

Red meat – essential nutrients or ethical dilemma? Symposium Highlights

Nutritional status of young women – preliminary results	2
Causes and consequences of zinc deficiency	3
Does eating red meat increase colorectal cancer risk?	4
Red meat production and the environment	5
Panel discussion	6





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Welcome to this special issue of *Vital*.

In this issue of *Vital* we share with you the highlights from the symposium, 'Red meat – essential nutrients or ethical dilemma?' The symposium held by MLA Nutrition and hosted by the Dietitians Association of Australia (DAA) not only focussed on the evidence supporting the health benefits of red meat but also addressed its possible link with cancer, and impact on the environment.

Chaired by Professor Katrine Baghurst and featuring high-calibre speakers, the symposium was attended by around 135 healthcare professionals.

Claire Hewat, Executive Director of the Dietitians Association of Australia, said DAA was pleased to host this symposium. "This symposium provided an opportunity to hear evidence-based presentations on a range of different issues relating to red meat with the overall result being that as healthcare professionals, we are better informed about red meat, and better equipped to make professional decisions about it in our practice."

I hope you enjoy this issue of *Vital* and I look forward to your feedback and ideas for future issues.

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Nutritional status of young women – preliminary results

Associate Professor Samir Samman revealed the possible negative effects of meat-avoidance on nutritional status.



Samir Samman,
ASSOCIATE PROFESSOR
OF HUMAN NUTRITION,
UNIVERSITY OF SYDNEY

Current guidelines recommend red meat consumption 3-4 times per week but little is known about the nutritional impact of lower intakes. Samir Samman, Associate Professor in Human Nutrition at the University of Sydney, has used the often restricted eating patterns of young women to unravel part of the answer, and to pose some serious questions of his own.

Associate Professor Samman and his team examined the nutritional status, dietary intake and eating behaviour of 300 female students aged 18-35 years. Women in this age group often follow restrictive eating patterns where red meat avoidance is common. The preliminary results of this study provide an insight into the impact on nutritional status when red meat intake is restricted.

Nutritional Status

Analysis of blood samples showed 36 per cent of the subjects had some degree of iron deficiency. "It is quite alarming that in a developed country where there is an adequate food supply we still see this severity of nutrient deficiency," Associate Professor Samman told the seminar audience, "yet it is consistent with data gathered 12 years ago by Binns and Rankin."

The folate status of the women was in stark contrast to their iron status: 99 per cent of the students were above the normal range for folate in red blood cells (which reflects long-term folate status). "This highlights that the recent action taken to address folate status in the population has clearly worked," explained Associate Professor Samman, "however iron fortification programs have been less successful and will always struggle because of the low absorbability of non-haem iron."

Dietary intake

A food frequency questionnaire showed that the diets were generally consistent with the recommendations of the Australian Guide

to Healthy Eating. The women met the required serves for vegetables, fruits, dairy and the 'meats and alternatives' group. However, Associate Professor Samman was concerned that the contribution of the 'meats and alternatives' group was largely from nuts and eggs rather than red meat, chicken or fish. With 36 per cent of these young women being iron deficient, Associate Professor Samman questioned the wisdom of clustering red meat, chicken, fish, eggs, nuts and legumes together in one group based on protein. He believes that future guidelines should also focus on the need to meet micronutrient requirements.

Dietary behaviour

The study found that participants who had sufficient iron levels generally met the Australian Guide to Healthy Eating recommendation, eating on average 3.2 serves of red meat per week. In contrast, those who were iron deficient ate less than half that amount - 1.2 serves per week. "When we assessed eating behaviour and dietary intake we found a strong correlation between avoidance of red meat and a deficit of iron. For example, 77 per cent of those with low iron stores reported restricted red meat eating, that is, they ate red meat less often than the recommended 3-4 times a week. This leads us to believe that avoidance of red meat may be a reason for low iron status, which is of particular importance to women of childbearing age," explained Associate Professor Samman.

