fatty acid biomarkers of dairy fat consumption and incidence of impaired glucose metabolism: a pooled analysis of prospective cohort studies.
- Li et al. Saturated fatty acid biomarkers and cardiometabolic health: a meta-analysis of prospective studies.
- Schaefer et al. Fatty acid biomarkers and metabolic health: a systemic review and dose-response meta-analysis of prospective observational studies.
- Sun et al. Erythrocyte odd-chain fatty acids and cardiometabolic health: a prospective study and updated meta-analysis.
- Bishop et al. Hepatadecanoic acid is not a key mediator in the prevention of diet-induced hepatic steatosis and insulin resistance in mice.
- Venn-Watson et al. Efficacy of dietary odd-chain saturated fatty acid pentadecanoic acid parallels broad associated health benefits in humans: could it be essential?
- Ruan et al. Free long-chain fatty acids trigger early postembryonic development in starved Caenorhabditis elegans by suppressing mTORC1.
- Dorman et al. Odd chain fatty acids and odd chain phenolic lipids (alkylresorcinols) are essential for diet.
- Cieslelski et al. Dietary pentadecanoic acid supplementation at weaning in essential fatty acid-deficient rats shed light on the new family of odd-chain n-8 PUFAs.