

Tackling zinc deficiency with a new approach to urine testing

September 10 2019, by Caroline Brogan



Dr Rebekah Moore testing for zinc isotopes. Credit: Imperial College London

Imperial College London researchers have developed a new urine test that looks to chemical fingerprints for more precise zinc testing.

This new approach, outlined in a new paper published in *Metallomics*, could provide more specific tests to warn of [zinc deficiency](#)—particularly in developing countries.

Caroline Brogan spoke to lead author Dr. Rebekah Moore, from Imperial's Department of Earth Science and Engineering, to find out more.

What is zinc deficiency?

Estimates suggest up to 1.3 billion, or one in six of the world's population, could be suffering from [zinc](#) deficiency.

Zinc is a component in many bodily proteins, including over 300 enzymes—so it plays an important role in all our cells and affects growth, hormones, the immune system, the brain, and other organs.

A lack of zinc therefore slows down wound healing and causes appetite loss, hair loss, fertility problems, and susceptibility to infection. Infants who are zinc deficient are at particular risk of infections and stunted growth.

Why do people become zinc deficient?

Experts recommend a daily zinc intake of between 8 and 11 milligrams (mg). Not eating enough zinc-rich foods (such as meat, shellfish, legumes) is certainly part of the problem—but the main issue lies with diets based largely on cereal crops, which are common in developing countries.

Cereal crops contain zinc that is bound to compounds called phytates. Humans lack the digestive enzymes needed to break the bonds between

zinc and phytates, so zinc is excreted without being absorbed into the body.

Why do we need a new test ?

Zinc deficiency is currently diagnosed using blood, urine, and hair tests. However, the tests are infamously insensitive, meaning they miss a lot of deficiencies even where symptoms are present.

We believe this is because these tests don't look for specific enough pools of zinc, so that they only capture a snapshot of the information on the total amount of bodily zinc.

How is the new test different?

Zinc exists in different forms—known as [isotopes](#)—depending on the number of subatomic particles—called neutrons—they contain. As current tests look only at total amounts of zinc, we wondered if detecting zinc isotopes might help us find more specific indicators to make tests more robust.

Our bodies contain varying amounts of five different zinc isotopes. Variation in the amount of each isotope can signal changes in the way biological processes work—acting as chemical fingerprints.

Different zinc isotopes bind, in varying amounts, to different chemical elements (such as oxygen, nitrogen, and sulphur) in the body. These chemical elements are found in our proteins, so different proteins will be bound to different proportions of zinc isotopes.

It therefore follows that if people have different proportions of these molecules in their bloodstream, each [urine sample](#) will carry a unique

make-up of zinc isotopes. Understanding this difference is key to developing a [test](#) for zinc deficiency.

So, we developed a new method that looks for ratios of the different forms of zinc in urine.

What does your paper show?

Specifically, we saw that heavier forms of zinc in the urine reflect less total zinc, which indicates that different molecules are in the blood and urine.

How could the new test help people with zinc deficiency?

Most people with zinc deficiency live in developing countries, where access to clinics and healthcare can be limited. Urine tests are, by design, easier to use than blood tests, most obviously in that people can more easily use them by themselves, away from a clinic.

We hope a more accurate diagnosis of zinc deficiency will prompt people to adjust their diet where possible, including using zinc supplements where appropriate, before serious health problems develop.

What's next?

Our results suggest that the test, and our ideas around zinc isotopes, hold promise. However, the study is the first to look at zinc in this way, so more research is needed to further interpret the findings and make them useful in real-world tests.

In the next study, we plan to engage with more people of more diverse

age ranges and backgrounds. In these people we will look further into the connection between zinc in blood and in [urine](#). We want to find which molecules are being signaled by our isotope testing to see how one sample can represent overall availability of zinc in the body.

Our ultimate aim is to find a robust indicator that recognizes what these chemical fingerprints are showing us, and to roll out tests to remote populations.

More information: Rebekah E. T. Moore et al. Assessment of coupled Zn concentration and natural stable isotope analyses of urine as a novel probe of Zn status, *Metallomics* (2019). [DOI: 10.1039/C9MT00160C](https://doi.org/10.1039/C9MT00160C)

Provided by Imperial College London

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