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Science and objective thinking

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Good morning. I have the pleasure of talking today as the current holder of the President's Office of the New Zealand Grassland Association (NZGA). I would like to discuss why I feel strongly about the NZGA and one of the reasons I joined its Executive, to support *science and objective thinking*.

For our Association, science is an integral part of who we are, as mentioned in our byline: 'Fuelled by science, tempered by experience.' And at present in the global world we live in science is under fire, as never before. It is being misquoted, misused and misunderstood. On TV, radio or social media the magic phrase "A new study has shown..." can lead anywhere.

A glass of red wine is equivalent to an hour at the gym

A classic example from the Huffington Post (2015) is "A glass of red wine is equivalent to an hour at the gym". This is great news for some of you, who may be thinking "we had a great work-out last night at the dinner". But this is simply not true. What is true is there was science behind this story, but it was then wildly extrapolated to a non-existent, erroneous conclusion.

The science comes from a study at the University of Alberta, published in the *Journal of Physiology* (Dolinsky et al. 2012) on the effects of eating the compound resveratrol, found in skin of red grapes. The media in reporting this, which included video footage of a chemistry lab for authenticity, overlooked the following four points:

1. The trial was undertaken with rats
2. There was no true control treatment. Rats were given resveratrol or not, but both groups were exercised. So the trial didn't have exercise as a treatment
3. The trial didn't use red wine, but a supplement
4. Lastly, the level given in the trial is equivalent to us each drinking 100–1000 bottles of red wine a day!

Which most people would agree would have side-effects on your health. While this is humorous, it is also a sad commentary of the where some of our 'science' reporting is.

And there are many such examples. A few more I came across when writing this presentation:

- Six-year-old Croatian boy Ivan Stoiljkovic is magnetic, and metal objects stick to him (CBS News

2011). Which in response scientist Barbara Ferreira was quoted in *Discover Magazine* (2011) to say "If Ivan had indeed magnetic powers, he wouldn't have the need to bend slightly backwards to keep the items stuck to his body."

- Nail polish makes you fat (News Radio 740 KTRH 2016) based on a wild extrapolation of a study of the chemical triphenyl phosphate (Mendelsohn et al. 2016)
- A warning issued by PETA (People for the Ethical Treatment of Animals) in 2013 for pregnant women "The latest scientific evidence shows that the sons of pregnant women who consume chicken wings are more likely to have smaller penises."

In this age it can be hard for some members of society to work through what exactly is right or wrong. For example coffee, for which I am a self-professed addict, I've listed 21 claims you can easily find on the internet as to why coffee is bad for you in Table 1.

Out of interest, I looked at number 21 as hearing loss sounded strange. This comment is based on work done by Zawawi et al. (2016) in a trial on 24 albino guinea pigs, which were played loud music and given 25 mg/kg of caffeine/day, which by my calculation is equivalent to me each day drinking around 14 double espressos. But while this particular comment seems of little relevance – given there are very few albino guinea pigs drinking 14 double espressos a day – the overall picture regarding coffee is more confusing, as on the right side of Table 1 are 21 easily found claims if you search why we should drink coffee. It is no wonder the credibility of science is being questioned.

Should we throw science away?

The answer is definitively NO. We need good science and good reporting of science and, in turn, need the NZGA more than ever before.

The pastoral industry needs the science base of developing knowledge, through good objective thinking and methods. I hope one of the reasons you are here today, is because you also believe in the importance of this, in this current very spin-orientated age.

So, what does this mean to us? I've chosen three principles that I believe the NZGA does well around science and objective thinking.

1. *Qualify statements*

Many of you have presented papers at our conference. But for those that haven't already, how about presenting an NZGA paper on your work? Setting up trials with a paper in mind, in my experience, means a more rigorous process around trial aims and design right from the start. The peer-review process of our Journal gives you a framework of objectivity. And it teaches you how to cite and reference. When you quote someone correctly you provide an auditable trail for the comments you make. It allows others to source the quoted work and understand its value and limitations. The process for providing a paper is described on the Journal website.

