Red meat and poultry

This position statement outlines the key findings and recommendations of the Heart Foundation's Expert Nutrition Policy (ENP) working group on the relationship between red meat and poultry and heart disease. This review was undertaken to address new evidence and update the Heart Foundation's position on meat and poultry developed in 1999.

EXECUTIVE SUMMARY

Previous evidence reviewed by the Heart Foundation on dietary patterns identified that no one food or nutrient should be solely promoted to improve heart health. Instead, focusing on what foods are eaten together to form a dietary pattern within an individual's, or whānau's, lifestyle, is likely to result in the greatest health benefits.

Dietary patterns for optimal heart health do not have specific ranges for carbohydrate, protein or fat intake, but do share common features. These include eating more vegetables, fruit, legumes, whole grains, nuts and healthy plant oils. These dietary patterns may also include some fish, poultry, lean meats and reduced fat dairy, and minimise the intake of processed red meat.

The Heart Foundation assessed the evidence on unprocessed red meat and poultry intake in heart health outcomes up to April 2020, which informs this update to our position. Current literature was consistent with the dietary pattern work but provided new evidence on the maximum amount of red meat recommended and the replacement of red meat in the diet.

For those consuming more than 350g of red meat per week, the Heart Foundation suggests reducing this intake to reduce the risk of heart disease and stroke. It was found that replacing at least one to two red meat meals per week with plant protein equivalents such as legumes, soy or nuts improved cholesterol levels. Overall, poultry had a neutral effect on heart health when considered within the context of the whole diet.

Alongside the heart health benefits identified, additional benefits to sustainability and potential improvements in health equity, related to reduced food costs, were identified when reducing red meat intakes to below 350g per week and replacing meat with plant sources of protein.

KEY OUTCOMES

Reducing red meat intake to less than 350g per week (cooked weight) is beneficial to reduce the occurrence of heart disease. Replacing red meat in meals with high-protein plant alternatives (such as legumes, soy or nuts) has been shown to reduce LDL cholesterol levels.

There was limited evidence to identify the effects of poultry intake on heart health. When looked at in the context of the whole diet, poultry had a relatively neutral impact on heart health. Avoiding deep fried poultry and removing skin and visible fat will be heart healthier choices.

Although this evidence summary has identified benefits with reducing red meat intakes, this advice should be considered within the context of an overall heart healthy diet.

BACKGROUND

In terms of the relationship between diet and the risk of heart disease, diet can include intakes of nutrients, foods, food groups or dietary patterns. The Heart Foundation's 2013 evidence paper on dietary patterns identified several eating patterns that reduce the risk of cardiovascular disease (CVD) such as coronary heart disease (CHD) and stroke (1). CHD and stroke are the leading causes of death in New Zealand (2). Estimates have shown total costs of coronary heart disease per year range from $193 – 203 million when accounting for both direct and indirect medical costs (3). In this position statement, the recommendations around red meat and poultry intake were considered within the context of a heart healthy dietary pattern.

Defining red meat, poultry and processed meat

In this paper, red meat is defined as unprocessed beef, veal, lamb, mutton, pork, goat and venison. Poultry is defined as unprocessed chicken. Turkey and duck are less common within the New Zealand diet and there is a lack of research looking at these foods individually in relation to heart health.

Processed meat is defined as *'any meat that has been transformed in some way through salting, curing, fermentation, smoking, or other processes to enhance flavour or improve preservation'*(4). Processed meats are commonly made from beef and pork but can also be made from poultry, offal and by-products such as blood (4). Processed meats include sausages, ham, bacon, corned beef, canned meat and meat-based prepared foods and sauces (4). Processed meats of all kinds are not included in this position statement as substantial evidence already exists between their intake and adverse health outcomes, including colorectal cancer and an increased risk of heart disease (5-7).

Nutrient content of red meat and poultry

Red meat is rich in protein (~20-25g protein per 100g) as well as iron, zinc, niacin, riboflavin, vitamin B12 and thiamine (8). Poultry is a source of protein, niacin, vitamin A, magnesium and zinc (9).

The Heart Foundation position on dietary patterns and fat recommends choosing foods lower in saturated and trans-unsaturated fat (1). Almost half the fat in red meat is saturated fat (SFA) – predominantly palmitic acid with some stearic acid. The remaining fat is mostly monounsaturated fat (MUFA) and a small amount of polyunsaturated fat (PUFA) - namely linoleic acid (9). The fat in chicken is about one-third SFA, with the majority being palmitic acid. Overall, lean chicken breast has a higher proportion of MUFA and PUFA and a lower proportion of SFA and trans-fat than beef and lamb.

