Iron overload drives aging

August 20, 2023

Welcome to Issue 58 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 over 80 peer-reviewed scientific publications, is reading.

HEALTHY AGING

Iron is essential, but it has a dark side (especially as we age)

In this series, we are covering the science behind our cell membranes - because they literally cover our cells, our health, and even our longevity.

Last week, we discussed fatty acids - including C15:0 - that help cells survive in extreme environments. This week, let's talk about a newly recognized phenomenon that *shortens* our cells' survival.

What shortens cell survival? Hint: It's a bit *iron*-ic

When we talk about iron and our health, most of us think "iron deficiency". Over the past decade, however, scientists have shown that iron metabolism is much more complicated than we once thought. In fact, as reviewed by Rochette et al., excess free iron is now recognized as a major driver of cellular breakdown.

The word of the week is ferroptosis

Apoptosis is defined as the normal death of cells. When cells are damaged beyond repair, they need to be recycled out: this is apoptosis.

In contrast, *ferro*ptosis is a phenomenon in which iron prematurely kills cells. As described by Rochette et al., iron requires an accomplice to take out our cells - namely, polyunsaturated fatty acids (PUFAs) in our cell membranes. When free iron meets fragile PUFAs, the result is a vicious cycle of lipid peroxidation, inflammation, and early cell death.

Wait, I thought iron was good for me.

Indeed, iron is an essential mineral that helps to keep our red blood cells healthy. In a paper titled "Role of iron in aging related diseases," however, Chen et al. describe how iron accumulates in our tissues as we get older, contributing to the onset or worsening of:

- Arthritis
- Liver cirrhosis
- Heart disease
- Neurodegenerative diseases
- Cancer
- Diabetes
- Anemia

This condition is called "iron overload". While iron overload was initially recognized as primarily a genetic disorder, Deugnier et al. found that a rising number of cases of iron overload are unexplained - and associated with the rise in metabolic diseases. Thus, they called this phenomenon dysmetabolic iron overload syndrome (aka, DIOS).

Are there treatments for iron overload?

Well, leeches. Or to get less medieval, clinical blood draws successfully pull iron from our tissues to treat iron overload. Alexandros et al. review the ongoing debate, however, regarding the benefits and risks of blood letting. Unfortunately, removing blood is a temporary treatment that does not address the underlying cause of iron overload. As such, it must be repeated routinely.

Iron chelators, which bind to free iron to remove excess amounts from the body, is another option. Entezari et al. summarize the advantages and disadvantages of the leading FDA-approved iron chelators, deferoxamine, deferiprone, and deferasirox. Like blood draws, however, iron chelators do not address the underlying causes of iron overload.

Dolphins get iron overload, too (and how nutritional C15:0 deficiencies may be the culprit)

Dolphins are long-lived, large brained mammals that age a lot like us. As dolphins get older, they can develop arthritis, nonalcoholic fatty liver disease (aka NAFLD), anemia, Alzheimer's disease, and yes - iron overload.

Back in 2015, our fatty15 founder, Dr. Stephanie Venn-Watson, discovered that dolphins with higher C15:0 levels were less likely to have these aging-associated conditions. Even better, when dolphins were provided fish diets with higher amounts of C15:0, their health improved.

Based on these findings, Steph and team chased the hypothesis that C15:0 helps to regulate iron metabolism. Lo and behold, they found that pure, free fatty acid C15:0 successfully stopped excess iron deposition in a relevant model of NAFLD and liver iron overload.

These studies support that nutritional C15:0 deficiencies may be driving the rise in unexplained iron overload… and the resultant fragility of our cells with aging.

Another fine reason for our team's movement to replenish C15:0 levels and restore global health. Save the dolphins, save the world!

Next week, we'll talk about how fatty acids in our cell membranes can determine our longevity… and even explain how humans (and dolphins) live longer than mice.

In the meantime, have a great week!

Dive deeper into the science

READ THESE STUDIES

- Rochette et al. Lipid peroxidation and iron metabolism: two corner stones in the homeostasis control of ferroptosis
- Chen et al. Role of iron in aging related diseases
- Deugnier et al. Dysmetabolic iron overload syndrome (DIOS)
- Alexandros et al. Dysmetabolic iron overload in metabolic syndrome
- Entezari et al. Iron chelators in treatment of iron overload
- Mazzaro et al. Iron indices in bottlenose dolphins (Tursiops truncatus)
- Venn-Watson et al. Increased dietary intake of saturated fatty acid associated with decreasing ferritin and alleviated metabolic syndrome in dolphins
- Venn-Watson et al. Modified fish diet alleviated chronic anemia in dolphins: potential role of odd-chain saturated fatty acids
- Venn-Watson et al. Use of C15:0 to regulate iron metabolism (study within larger paper of many studies)

- Check out all the C15:0 science at www.discoverC15.com