"Impaired iron status in young women has implications for work capacity, cognitive function and pregnancy outcomes, and these results show that iron deficiency in Australian women is a significant public health concern," he concluded.

Key points

- 36 per cent of young women were iron deficient despite meeting Australian Guide to Healthy Eating requirements.
- 77 per cent of those with low iron stores reported restricting red meat intake to less than 3-4 times a week.
- Replacing red meat with plant sources of protein has implications for micronutrient status.

Causes and consequences of zinc deficiency

Professor Rosalind Gibson presented on the causes and consequences of zinc deficiency. She explained how inadequate intakes of zinc are frequently associated with poor food selection patterns, which also compromise the bioavailability of dietary zinc. She cautioned that although zinc deficiency was low in Australia, three groups in particular may be at risk.



Rosalind Gibson,
PROFESSOR OF HUMAN
NUTRITION,
UNIVERSITY OF OTAGO,
NEW ZEALAND

A third of the world's population live in countries with a high risk of zinc deficiency. As a result, zinc has recently been added onto the World Health Organisation's (WHO) global burden of disease list. Data from the WHO Global Database on stunting and the National Nutrition Surveys on dietary zinc intakes suggest the risk of zinc deficiency in Australia and New Zealand in general is low. However, Professor Rosalind Gibson, Research Professor in Human Nutrition at the University of Otago in New Zealand, and member of the International Zinc Consultative Group, reported that three groups may be at risk: vegetarians; toddlers and the elderly.

Vegetarians

Professor Gibson explained that zinc deficiency is often induced by diet. "If you look at countries like Ethiopia, where the risk of zinc deficiency is high, compared to where it is low, like Australia, the key difference is the source of zinc in the diet," she said. "Where zinc is dependent on plant sources, such as unrefined cereals and legumes, which are high in phytic acid, there is a higher risk of zinc deficiency (e.g. Ethiopia). There is a clear inverse correlation between phytic acid and zinc absorbed from the gut. As the phytic acid content of the diet increases, zinc absorption decreases.¹ This suggests that diets predominantly based on unrefined cereals and legumes may have a problem with zinc bioavailability."

This has implications for vegetarian diets. Professor Gibson has looked at studies comparing omnivorous and vegetarian diets in western countries. When diets with the same zinc content are compared, absorption is substantially higher in omnivorous diets, due to the inhibiting effects of the higher phytic acid content of vegetarian diets.² Conversely, when

diets are matched for high phytic acid intake, the percentage of zinc absorbed is the same, but the total amount of zinc absorbed is higher in an omnivorous diet, simply because meat-containing diets are higher in zinc.³

Professor Gibson mentioned that the growing trend towards vegetarianism among young women may place them at risk of zinc deficiency. "In our studies,"^{4,5} she said, "the prevalence of low serum zinc among both lacto-ovo vegetarians and semi-vegetarians exceeded the 20 per cent trigger level set by the WHO, indicative of a public health concern." (See Table 1.).

Toddlers

The major cause of zinc deficiency in toddlers is inadequate dietary intakes, due to high physiological requirements. Because breast milk does not supply an abundant amount of zinc it can be difficult for toddlers to meet zinc requirements during the transition from breast milk to solid food, especially if the addition of cereals, high in phytic acid, is limiting zinc absorption. The WHO Global database indicates that Australia and New Zealand have a low prevalence of stunting⁶ however the limited data on serum zinc levels suggests there is no room for complacency. Dr Elaine Ferguson (and colleagues), from Otago University, found that the prevalence of low serum zinc among toddlers from the South Island of New Zealand, was greater than 20 per cent, indicating a high risk of zinc deficiency.