The quality of the meat and its nutrient composition is influenced by the animal's breed, feed source (grain, pasture and grass) and animal genetics (10). Meat produced from pasture-finished cattle have higher levels of both short and long-chain omega-3 PUFA, compared with cattle from a highly-concentrated grain diet (11). There is a lack of evidence to show whether this small variance in fat composition translates to any difference in the association between beef and heart health.

Further nutrient composition variations are noted in red meat depending on cut (rump, sirloin etc.) and in chicken depending on the part of the bird (wing, thigh, breast, leg etc.). Fat modification in both preparation (fat removed or retained, skin on or off) as well as cooking methods (raw, baking, frying or adding fat) also influences the fat composition for both red meat and poultry.

Red meat and poultry consumption in New Zealand

In New Zealand, the Ministry of Health Eating and Activity Guidelines for Adults recommend a red meat intake less than 500g of cooked red meat a week (700-750g raw meat) and, within this recommendation, a suggested serving size of 100g (cooked meat) (12). The World Cancer Research Fund recommends consuming no more than 350-500g of cooked red meat per week and little to no processed meat (5). The Australian Heart Foundation's 2019 update on meat and heart health resulted in a reduced recommendation to a maximum of 350g cooked red meat per week (13). The updates to dietary recommendations overseas have seen a decrease in the maximum recommended amount of red meat consumed as new evidence on its health impact emerges.

National nutrition surveys provide the most accurate picture of food consumption and therefore dietary intakes across New Zealand. The last Adult National Nutrition Survey (2008/2009) reported 60% of adults eating red meat at least three times a week (65% for males and 57% for females) (14). A total of 85% of adults reported eating chicken at least once a week (12). More than half the population reported that they regularly or always trimmed the excess fat from meat (14). For adults, the average beef and veal intake was 41.1g per day, while lamb and mutton intake was 9.3g per day (both cooked weight) (15). These average intakes equate to 50.4g per day of beef, veal, lamb and mutton and do not include an average pork intake. Average population intakes of pork, goat, venison and poultry are not currently available in New Zealand.

A 2019 survey looking at the dietary habits of 1,346 New Zealand adults reported 88% of respondents ate red meat at least once a week and more than 50% ate red meat three to four times each week or more (16). Another recent report of New Zealanders showed that one third of those surveyed were consciously limiting their meat consumption (17). From 2018-2019, 24% of meat eaters reported reducing their meat consumption and those who defined themselves as 'flexitarian' had increased by 18% (17).

In New Zealand, there is growing awareness around health and sustainability issues that are shaping consumer decisions. The popularity of poultry has increased in New Zealand and is projected to increase by a further 1.6kg per capita by 2028 (18). In contrast, consumption of beef and veal is projected to decrease in New Zealand by a further 1kg per capita in the same period (18).

EVIDENCE FOR RED MEAT AND POULTRY AND HEART HEALTH

In updating the Heart Foundation's position on red meat, poultry and heart health, the Heart Foundation Expert Nutrition Policy (ENP) working group followed a rigorous process to consider the available scientific evidence. This process was undertaken by the ENP working group with additional independent systematic review experts, Dr Vanessa Jordan and Emeritus Professor Peter Herbison.

A systematic search was conducted up to April 2020 to identify systematic reviews and meta-analyses of trials or prospective observational studies on red meat intake and heart health outcomes.

The systematic reviews and meta-analyses were ranked and the most recent publications with relevant health outcomes were assessed using ROBIS (risk of bias in systematic reviews) to identify reviews with a low risk of bias to inform the evidence base of this position (19).

Authors of the reviews were contacted for further information and an extension of their analysis was also completed, where possible, to better inform this position on red meat intakes and heart health.

The GRADE (Grading of Recommendations Assessment, Development and Evaluation) framework was used to assess the quality of the evidence available on the topic as high, moderate, low or very low quality (20, 21). The GRADE assessments summary is in **Appendix 1**.

Three reviews published in 2019 by the same research group within the area of red meat and heart health were identified (22-24). Each paper reported a small or no beneficial effect of reduced or lower red meat intake. These papers were considered by the ENP working group but not used to inform this position statement as the analyses reported varied from what was initially planned and outlined in the pre-registered study protocol. This deviation from how the analyses were reported in these high-profile reviews indicated an unacceptable risk of bias.