2. *Good controls*

In the pastoral sector, we work in biological systems, which have a myriad of complex interactions. So we need to have a good control(s) as a standard to compare against, otherwise we can draw the wrong conclusion.

A nice example of this is a hoax article put out by Queen Mary University of London mathematician Matt Parker in *The Guardian* (2010). This article stated that publicly available data showed "...for every extra mobile phone mast in an area, there are 18 more babies born above the national average." When a regression line was calculated it had a correlation coefficient

of 98.1 out of 100, that is there is a 99.99997% probability of it being a real effect. The issue he was highlighting in poor media reporting is the difference between correlation and causation. He explained as the population of an area goes up, so do both the number of mobile phone towers, as do the number people giving birth. Birth rates are correlated to cell tower number, but it's the greater number of people that causes more births.

An analogous situation we come across in our industry is where farmers undertake a simple side by side paddock trial as in the top example in Figure 1. Where a fertiliser, seed mix, subsoiling or other treatment is applied in one paddock, but not in the adjacent paddock which provides a 'control' treatment. Then, if there is a difference between paddocks, we hear "This treatment (whatever it may be) is better". Which is correct, but jumps to the conclusion that this treatment is the factor causing the difference, not one of the myriad of other differences, or interactions, that occur between paddocks, both historic and on-going.

A smarter design is the middle example in Figure 1, splitting the two paddocks, so a control is included within each paddock. Here if you have a paddock effect, for example unexpected rain and pugging, this effect will be across treatments in one paddock. Or, is

Table 1 An example of conflicting information on the internet, issues with vs advantages of drinking coffee.

Issues with coffee	Why drink coffee
1. Linked to early death	1. Reduces pain
2. Caffeine may raise blood pressure	2. Increases fibre intake
3. Increased risk heart attacks young adults	3. Protection against cirrhosis of the liver
4. Caffeine linked to gout attacks	4. Lowered risk of type-2 diabetes
5. Breast tissue cysts in women	5. Lowered risk of Alzheimer's disease
6. Caffeine could cause incontinence	6. Reduces suicide risk and depression
7. Caffeine may cause insomnia	7. Protection against Parkinson's disease
8. Caffeine can cause indigestion	8. Coffee drinkers less risk of heart disease
9. Caffeine can cause headaches	9. Coffee drinkers have stronger DNA
10. Caffeine could reduce fertility in women	10. Lower risk of multiple sclerosis
11. Caffeine and miscarriage risk	11. Coffee reduces colorectal cancer risk
12. Caffeine may not be healthy for type-2 diabetics	12. Reduced liver cancer risk
13. Caffeine allergies	13. Less gout risk
14. Caffeine more forceful heart contractions	14. Longevity (prolonged life)
15. Worse menopause symptoms	15. Prevents retinal damage
16. Caffeine can increase anxiety & depression	16. Black coffee prevents cavities
17. Caffeine increases sugary drink consumed	17. May protect against periodontal disease
18. Caffeine inhibits collagen production in skin	18. Coffee may protect against melanoma
19. Caffeine could lead to risk of bone fractures	19. USDA dietary guidelines recommend it
20. Caffeine does not help sleep deprivation	20. Reduced heart attack mortality risk
21. Caffeine may impair hearing loss recovery	21. Helps people get along with co-workers

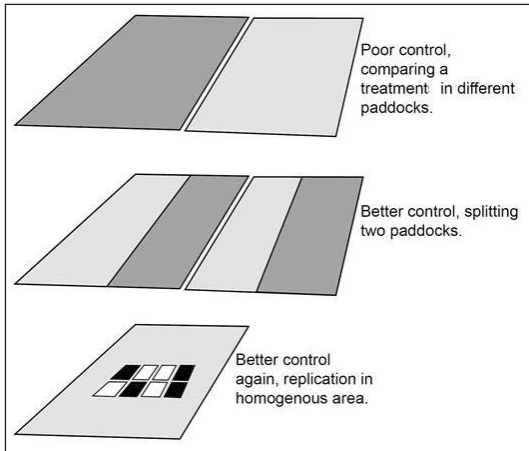


Figure 1 Getting the right control treatment is critical in any trial design.

a more sophisticated trial required such as the bottom example in Figure 1, with greater replication, in a smaller and more homogenous area, with better control of management interactions?