The elderly

Studies in the US have indicated an increased risk in the elderly, primarily associated with a reduction in zinc absorption at a time when energy and nutrient intakes, including zinc,

are often low. As a consequence immune function may be impaired. Professor Gibson reported that 12 per cent of elderly women in Dunedin, New Zealand had low serum zinc levels and in some cases low zinc intakes suggesting this group may be at risk.

Conclusions

The data indicate that although zinc deficiency is not a risk for the general population in Australia, there are groups at risk, particularly toddlers, the elderly, and those choosing to replace animal foods with plant foods.

Key points

- Replacing red meat with plant alternatives can have a negative consequence on zinc status in two ways:
 1. Diets low in meat, or with no meat, have lower total zinc content than omnivorous diets.
 2. The higher phytic acid intake in diets high in unrefined cereals and legumes reduces zinc absorption.
- The risk of zinc deficiency in the Australian population is low though toddlers, vegetarians and the elderly may be at risk.

References:

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3. Kristensen *et al* (2006), 'Total zinc absorption in young women, but not fractional zinc absorption, differs between vegetarian and meat-based diets with equal phytic acid content', *BJN*, 95(5):963-67.
4. Donovan UM and Gibson RS (1996), 'Dietary intakes of adolescent females consuming vegetarian, semi-vegetarian, and omnivorous diets', *J Adol. Health*, 18: 292-300.
5. Gibson RS *et al* (2001), 'Are changes in food consumption patterns associated with lower biochemical zinc status among women from Dunedin, New Zealand?', *BJN*, 86(1):71-80.
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Table 1: Recommended indicators for identifying risk of zinc deficiency in populations

Indicators	Measure	High risk
Dietary Indicator	Prevalence of zinc intakes below Estimated Average Requirements (EAR)	>25 per cent
Biochemical Indicator	Per cent with low serum zinc concentrations	>20 per cent
Functional Indicator	Per cent of children <5 years old with length or height-for-age <-2.0	>20 per cent

Source: WHO/UNICEF/IAEA/ZINCG (2007)

Does eating red meat increase colorectal cancer risk?

Professor Graham Giles provided some food for thought on the recommendations for red meat consumption outlined in the recent World Cancer Research Fund (WCRF) report and highlighted the need for more research in the area of genetic susceptibility.



Professor Graham Giles,
DIRECTOR, CANCER
EPIDEMIOLOGY CENTRE,
CANCER COUNCIL OF
VICTORIA

The WCRF found the evidence for a relation between red meat and cancer 'convincing'. In his presentation, Professor Graham Giles, Director of the Cancer Council of Victoria's Cancer Epidemiology Centre, looked at the same evidence and expressed caution about concluding that the data reflected a causal link between red meat and colorectal cancer

Assessing the Evidence

Strength of association

The majority of individual cohort studies reviewed by the WCRF show a positive, but non-significant association between the consumption of red meat and the risk of colorectal cancer. When these cohort studies are meta-analysed the association becomes significant, though the effect size is small. Professor Giles outlined differences in the way data on meat intake had been reported in the cohort studies, highlighting that the meaning of a 'high' intake varied between studies. Directly comparing one study with another or summing the results of different studies needed to be done with care. Also, in interpreting the studies the possibility of unresolved confounding and the error inherent in measuring diet needed to be considered.

Professor Giles concluded that "the relative risk [for red meat and colorectal cancer] is modest, in the order of 1.2 to 1.7. Risks of this level are difficult to argue causality from. When you compare the relative risk of cigarette smoking and cancer which is in the order of 10 or 20, a relative risk of 1.4 does not summon a great need to change meat-eating habits."

Dose response

Professor Giles explained "even if you have modest risks, if one can show a dose

response – that is with increasing amount consumed the risk goes up - this adds more strength to the association." The evidence in the WCRF report that supports a dose response is largely from an earlier North American study. A later report from the same cohort showed a much lower relative risk and a lack of dose response, suggesting that the evidence is inconclusive.

"The relative risk [for red meat and colorectal cancer] is modest, in the order of 1.2 to 1.7. Risks of this level are difficult to argue causality from."

