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A new food guidance system for Australia – Foundation and Total Diets

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Executive summary and recommendations

Meat and Livestock Australia supports the need for dietary recommendations that deliver the nutrient requirements of people at different life stages, promotes health and wellbeing and addresses issues such as chronic disease prevention, environmental sustainability, social equity and food culture.

We support the decision to consider iron, zinc, omega-3 and vitamin B12 as distinguishing nutrients in the Foundation Diet. However, it is important to ensure that differences in nutrient density and bioavailability within the relevant food group are clearly indicated to ensure nutrient requirements are met, particularly for iron and zinc.

We support the need to consider foods and dietary patterns which increase the risk of chronic disease. However, interpretation of findings from foreign epidemiological studies must reflect the Australian red meat supply and consumption practices. In Australia, red meat is commonly referred to by consumers as beef and sheep meat. It is consumed mainly as a main meal, approximately 3 times a week, trimmed of visible fat and with vegetables. Dietary recommendations which reflect current practices, reinforcing positive habits, are more likely to contribute to healthy eating practices in Australia.

We support the flexibility of the Total Diet and the need for practical recommendations. Flexibility for replacing an “other food” which contains meat, with an appropriate amount of trimmed red meat, should be included, particularly since red meat is usually consumed with vegetables. In addition, meaningful serve sizes should be provided.

We believe that red meat, as it is produced and consumed in Australia, can make a positive contribution to both the environmental sustainability of the Australian food supply and the overall health and wellbeing of Australians.

Meat and Livestock Australia recommends:

1. Red meat is referred to as beef and sheep meat.
2. Red meat (beef/veal/lamb) is recommended 3 to 4 times a week and appropriate advice is provided for replacement foods.
3. Serve size is described as meaningful portion sizes.
4. Recommendations encourage Australians to eat red meat as part of a healthy, balanced diet in accordance with current practices i.e. freshly cooked meals, using trimmed meat and 3 to 4 vegetables.
5. Flexibility is offered for replacing relevant “other foods” with red meat, similar to options provided for dairy foods, to maintain a healthy, balanced diet.

6. Red meat produced using sustainable agricultural practices are recommended, where environmental sustainability refers to all relevant environmental indicators.

Preface

Meat and Livestock Australia (MLA) is a marketing and research delivery company for all sectors of the red meat industry (beef, sheep and goat meat). We are primarily funded by levies on farmers and government contributions for our expensive research and development portfolio.

MLA is uniquely placed to provide up-to-date evidence on the Australian red meat supply chain, including production and consumption practices and environmental impacts. Our comments and information provided will refer specifically to the red meat recommendations in the Foundation Diet.

We welcome the opportunity to contribute to the development of dietary recommendations relating to red meat. For the MLA, it is important that Australian red meat makes a positive contribution to healthy eating and environmental sustainability.

We support the goal of the document and the guiding principles indicated (p.5).

We support the selection of iron, zinc, vitamin B12 and omega-3 as distinguishing nutrients for red meat and equivalent foods (p. 111). Red meat's role as a valuable source of these nutrients in the Australian diet, particularly iron and zinc and omega-3, has been acknowledged in the modelling (p.11 & 120).

MLA supports the need to consider the environmental sustainability of all foods, including red meat production. Since this is a complex area, we have provided comprehensive information on Australian red meat production to assist in balancing environmental and nutritional needs in a meaningful way that is appropriate for Australia.

With the increasing prevalence of chronic diseases in Australia and rising associated healthcare costs, it is appropriate to understand the role of diet, including that of red meat. We understand the decision to limit red meat consumption to the Foundation Diet was based on systematic reviews commissioned by the NHMRC (p.11). Since up-to-date information on red meat consumption in Australia is limited, we have provided extensive information on current Australian production and consumption practices to help determine the applicability of findings that have been conducted in other countries.

Finally, we have provided practical information on meat purchasing and cooking to assist the development of meaningful, practical advice for including red meat in a healthy diet.

1. Recommendations in the final food selection guide should reflect the role of beef/veal/lamb in the Foundation Diet, recognising differences in nutrient density and bioavailability

The Foundation diet separates red meat (defined as beef, lamb, pork, veal, venison, kangaroo) from poultry/fish/seafood/eggs/legumes (p.120). The same distinguishing nutrients– iron, zinc, omega-3 and vitamin B12 - have been attributed to both groups (p.111).

The composite red meat group modelled in the Foundation Diet includes the red meats (as defined above) and poultry, fish, seafood, eggs and legumes (p.120). Since these foods are not equivalent in terms of nutrient density (see Table 1, Appendix 1), adjustments were made to achieve nutrient equivalence (p. 122, Table A. 7.5). The proportion of foods within the composite group reflected the relative contributions of individual foods to the composite, based on the NNS95 data. Beef/veal/lamb made a substantial contribution to intake of iron and zinc, and its contribution to omega-3 intakes is acknowledged (Appendix 6, p. 99, p.103, p.107). Consequently, on average, 58g out of the 65g composite red meat food group modelled in the Foundation Diet was composed of beef, lamb, veal (see Table 2, Appendix 1).

Since iron was a limiting nutrient in the Foundation Diet (p.14) and considering the contribution of beef/veal/lamb in meeting iron, zinc and omega-3 requirements in the modelling, recommendations in the final food selection guide should reflect the amount of beef/lamb/veal in the modelling.

