The benefits of constraining processed meat and red meat consumption in New Zealand: a public health perspective

Christine Cleghorn, Nick Wilson

ABSTRACT

There is now strong scientific evidence of an increased risk of colorectal cancer with processed meat consumption, some evidence of red meats being associated with colorectal cancer and some evidence of an association between red and processed meat and cardiovascular disease and type 2 diabetes. This is important as these diseases collectively impose substantial health loss for New Zealanders and also large costs on publicly-funded health systems. There are also other indirect health issues involved with meat production including pollution of waterways and greenhouse gas (GHG) emissions from ruminant agriculture that contribute to climate change. Fortunately, there are a range of plausible options for New Zealand agencies to consider (such as GHG taxes applied to agriculture and health warning labels), if they decide to encourage reductions in the consumption of processed and red meat consumption in this country.

It seems timely to consider the issue of processed and red meat consumption in New Zealand given a recent International Agency for Research on Cancer (IARC) monograph on the related cancer risk. Furthermore, there are growing concerns around the need to make dietary patterns more sustainable, including around agricultural greenhouse gas (GHG) emissions and the threat of climate change. Here we briefly look at this topic from a public health perspective and give consideration to the possible options for New Zealand moving forward.

Meat consumption and risk of chronic disease

In September 2015 the cancer agency of the World Health Organization, IARC, published a monograph on the carcinogenicity of consuming red and processed meat. Over 400 different epidemiological studies on cancer in humans provided data on processed meat and over 700 provided data on red meat. IARC defines processed meat as “meat that has been transformed through salting, curing, fermentation, smoking or other processes to enhance flavour or improve preservation. Most processed meats contain pork or beef, but processed meats may also contain other red meats, poultry, offal or meat by-products such as blood”. Examples of processed meat include hot dogs, ham, sausages, corned beef, beef jerky, canned meat and meat-based preparations and sauces.

In this monograph, IARC classified processed meat as being carcinogenic to humans, based on “sufficient evidence” in humans that the consumption of processed meat causes colorectal cancer. An association with stomach cancer was also seen, but the evidence is described as “not conclusive”.

In the IARC monograph, red meat refers to unprocessed mammalian muscle meat, including beef, veal, pork, lamb, mutton, horse and goat. Red meat was classified by IARC as probably carcinogenic to humans, based on limited evidence that the consumption of red meat causes colorectal cancer in humans and strong mechanistic evidence supporting a carcinogenic effect.
Evidence of associations with pancreatic cancer and prostate cancer were also reported.4

IARC has categorised the association of processed meat with cancer in the highest category of strength of evidence, but how strongly is processed meat actually associated with cancer? IARC reported that a 50g portion (eg, 1–2 rashers of bacon) of processed meat eaten daily increases the risk of colorectal cancer by 18%. Only 12.7% of the New Zealand adult population ‘never consumed (or not consumed in past four weeks)’ processed meat,5 and the average total consumption of processed meat (a narrower definition, ignoring corned beef, canned meat and meat-based preparations and sauces) ranged from 24g per day in non-Māori females to 56g per day in Māori males in the last New Zealand adult nutrition survey (unpublished data supplied by Otago University Life in New Zealand staff (Charlie Blakey, Claire Smith, Winsome Parnell)). So this increased risk is relevant to the average New Zealander and equates to 9% to 20% increased risk compared to an equivalent New Zealander who did not consume processed meat.

The risks of cardiovascular disease (CVD) and diabetes are also likely to be relevant. A recently published meta-analysis found that those in the highest category of consumption of processed meat and red meat had an increased risk of dying from CVD compared to those in the lowest category of consumption6 (see Table 1). Similarly, the risk of type 2 diabetes was between 9% and 35% higher per 100g consumption of red meat and between 24% and 105% higher for 50g consumption of processed meat.7 While the results from such meta-analyses should be interpreted with caution due to the potential of residual confounding, the overall evidence from systematic reviews in recent years (Table 1) seems enough to justify concern from a public health perspective.

Some indication of the likely scale of the impact of such risks comes from the Global Burden of Disease study. It has been estimated that approximately 841,000 global deaths per year, due to colorectal cancer, coronary heart disease and diabetes, are attributable to diets high in processed meat8 (ranked the 14th most important risk factor for health loss in Australasia). This study estimates that 13% of the disability-adjusted life-years lost from coronary heart disease globally are attributable to processed meat consumption. Furthermore, an estimated 38,000 deaths per year, due to colorectal cancer and diabetes, were attributed to (non-processed) red meat consumption globally each year.8

Other nutritional issues

Red meat is a good source of protein and certain micronutrients such as iron, zinc and B12.9,10 But such nutrients can be obtained from plant-based foods with the partial exception of B12 which can be obtained from eggs, dairy and some fortified plant foods, fermented soy products such as tempeh11 and nori12 (the seaweed commonly used to wrap sushi). Furthermore, these alternatives may provide a healthier source given the lower associated risks of various diseases. For example, nuts are a good source of protein and micronutrients and the evidence favouring nut consumption for reduction in CVD deaths, cancer deaths and all-cause mortality is relatively strong (see these systematic reviews13,14).