Poultry was outside the scope of the review process outlined above. However, we included commentary within this position statement based on a recently available review of the evidence (7).

Coronary heart disease, stroke and red meat

Evidence on coronary heart disease and stroke outcomes came from a 2017 systematic review and meta-analysis identified as having a low risk of bias (25). Bechthold et al. identified 261 publications and, from this, 15 publications that reported on meat intakes and coronary heart disease or stroke were identified. These publications followed 484,140 participants for 18.4 years, accumulating in 8.9 million person years. Meat intakes of participants ranged from 9–205g per day for coronary heart disease and from 6–195g per day for stroke.

This review looked at the relationship between the highest and lowest intakes of red meat on coronary heart disease and stroke as well as a dose-response of each additional 100g of red meat. The highest intakes of meat showed a 16% increase in risk of both coronary heart disease and stroke compared with the lowest intakes (25). The lowest intakes of red meat averaged less

than 50g per day for both coronary heart disease and stroke and the highest intakes averaged more than 100g per day (cooked meat weight) (25).

Each additional 100g of red meat eaten per day was associated with a 15% higher risk of coronary heart disease and a 12% higher risk of stroke (25). A significant non-linear, dose-response showed that eating red meat up to 100g per day was associated with a 10-20% higher risk of coronary heart disease and stroke (25). This evidence was assessed as moderate quality using the GRADE framework.

Blood lipids and red meat

Previous studies have shown that plant proteins such as soy, pulses and nuts lower blood lipids (26, 27). In addition, dietary patterns focused on more plant foods, such as the Mediterranean dietary pattern, have been associated with reduced cardiovascular disease risk and mortality (28, 29).

To show the relationship between blood lipids and red meat, a 2017 systematic review and meta-analysis of randomised controlled trials was identified with a low risk of bias (30). Li et al. initially considered 112 publications, and trials ranged from three weeks to four years, with a median trial follow-up of six weeks. The median protein substitution of red meat with plant proteins was 30g per day. This reflects the substitution of one to two servings of red meat with plant proteins (legumes, soy and nuts). From these 112 publications, 10 relevant publications, including 413 people, were identified.

This review looked at the change in blood lipids when consuming plant proteins compared with red meat. When compared with those randomised to consume red meat, LDL cholesterol levels were 0.26 mmol/L lower and non-HDL cholesterol levels were 0.20 mmol/L lower in those randomised to consume plant proteins (30). This evidence was assessed as high quality using the GRADE framework.

Poultry

In addition to the literature review and assessment on red meat, recent evidence on poultry was identified in a review by Ndanuko et al (7). Few studies show a strong risk or benefit to heart health when consuming poultry. Studies considered poultry as chicken, some included chicken with and without skin, others included chicken, turkey and rabbit. Overall, most studies showed a relatively neutral effect of poultry on cardiovascular health (31). Within this review, a meta-analysis of nine cohort studies (n=1,660,588) from 2014 showed poultry was not associated with CVD or CHD mortality (31). Poultry consumption for the highest intake ranged between 50-100g per day (0.5-1 serve per day) (31).

Certainty of evidence

Using data from reviews that underpin this position statement, the certainty of evidence in this area was assessed as moderate to high quality (Appendix 1) (25, 30). Consistent findings from both trials, that studied lowering meat intakes, and from cohort studies, that consider meat

intake over time, increases the confidence in the association seen between red meat and heart health.

Although residual confounding cannot be entirely ruled out, the most adjusted effect sizes were combined within the most conservative statistical model, which increases the confidence that the associations observed reflect a relationship between higher meat intakes and poorer heart health outcomes. Consideration is given to the fact that participants self-report their own food intake, which can lead to errors.

Adverse blood lipids and high blood pressure are well-established risk factors for heart disease. It is also important to acknowledge the recent advances in modern nutrition science that considers the diversity of diet-related risk pathways when it comes to heart disease (32). This includes looking beyond changes to blood lipids and blood pressure to assess diet-related cardiovascular risk. There is growing evidence that diet (encompassing nutrients, single foods, combinations of foods and dietary patterns) influences other factors such as oxidative stress, inflammation, visceral adiposity and the microbiome (32). More research is needed to understand these factors and their relationship to cardiovascular health as well as how to adequately assess diet-related cardiovascular risk in addition to that of blood lipid changes.