3. Number of trials that are required

To get a robust result, given the variability in the biological systems we work in, we often need multiple trials. This requirement is well explained by Edmeades & McBride's 2012 paper, looking at cumulative frequency. A set of over 25 experiments is presented on the effect on crop yield from applying a negligible amount of water, of 225 litres/ha in Figure 1 of that paper. As expected, the mean effect over all experiments is about a 0% change in yield. However, individual results ranged from a 22% decrease to 32% increase in yield. This paper is worth studying on the need for multiple trials.

So, trial data relate to what was found in those specific conditions. Further trial(s) may be needed to confirm the result, or test it under different conditions. It may be possible to hypothesise what the results might mean on a wider scale but beware of people extrapolating data into places it doesn't cover, as in some of the examples given earlier in this presentation.

Conclusions

In a world where "A new study has shown..." can lead anywhere, we need science, objective thinking and independent organisations such as the NZGA more than ever.

When you look at data, among other things look for: qualified statements, which you can check; good controls; and the right number of trials to provide a robust result.

The New Zealand Grassland Association strongly supports science through this conference and its Journal. And, in this "post-truth" age, my wish is you, in turn, support your Association in this role and, like me, be promoters of science and objective thinking in our industry.

REFERENCES

- CBSNews. 2011. "Magnet boy" attracts metal to chest. Accessed: 21/10/2018 from: <https://www.cbsnews.com/news/magnet-boy-attracts-metal-to-chest/>
- Discover Magazine. 2011. "Magnetic" boy is probably just "plump-and-sticky" boy. Accessed: 21/10/2018 from: <http://blogs.discovermagazine.com/discoblog/2011/05/24/magnetic-boy-is-probably-just-plump-and-sticky-boy/#.XUjFfvIzapr>
- Dolinsky VW, Jones KE, Sidhu RS, Haykowsky M, Czubryt MP, Gordon T, Dyck JR. 2012. Improvements in skeletal muscle strength and cardiac function induced by resveratrol contribute to enhanced exercise performance in rats. *Journal of Physiology* 590: 2783–2799.
- Huffington Post. 2015. A glass of red wine is the equivalent to an hour at the gym, says new study. Accessed: 21/10/2018 from: https://www.huffingtonpost.co.uk/2016/01/08/a-glass-of-red-wine-is-the-equivalent-to-an-hour-at-the-gym-says-new-study_n_7317240.html
- Mendelsohn E, Hagopian A, Hoffman K, Butt CM, Lorenzo A, Congleton J, Webster TF, Stapleton HM. 2016. Nail polish as a source of exposure to triphenyl phosphate. *Environment International* 86: 45-51.
- News Radio 740 KTRH. 2016. How nail polish makes you fat. Accessed: 21/10/2018 from: <http://www.ktrh.com/onair/ktrh-connected-with-rachel-estrada-18526/how-nail-polish-makes-you-fat-14053012/>
- PETA. 2013. Keep pregnant women out for the sake of their sons' sex organs, PETA tells buffalo wing festival. Accessed: 21/10/2018 from: <https://www.peta.org/media/news-releases/keep-pregnant-women-sake-sons-sex-organs-peta-tells-buffalo-wing-festival/>
- The Guardian. 2010. Mobile phone masts linked to mysterious spikes in births. Accessed: 21/10/2018 from: <https://www.theguardian.com/science/blog/2010/dec/17/mobile-phone-masts-birth-rate>
- Zawawi F, Bezdjian A, Mujica-Mota M, Rappaport J, Daniel SJ. 2016. Association of caffeine and hearing recovery after acoustic overstimulation events in a guinea pig model. *JAMA Otolaryngology - Head and Neck Surgery* 142(4): 383-388.