Environmental impacts of meat production and consumption

Last December 195 nations, including New Zealand, agreed to a goal of limiting global warming to well below 2°C above pre-industrial levels at the COP 21: UN Climate Change Conference in Paris. In order for this to happen, global emissions need to peak as soon as possible and then rapidly reduce. It has been estimated that by the year 2050, with current global dietary trends (if unchecked), diets high in red meat would be a major contributor to an estimated 80 percent increase in global agricultural GHG emissions from food production and global land clearing.2 Yet alternative diets “could, if widely adopted, reduce global agricultural GHG emissions, reduce land clearing and resultant species extinctions.”2

More specifically, a review has reported that life cycle analyses of animal foods in OECD countries yield consistent results for their impacts on use of land, energy and climate change impacts.15 The production of beef uses the most land and energy, and has the greatest potential to impact global warming, followed by the production of
pork and chicken (when considering per kg of product and also per kg of protein from these products). The use of such metrics (eg, impact per weight of protein) is likely to be more appropriate than the metrics used in some other studies (eg, impact per caloric intake used by in a recent study by Tom et al16). This is because protein is one of the main non-taste reasons as to why people consume meat products.

An estimated 49% of New Zealand’s GHG emissions (in CO₂ equivalents) comes from agriculture, which is well ahead of the next largest source: the energy sector at 40%.17 Work carried out in New Zealand suggests the potential for major reductions in GHG emissions from a shift to different dietary patterns that involve less red meat (eg, towards an Asian-style diet, Mediterranean style diet and vegetarian diets).18 Such diets were also estimated to be lower cost than the traditional New Zealand diet.18

Another concern for the New Zealand context is water pollution caused by livestock. New Zealand research on river catchments has reported “high level of ruminant faecal contamination was detected all over the farming areas”. Cattle grazing in wetland areas may be a particularly important contributor to this problem.20 A report by the Parliamentary Commissioner for the Environment has noted that there is high public concern and vigorous debate on water quality in New Zealand.21 Furthermore, that most of the nitrogen that is present in fresh water has come from animal urine. While this report did indicate growing land use for dairy farming in New Zealand, there were still over five times higher land use dedicated to sheep and beef farming (see Figure 3.4, p29 in the Report).

### Livestock production and microbes

Antibiotic resistance development and spread is linked with animal production, and of 51 antibiotics commonly used in aquaculture and agriculture, 76% are also of importance in human medicine.22 One part of this global problem is with intensive pig production.23 Indeed, in New Zealand pig offal isolates of *Campylobacter* have been found to be highly erythromycin resistant,24 and other New Zealand research has found that for: “commercial pig farms which used antimicrobial agents, there was a higher level of antimicrobial resistance in the E.

<table>
<thead>
<tr>
<th>Systematic review</th>
<th>Health outcome</th>
<th>Relative risk (95% CI)</th>
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<tr>
<td><strong>Red meat (for each additional 100g/day consumed)</strong></td>
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<tr>
<td>IARC 2015⁴</td>
<td>Colorectal cancer (incidence)</td>
<td>1.17 (1.05–1.31)</td>
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<td>GBD 2015⁵</td>
<td>Colorectal cancer (incidence)</td>
<td>1.18 (1.05–1.31)</td>
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<td></td>
<td>Type 2 diabetes (incidence)</td>
<td>1.09 (1.06–1.12) to 1.35 (1.09–1.68)*</td>
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<tr>
<td>Abete et al 2014**</td>
<td>All-cause mortality</td>
<td>1.04 (0.92–1.17)</td>
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<td>CVD (mortality)</td>
<td>1.15 (1.05–1.26)</td>
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<td><strong>Processed meat (for each additional 50g/day consumed)</strong></td>
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<tr>
<td>IARC 2015⁴</td>
<td>Colorectal cancer (incidence)</td>
<td>1.18 (1.10–1.28)</td>
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<td></td>
<td>Type 2 diabetes (incidence)</td>
<td>1.24 (1.19–1.29) to 2.05 (1.49–2.78)*</td>
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<td></td>
<td>CHD (incidence)</td>
<td>1.21 (1.13–1.29) to 1.94 (1.16–3.19)*</td>
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<tr>
<td>Abete et al 2014**</td>
<td>All-cause mortality</td>
<td>1.25 (1.07–1.45)</td>
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<tr>
<td></td>
<td>CVD (mortality)</td>
<td>1.24 (1.09–1.40)</td>
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*Range presented, varies depending on age group.
**We did a Medline search with the term “meat” and “mortality” for the period from January 2013 to June 2016. This was limited to ‘human’ and ‘meta-analyses’. The most recent meta-analyses that reported dose response analyses are reported in this table.
coli and Enterococcus spp cultured from the faeces of pigs compared with an organic farm which used no antibiotics.\textsuperscript{25}

Mass pig production also contributes to the global risk of pandemic influenza in humans, along with poultry production.\textsuperscript{26} Indeed, the “swine flu” pandemic arose in 2009 from influenza virus infection in US pigs.\textsuperscript{27} While New Zealand pig farming is likely to be a tiny part of the risk of new influenza pandemics internationally—there is arguably a global public health rationale for minimising factory farms for pigs in all countries.