Very few studies look at poultry on its own as a risk factor for CVD and this limits the body of evidence in the form of recent systematic reviews and meta-analyses.

When looking at intervention studies, the length of these studies and the overall dietary patterns from international studies are unlikely to represent the average intake of the New Zealand population. Therefore, generalising these results must be done carefully.

DISCUSSION

Overall, the most recent evidence shows that reducing red meat intake is beneficial to reduce the risk of heart disease and stroke. In addition, swapping red meat with plant protein (soy, legumes and nuts) proved to be of benefit in reducing both LDL and non-HDL cholesterol levels. These modifications need to be considered within the context of the entire dietary pattern as well as the ability of the individual or whānau to maintain the consistency of this eating pattern over time.

Based on observational data, findings suggest an intake of less than 50g per day (cooked weight) of unprocessed red meat reduces the risk of coronary heart disease and stroke. If meat is chosen as part of a heart healthy eating pattern, it should be limited to less than 350g of cooked red meat per week. The New Zealand Eating and Activity Guidelines advise a serving size of 100g (cooked) red meat. Therefore, it is recommended that if unprocessed red meat is included it is spread across three meals per week. Currently, there is no specified limit for poultry intake per week. However, it is important to acknowledge this is not suggesting poultry is beneficial to heart health. While not part of this review, it has been previously been shown that other proteins such as fish and legumes are preferred protein options.

It has been shown that health is the number one factor to motivate New Zealanders to eat less meat (17). Reducing the chances of having a stroke or improving overall health were reported as the main drivers (17). Communicating the health benefits relating to a decrease or lower

consumption of red meat to educate people on reducing meat consumption is likely to have an impact on the health of New Zealanders.

A system-wide approach that supports the New Zealand population to both learn about plant foods and ways to cook them, and introduces these foods into the many cultures in New Zealand, is needed to reduce the burden of change and increase the likelihood that these recommendations will be adopted. Legumes, soy and nuts in their whole form can be an alternative for meat (both processed and unprocessed). A variety of cuisines internationally feature plant proteins and the diversity of flavours and dishes can support individuals and whānau to include these proteins in place of red meat.

It is important to note that not all plant protein (i.e. processed meat-alternatives) can be considered an equal substitute for red meat and expected to deliver the same health benefits as legumes, nuts and soy in their whole form.

The cost of meat in New Zealand continues to increase, reaching an all-time high for the year end January 2020 (33). The annual increase in food prices is the highest since 2011. Beef mince increased in cost by 13% to an average of $17.07 per kg. Lamb chops also increased 14% to an average of $18.07 per kg. In contrast, the cost of chicken remained steady with only a 0.2% decrease over the year. Chickpeas (tinned) range from $2-5 per kg and lentils range from $2-10 per kg for both tinned and dried. With meat costs ranging from 70-90% more expensive than plant proteins, the financial benefit to swapping some red meat meals for plant proteins could be significant.

Recommendations around nutrition and human health can no longer be discussed without considering the environmental impact of food choices and/or recommendations. The environmental impact of red meat is primarily considered within the context of commercially produced meat only. Within commercial meat production there are further variances in the extent of environmental impact from both farming practices and feed sources (i.e. grain fed vs grass-fed meat). The variable environmental impact of wild or traditionally hunted foods do not fall into the scope of the following environmental considerations.

Red meat production is taxing on the environment. A serving of unprocessed meat (100g) has an environmental impact up to 100 times larger than plant sources (34). Red meat produced from ruminant animals (e.g. beef, sheep and goat) has a higher environmental impact compared with pork (34, 35). Meat production from ruminant animals uses more agricultural inputs per unit of meat produced and ruminant animals emit methane when digesting food (34). A shift from red meat to plant proteins could reduce the environmental footprint of the diet.

Caution is needed with generalisations around one food group and one health condition as there are other variations that impact health including the food preparation method and further environmental variations such as food waste, farming and processing methods (34).

Meat is a central part of certain cultural traditions in New Zealand. It is important not to generalise without considering these situations and understanding the balance between human and environmental health in New Zealand and maintaining the important, long-standing traditions that underpin these cultures.

RECOMMENDATIONS

The recommendations for red meat and poultry are made in the context of a heart healthy dietary pattern, which includes vegetables and fruit, wholegrains, nuts, seeds, oily fish and reduced fat dairy.

