# Seeking answers from iron and blood

Dr. Lynn Riddell



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Dr. Lynn Riddell of Deakin University's Centre for Physical Activity and Nutrition Research (CPAN), has made a career out of studying nutrition and public health. Here we talk to her about her latest venture, an app to improve iron nutrition in women.



To begin with, tell us about yourself. How did you get to this point in your career?

I began my studies in food and nutrition science at the University of Otago straight out of school and have never really looked back. I loved learning about food science along with learning about nutrition and the impact of food on health. After working for a couple of years as a food chemist I wanted to further explore the relationship between compounds in food and their influence on health and so returned to the University of Otago looking at the impact of folate on health. I greatly enjoyed the opportunity to work in a research area that was at the interface of micronutrient intake, the impact on health and potential implications for national food policy. This was a time where the debate around fortification of the food supply with folic acid was a hot topic. Following the completion of my PhD, undertook postdoctoral research training at Drexel University where I further developed my dietary intervention skills and since joining Deakin University's Centre for Physical Activity and Nutrition Research (CPAN) over a decade ago I have been able to continue my work investigating the impact of micronutrient intake and health outcomes. The primary focus of my work currently is iron and zinc but I also collaborate with colleagues such as Professor Caryl Nowson and Dr Carley Grimes also from CPAN on sodium and iodine.

### Why did you decide to get into the field of nutrition?

I can't really say with any certainty – I was always fascinated by food and its relationship with health. As an adolescent I remember experimenting with new foods (tofu – a novelty in NZ in the 80s!), and different eating patterns and it was a natural progression to move into tertiary studies in food and nutrition sciences. My interests started to focus more on the nutrition sciences mid-way through my PhD and this is the field that I have stayed in since. With the rise in dietary related chronic diseases and the overwhelming challenges facing our population at the moment with abundant, dietary energy and increasing opportunities for sedentary lifestyles, we aren't running out of work anytime soon.

#### A lot of people are taking iron/multivitamin supplements at the moment. What are your thoughts on this?

Iron supplements are recommended for individuals who have been diagnosed through blood tests to have iron deficiency anaemia. Thus, in the presence of a diagnosed micronutrient deficiency then iron or multivitamin mineral supplements are important. For the general population however, vitamin and mineral supplements are not necessary. There is good evidence from a number of studies from a range of different countries that individuals who use supplements have better diet quality simply from food alone than those that don't use supplements. There are a number of phytochemicals present in foods that aren't included in supplements and studies have shown that individuals who consume diets more closely aligned to national and international dietary guidelines have better health outcomes. The concerns with taking unnecessary supplements are many: the cost; the waste; potential excess intakes; and potentially a sense of complacency that nutrient needs are met through the supplement.

The WIZE app, developed to help women with avoid Iron/Zinc deficiencies, is currently the centrepiece of a clinical trial. How do you feel about its progress?

With the rise of mobile phone technology and the increasing proportion of the population owning a smart phone, moving traditional dietary intervention materials into an accessible and interactive platform appeared to be a natural progression for our research. Dietary trials have indicated that when women with low iron stores increase the amount of iron they eat and increase the bioavailability of the iron in their diet they are able to improve their iron stores. These trials are typically very resource intensive, requiring repeat appointments with nutritionists and individual dietary planning. We are interested to see if we can achieve similar outcomes using a platform that has the ability to reach a larger number of women. Within economically developed countries, there are very few trials looking at dietary strategies aimed at improving zinc status in women so we have less to go on for the dietary recommendations to improve zinc status. Increasing bioavailable forms of iron in the diet should also increase the bioavailability of zinc and if we combined these recommendations with recommendations for increasing other sources of zinc, such as milk, we hope to see an improvement in both zinc intake and zinc status. So far we are only about half way through the trial so it is too early to tell if the app is working and too early to tell if we can initiate dietary change to a level that can result in improvements in iron and zinc stores.

## Smart phones, smart nutrition

The Centre for Physical Activity and Nutrition Research is an Australia-based world-class institute devoted to improving public health by researching preventative measures such as good nutrition and exercise.



Iron and zinc are two of the most commonly used metals in modern society, providing us with products ranging from corrosion-proof building materials to the batteries in our homes. They are also immensely important to us as living beings, acting as essential metal ions for many, many enzymes within the body. Iron is easy to observe, the red colour of blood and muscle is due to the iron locked into haemoglobin and myoglobin, carrying oxygen to where it is needed. Zinc is more subtle, appearing in over one hundred different enzymes as a structural or catalytic element. The importance of both leads to the body stockpiling stores for later use - indeed each of us have over 3 grams of iron and 2 of zinc scattered between our various organs.