Alternative perspectives

This article uses a public health perspective but we recognise that a range of other perspectives could be taken. For example, if the size of the New Zealand economy was a dominant consideration, then the Government may wish to move cautiously on anything that might impede the export-orientated red meat production sector. But this is a complex issue as this sector could conceivably benefit in the long-term if its production levels were somewhat lower but were at the same time more sustainable (ie, New Zealand meat exports became more favoured by environmentally-concerned overseas customers). Furthermore, the government needs to consider all costs and benefits to society and so should balance economic considerations with health and environmental ones (including the health costs from chronic diseases). Indeed, as tourism is a larger contributor to the New Zealand economy than meat exports, such issues as protecting the New Zealand environment (including avoiding the pollution of waterways) become an even more important consideration.

Another perspective is around the ethics of killing animals for food and around animal welfare. While there is a vast philosophical literature on such topics, there is likely to be fairly widespread public agreement that animal welfare does matter and that farmed animals should not suffer unnecessary pain and deprivations. Unfortunately there is evidence that modern factory-farming practice causes animal suffering in various forms, see these two systematic reviews on pain in farmed piglets.\textsuperscript{28,29}

Potential responses by New Zealand agencies

Individuals can make their own decisions about reducing food-related risks to health and the trade-offs (eg, taste preferences, food costs etc). But New Zealand health agencies have specific responsibilities and should be concerned about reducing disease burdens and also reducing the costs of such chronic diseases to the taxpayer-funded health system. For example, there could be large savings to the health sector from reducing CVD (eg, up to 211,000 quality-adjusted life-years gained for reducing CVD by changing levels of dietary salt, as per New Zealand modelling work\textsuperscript{30}). Similarly, the cost associated with treating colorectal cancer in this country is large at around $130 million per year ($43,000 per case).\textsuperscript{31} While there is probably enough information for health agencies to be concerned about processed and red meat consumption, they may also need to commission more research into the health consequences of dietary changes. For example, can the health gains be quantified and are there any risks (eg, some people replacing meat products by increasing intake of ultra-processed foods).

Government agencies concerned with meeting New Zealand’s international commitments around reducing GHGs should have an interest in lowering these emissions from the agricultural sector. Local government should also have interests in water quality improvements through reductions of livestock-based agriculture. So what then could be done if these New Zealand agencies decided to act on this topic? One place they could start is to promote the inclusion of agricultural GHGs in New Zealand’s system for pricing carbon. At present the Emissions Trading System in New Zealand (which has multiple design problems\textsuperscript{32,33,34,35}) does not include such gases and so the agricultural sector is currently getting a free ride while the rest of New Zealand pays for carbon emissions. Agricultural GHG taxes (such as methane and nitrogen taxes) are internationally regarded as potential instruments to help achieve emissions reductions,\textsuperscript{36–40} though clear gaps exist in the evidence-base around the potential co-benefits for health.\textsuperscript{41,42} These taxes could work in New Zealand by taxing each ruminant animal arriving...
at the freezing works with the likely result being the increase in processed and red meat prices. Additional taxes for GHG emissions from manure would increase the price of pork (pigs would be exempt from the tax on methane as they are not ruminants). These higher prices are then likely to reduce consumption of these meat products (as per basic economic theory and as seen with taxes on tobacco, alcohol and soft drinks). Research into the health, environmental and welfare implications of consumers switching their consumption from red and processed meat onto poultry, fish or plant-based protein as a result of these taxes may be useful for guiding further policies.

Other options that could be assessed and then evaluated in trials include the following:

- Regulations to limit the portion size and use of processed and red meat in government-funded institutions (eg, schools, hospitals and military camps). Indeed, the National Health Service (NHS) Carbon Reduction Strategy for England has recommended the NHS reduce its reliance on meat in hospital food. Such institutions could even test out having regular days with only vegetarian options.

- Regulations to require warning labels on processed meat products (eg, on the cancer risk or other aspects such as the high salt levels in some of these products).

- Ministry of Health funded promotional campaigns to improve New Zealand dietary patterns. For example, themes for campaigns could be based on a report published by the global food security programme on ‘How to eat well for a healthy planet’. It suggests eating meat in smaller portion sizes, making dishes with less meat by incorporating other plant sources of protein and using small quantities of meat as a garnish to add flavour to dishes. Myths that vegetarian diets are inadequate or unhealthy could also be addressed.

**Conclusions**

There is strong scientific evidence of an increased risk of colorectal cancer with processed meat consumption in addition to some evidence of red meats being associated with colorectal cancer and red and processed meat being associated with cardiovascular disease and type 2 diabetes. These diseases collectively impose substantial health loss on New Zealanders and large costs on the publicly-funded health system. Additionally, meat production adds to the pollution of waterways and increases GHG emissions which contribute to climate change. Fortunately, there are a range of options for New Zealand agencies to consider if they decide to encourage reductions in processed and red meat consumption in this country, including agricultural GHG taxes, health warning labels and promotional campaigns.

**Competing interests:**

Nil.

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