Potential mechanisms

Professor Giles also discussed possible mechanisms underlying the positive association between red meat and cancer such as cooking methods; an effect of haem iron; and genetic variation in susceptibility.

Of these the most established line of research relates to charring, which is known to produce carcinogenic substances. Yet Professor Giles reported that there is little evidence that charring of meat actually increases risk for humans. It appears that DNA repair genes can deal with modest levels of carcinogens in food. "Although this is an active area of research, there's not a lot of hard evidence to confirm that barbecuing and charring meat actually increases risk," concluded Professor Giles.

Studies investigating whether haem iron might affect cancer risk and whether any risk is modulated by alcohol and calcium are underway.



Genetic variation

Colorectal cancer runs in families, suggesting that some individuals are carrying genetic mutations that predispose them to the disease. Professor Giles suggested that there may be a subgroup within the population who carry defects in DNA repair genes. "The modest risk [for the total population] could be due to the fact that we're not all at risk. However there may be a subgroup with defects in their DNA repair genes with a relative risk of 15, compared to 0.1 for the rest of the population."

Conclusion

Professor Giles does not see how the evidence presented by the WCRF could underpin their quantitative recommendations for red meat. "I'm still unsure, having read the report, how they've come to their recommendations [for red meat]," he said. "I don't believe the evidence is there to give that piece of advice from the data they had available."

He made the point that an individual food's impact on cancer pales into insignificance beside the increasing problem of obesity and suggested that the area of genetic susceptibility to cancer might prove more fruitful for researchers: that looking at individuals rather than individual foods might offer new clues to cancer prevention.

Key points

- Relative risk for highest meat intake versus lowest meat intake in relation to colorectal cancer is in the order of 1.2-1.7.
- Relative risk for lung cancer among smokers is 10-20, compared to non-smokers.
- There is no conclusive evidence of a dose response relationship between red meat consumption and colorectal cancer.
- There is little evidence that charring meat increases risk in humans.
- Genetic susceptibility is suggested to be an area for future research in cancer prevention.

Red meat production and the environment

With increasing attention on climate change, Professor Nick Costa focused on just one aspect of environmental sustainability - greenhouse gas emissions. He addressed the challenges facing the livestock industry and the past and current areas of research looking at ways to reduce methane emissions from ruminants.



Nick Costa,
PROFESSOR OF
SUSTAINABLE
AGRICULTURE,
MURDOCH UNIVERSITY

Global warming poses major challenges to us all, demanding that we 1) adapt to the existing climate change; and 2) alter our current practices to prevent further damage. Since 1960 all areas of Australia have experienced steady or increasing temperatures, and significant changes in rainfall patterns. As farmers adapt to changing climates, the Australian livestock industry as a whole is investigating ways of reducing its environmental impact.

Sources of greenhouse gases

Nick Costa, Professor of Sustainable Agriculture and Dean of the School of Environmental Science at Murdoch University reported that the bulk of methane-associated greenhouse gases come from landfills, natural gas systems, coal mining and ruminant animals with the livestock industry currently contributing about 11 per cent to the total emissions in Australia.

Ruminants and methane

Ninety-seven per cent of livestock greenhouse gas emissions, principally methane, arise from enteric fermentation. The rumen is one of the four stomachs present in sheep, cows and goats, explained Professor Costa. "There are more than 600 species of anaerobic organisms living in the rumen, and the ones that concern us are the methanogens. These organisms convert carbon dioxide and

hydrogen to methane and so are targets for reducing the methane emissions of ruminants."

Reducing methane production

Professor Costa discussed the extensive research and development projects the Australian livestock industry has undertaken to address the issue of methane production, specifically looking at ways of controlling methanogens.

Potential methods of controlling methanogens include:

1. sulphur hexafluoride, a chemical methane inhibitor;
2. vaccination programs against methanogens;
3. introducing acetogen organisms from marsupials, which don't produce methane, into ruminants;
4. improving feed efficiency.