But where do these metals come from in the first place? Both tend to occur in the same food types, coming in particular from two main sources, namely meat but also cereal grains such as wheat. Meat, being basically muscle, acts as a concentrated and readily bioavailable source of both micronutrients, and thus vegetarians often have lower zinc intake and lower iron levels than others (although we can also take 'cereals' to the literal extreme and note that Cheerios® have very high zinc and iron levels). Iron and zinc levels in food often correlate to each other, although there are naturally exceptions to this rule – e.g. dairy foods are high in zinc but bad in iron, dark chocolate has more iron than zinc.

To ensure that their communities have enough of these minerals, several countries are actively engaged in fortifying flours with added metals. Thus residents of the US will find that their wheaten baked goods contain added iron, while Indonesians and Mexicans have fortified levels of zinc. The levels vary around the world, however, as do the regulations – thus Australia has no additional minerals while somewhere such as Canada will only have iron fortification. Making this more complicated is the fact that iron/zinc uptake and secretion is heavily dependent on the form in which it is presented (meat iron is simpler to absorb than plant) and the presence of other molecules in the same meal (polyphenols from tea will inhibit uptake, while the ascorbic acid from an orange will boost it). The variation across the globe in both micronutrient supply and absorption means that it is remarkably difficult to determine when people are getting the right amount of both.

This is a particular problem for women, as the blood loss during menstruation means that they require higher iron intake compared to men. Indeed, studies have shown that around 12% of women have depleted iron stores, as compared to only 1-2% of men. Insufficient iron has been linked to reduced physical capability (particularly tiredness and weakness) and has also been shown to affect some mental skills. as well. Testing for deficiency is also difficult, while most iron can be easily measured as it floats around in the blood as haemoglobin or ferritin, there is no equivalent biomarker for zinc levels. Thus a lot of recent research focuses on both determining correlations between the two as well as encouraging women to consume sufficient amounts of each.

Setting out to answer these questions are scientists such as Lynn Riddell, currently the Deputy Head of the Deakin University School of Exercise and Nutrition Sciences. Her long career in nutrition research has recently come to focus on iron and zinc metabolism within the greater population, in particular how these levels are affected by nutrition and each other. A recent publication from their group examined the eating habits and blood mineral levels of a number of women, both blood donors and volunteers from university staff and students. Their work supported the importance of encouraging micronutrient consumption, as over 30% of those studied had low iron intake, and almost 19% low zinc (the flip-side of this is that 20% of those interviewed were taking some form of iron/multivitamin supplement, although as she points out "for the general population, however, vitamin and mineral supplements are not necessary"). As expected, their study showed that women who consumed more iron had higher zinc levels, but were unable to show that low zinc could be detected by a corresponding low level of iron in the blood. This lack of success in finding a simple biomarker for zinc deficiency meant that the research and public health focus would remain on prevention rather than diagnosis.

To support the prevention of iron/zinc deficiency, Dr. Riddell has also been involved in the development of public-health mobile apps, with their latest creation being known as Women's Iron, Zinc, and Energy (or WIZE, for short). This app has been designed so as to inform women as to the importance of iron/zinc, teach them which foods provide the highest nutrition, and help support higher nutrient uptake. Information is provided in the form of facts and games, while the app also uses goal setting, monitoring and feedback reminders as a way to encourage better health. Initial testing was positive, and a number of suggestions by the first set of users was incorporated to make the new, improved version which is currently undergoing clinical trials. As Dr. Riddell comments "mobile phone technology, when combined with well communicated public health nutrition recommendations, has the potential to help people make healthy food choices."

WIZE joins a growing list of health-related applications, with health apps accounting for 10-15% of all downloads in the last few years. The personalised feedback and information provided by these apps has been shown to increase several health-related outcomes, and their role in the new world of 'personalised medicine' is drawing in groups from business, academia, and government. Given the importance of iron and zinc to our well-being, apps such as WIZE could make a significant difference to public health. As such, it will be very interesting to see the outcome of Dr. Riddell's clinical trial when it finishes next year.

Dr. Riddell also plans to continue her research investigating strategies to help young adults improve their diet quality and improve their nutrient intakes. Without going into too much detail, she plans to work on an app that helps provide young adults with real time nutrition and food advice to help with meal decision making. If more people were able to follow dietary guidelines for good health (without the confusion of mass media on what makes up a healthy diet), Dr. Riddell believes we would see fewer micronutrient deficiencies, improvements in body weight and decreased dietary related chronic disease rates. It is a matter of figuring out how best to empower people to make these changes.

## Researcher Profile



#### Lynn Riddell, PhD

Associate Professor, Centre for Physical Activity and Nutrition Research and Deputy Head of School, Exercise & Nutrition Sciences, Deakin University

Lynn Riddell has long been interested in nutrition, majoring in the field for her Bachelor of Science degree, then continuing on with a PhD from the Dept. of Human Nutrition at the New Zealand University of Otago. A stint as a post-doc and then Assistant Professor at Drexel University, US, led to further success and eventually her current role as Deputy Head of the School of Exercise & Nutrition Sciences, at Deakin University. During all of these travels she has managed to find the time to write over 40 publications and become a recognised expert in the field of nutrition and public health.

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