The Heart Foundation's dietary pattern for heart health includes (1):

1. Eating more vegetables and fruit
2. Swapping from refined cereals and grains to whole grains
3. Choosing reduced-fat varieties of dairy products
4. Eating healthy fats sourced from nuts, seeds, plant oils (other than coconut and palm), avocado, and oily fish in place of animal fats
5. Focusing on reducing unprocessed red meat to less than 350g per week (cooked) spread across three meals per week (with an individual portion size of 100g cooked red meat)
6. Swap some red meat meals for plant proteins such as soy, legumes and nuts
7. Limit or avoid processed red meat
8. Reduce processed foods such as takeaways, deep-fried foods, pastries, pies, sweet bakery items, lollies, highly processed and refined foods, processed snack foods and sugary drinks.

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Appendix 1

Question: What is the evidence for red meat intakes on heart health and risk?
Bibliography: Bechthold et al. 2017, and Li et al. 2017*

№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	№ of patients	Relative (95% CI)	Absolute (95% CI)	Certainty	Importance
Certainty assessment								**Effect**			
Coronary heart disease occurrence for the highest red meat consumers when compared with the lowest red meat consumers (follow up: mean 21.2 years, incidence rate 4.4%)											
3	observational studies	not serious [a]	not serious [b]	not serious	not serious	dose response gradient [c,d]	6,659 cases from 151,373 participants	**RR 1.16** (1.08 to 1.24)	**7 more per 1,000** (from 4 more to 11 more)	⊕⊕⊕ MODERATE	CRITICAL
Stroke occurrence for the highest red meat consumers when compared with the lowest red meat consumers (follow up: mean 15.6 years, incidence rate 3.2%)											
7	observational studies	not serious [e]	not serious [b]	not serious	not serious	dose response gradient [c,f]	10,541 cases from 332,767 participants	**RR 1.16** (1.08 to 1.25)	**5 more per 1,000** (from 3 more to 8 more)	⊕⊕⊕ MODERATE	CRITICAL
Heart failure occurrence for the highest red meat consumers when compared with the lowest red meat consumers (follow up: mean 14.3 years, incidence rate 8.3%)											
5	observational studies	not serious [g]	not serious [h]	not serious	not serious	dose response gradient [c,i,j]	9,229 cases from 111,845 participants	**RR 1.12** (1.04 to 1.21)	**10 more per 1,000** (from 3 more to 17 more)	⊕⊕⊕ MODERATE	IMPORTANT
LDL cholesterol change due to consuming plant based protein when compared with consuming red meat protein								**Mean difference (95% CI)**			
10	randomised trials	not serious [k,l]	not serious [m]	not serious	not serious	none [n,o]	201 ate meat, 212 ate legume/soy	**MD 0.26 mmol/L lower** (0.40 lower to 0.13 lower)		⊕⊕⊕⊕ HIGH	CRITICAL
Non-HDL cholesterol change due to consuming plant based protein when compared with consuming red meat protein											
10	randomised trials	not serious [k,l]	not serious [b]	not serious	not serious	none [n,o]	201 ate meat, 212 ate legume/soy	**MD 0.20 mmol/L lower** (0.33 lower to 0.06 lower)		⊕⊕⊕⊕ HIGH	IMPORTANT

CI: Confidence interval; **RR:** Risk ratio; **MD:** Mean difference *separate analyses occurred on meat trials with additional data provided by the authors.

Explanations

a. Two European cohorts, one USA cohort
b. I^2 = 0%
c. Not assessed
d. Each additional daily 100 g of red meat were positively associated with risk of CHD (RR: 1.15; 95% CI 1.08 to 1.23, I2 = 0%)
e. Three European cohorts, four USA cohorts
f. Each additional daily 100 g of red meat were positively associated with risk of stroke (RR: 1.12; 95% CI 1.06 to 1.17, I2 = 0%)
g. Two European cohorts, three USA cohorts
h. I^2 = 26%
i. Each additional daily 100 g of red meat were positively associated with risk of HF (RR: 1.08; 95% CI 1.02 to 1.14, I2 = 4%)
j. This association was non-linear
k. Meta regression of the five studies with at least on high-risk-of-bias domains did not identify a difference between trials in what was reported
l. Influence analysis did not statistically alter the mean result
m. I^2 49%
n. Meta regression of the five studies using soy did not identify a difference from trials reporting on legumes or pulses
o. Dose response not considered