Although significant challenges remain, Professor Costa said that so far the research has found feed efficiency to be the most successful method as it speeds up the growth of an animal, therefore resulting in lower methane production over its lifetime.

'The bulk of methane-associated greenhouse gases come from landfills, natural gas systems, coal mining and ruminant animals.'

Professor Costa concluded that all agricultural systems, not just the livestock industry are facing environmental challenges; however the industry has taken considerable steps to change production systems through an extensive research and development program. He advised that

"the unique and important nutritional benefits of red meat should not be lost in the debate about the environmental impact of the livestock industry in Australia."

Key Points

- Methane-associated greenhouse gases come from landfills, natural gas systems, coal mining and ruminant animals with emissions from the livestock industry contributing about 11 per cent to Australia's total greenhouse gas emissions.
- Methane is produced by anaerobic organisms called methanogens, present in the rumen of sheep, cows and goats.
- The Australian livestock industry undertakes extensive research and development projects to address the issue of environmental sustainability including investigating ways to reduce methane production through controlling methanogens.
- The unique and important nutritional benefits of red meat should not be lost in the debate about the environmental impact of the livestock industry in Australia.

Panel discussion

The symposium concluded with a panel discussion, involving the audience, which generated some interesting debate on whether the current Australian Guide to Healthy Eating recommendation of red meat 3-4 times a week is still relevant.



The panel: Associate Professor Samir Samman, Professor Rosalind Gibson, Professor Nick Costa and Professor Linda Tapsell.

Consumers are advised to limit red meat consumption to 500g (cooked) per week by the World Cancer Research Fund (WCRF) and there are suggestions that reducing red meat consumption may help reduce our carbon footprint. With this in mind and with the Dietary Guidelines for Australians and Australian Guide to Healthy Eating up for review, the panel discussion addressed the question of whether the current recommendation to eat red meat 3–4 times a week should change.

Professor Linda Tapsell, who acted as DAA representative on the night, believed the answer was no. “It comes back to the fundamental question of balance. No matter whether our particular concerns lie in meeting requirements such as zinc intakes, or reducing possible risk of diseases such as cancer, we can’t be extreme either way. When all is considered we are doing well with the recommendations we have – they suggest to me that we have got the balance that we need.”

The audience raised concerns about extreme thinking on meat resulting in meat avoidance. Associate Professor Manny Noakes, Senior Research Dietitian at CSIRO Human Nutrition, said, “we are seeing a switch towards making non-meat-eating a virtue. Whilst there may be healthy vegetarian patterns there are many vegetarian patterns that are not healthy. The WCRF report does not recommend meat-avoidance. There is an important role for animal foods to play in nutrition.” Professor Nick Costa added that “the WCRF’s recommendations are for up to 750g of raw red meat per week,” a long way from meat-avoidance.

Associate Professor Samir Samman is particularly concerned about the perceived virtues of meat avoidance among young women, who he says practice dietary restriction in the context of inadequate nutrition knowledge. He reiterated his concern that plant sources of protein are not nutritionally equal to animal sources. “I think we should fine-tune the way we separate

foods into groups. Legumes and eggs don’t belong in the same category as meat, fish and chicken. Legumes and eggs are not substitutes, certainly not for iron. The current grouping of foods appears to be driven by protein requirements not micronutrient requirements.”

Other comments from the audience reflected that it was easier to meet iron, B12 and zinc requirements when red meat was included in the diet but that is not to say it can’t be achieved with vegetarian eating patterns.

The consensus

The consensus view in the audience following the symposium was that the questions over colorectal cancer raised by the WCRF report, and the environmental issues around sustainable farming, do not negate the nutritional benefits of red meat. When asked for a show of hands most of the audience indicated they did not think the current recommendations for red meat consumption should change.