In addition, advice on selecting foods to address differences in bioavailability should be provided in the final selection guide consistent with recommendations for meeting iron and zinc requirements[1]. We understand that it is difficult to address differences in bioavailability in the modelling of the Foundation and Total Diets. However, it is important to note that since no limits have been placed on plant-based foods, it would be prudent to provide advice on necessary precautions for those restricting red meat.

Many of the Total Diets contained 7 serves/day of legumes (which have a high phytate content) with some, providing up to 21 serves (Appendix 14). The dietary fibre content, particularly in the sample 7-day total diets for men were mostly around 50g/day or higher (A15.1). It is well established that zinc deficiency is a risk in predominantly plant-based diets where intakes of meat are low[2]. Furthermore, it is recommended to increase requirements for zinc by as much as 50% in strict vegetarian diets with dietary phytate:zinc molar ratios of >15:1. Whilst most diets met the EAR for zinc, 99% was met in men 51-70 years (p.44).

Appropriate advice is particularly relevant for vulnerable groups at risk of iron deficiency who are eating red meat (beef, veal, lamb) below those recommended in the Foundation Diet:

- In the recent 2007 Australian National Children's Nutrition and Physical Activity Survey (ANCNP), mean red meat intake (from cuts and mixed dishes) was 23g/day in girls 2 to 3 years and 34g in girls 14 to 16 years[3].
- Mean red meat intake in women aged 19 to 24 yrs was 52g/day and in those aged 25 to 44 yrs, 46g/day in the 1995 National Nutrition Survey[4].
- A cross-sectional study in Australian young adult females found restrained eating was frequently expressed by restriction of meat and that this behaviour is associated with lower nutritional status, especially of iron and vitamin B12[5] [6].
- Several intervention studies in infants, toddlers and women of child-bearing age support the importance of red meat in helping to prevent iron and zinc deficiency[7] [8] [9] [10] [11] [12] [13] [14]. They suggest it is difficult to maintain iron status when meat intake is low, without use of iron fortified products.

Recommendations in the final food selection guide should provide appropriate advice to ensure iron and zinc requirements are met. The advice should reflect the amount of beef/veal/lamb in the Foundation Diet. Appropriate guidance on selecting foods within the food group should recognise the differences in nutrient density and bioavailablity between food choices.

2. Recommendations should reflect how red meat is consumed in Australia

Red meat was restricted in the dietary modelling due to evidence that high intakes of red meat are associated with increased risk of total mortality and ischaemic heart disease (p. 28).

Pork was included in the red meat group of the Foundation Diet to reflect findings from epidemiological studies (Table 1 A. p.22). According to most consumers in Australia, red meat refers to beef and sheep meat. However, in Europe and the USA, pork is referred to as "red meat", even though it is not a ruminant.

It is difficult to capture the wide diversity of different ways in which red meat is produced and consumed in epidemiological studies and dietary surveys. In addition, details regarding meat consumption data is usually limited and in Australia, outdated.

It is therefore worth considering current Australian red meat practices and how they differ from those in countries when interpreting epidemiological findings from other countries.

2.1 Meat consumption trends in Australia

Total meat consumption has remained constant over the last 13 years:

- There has been little change in lamb and pork, a slight decrease in beef and an increase in chicken consumption (see Graph 1).
- Beef and poultry are generally served twice a week, lamb once a week and pork, 0.65 serves/week[15].

Most meat consumed is produced in Australia, with the exception of pork[16]:

- Beef and lamb consumed in Australia is primarily produced in Australia, with <1% imported from New Zealand [17].
- Fresh pork meat is locally produced, whilst about half of processed pork consumed is imported.

Most of the fresh meat consumed in Australia is beef and lamb:

- Beef and lamb account for over half of all fresh meat sold at retail in Australia, representing 56% of retail fresh meat supplies (excluding kangaroo and seafood). Poultry represents 28% and pork, 12%. There has been a shift away from unprocessed chicken and increasing demand for value-added chicken products and cooked chicken products[18].
- Of total meat produced for the Australian market, 68% of beef and 89% of lamb is supplied as fresh meat[19] .
- The most popular fresh beef cuts consumed are steak (32.7%), mince (30.0%), sausages (16.6%), diced/strips (11.6%) and for lamb, chops & cutlets (47.2%) and roasts (25.9%).

Pork is mostly consumed as processed meat:

- 62% of pork is processed (35% imported), mainly ham and bacon products.
- 5% of beef and 0% of lamb is processed into smallgoods or manufactured foods such as pies and lasagne.

Poultry is popular in food service outlets:

- 26% of beef and 11% of lamb produced for the domestic market is supplied to food service outlets.
- On average, more poultry (101kg/wk/outlet) than beef (69kg/wk/outlet) is purchased by food service outlets, whilst lower levels of pork and lamb are purchased (30kg/wk/outlet)[20].
- Poultry was universally purchased by the majority operators surveyed. Beef/veal has a very high penetration in virtually all food service outlets (i.e. purchased by 90%+ of outlets) except fast food chains (72%) and fast food independents (89%)[*].

[*] Represents average of responses in May and Nov 2009 based on sample of 431 food service operators. The survey, commissioned by MLA, has been conducted every 6 months since 2000. It asked operators "how many kg of beef/veal/lamb/mutton/pork/poultry did you buy last week".

- Poultry has grown by 34% since 2002 in the fast food industry [21].

2.2 Key differences in meat consumption between Australia, the US and Europe

There are differences in the amount and type of meat consumed in Australia compared to Europe and the USA. Beef consumed in the USA and Europe is primarily produced within these countries. Key export markets for Australian beef and lamb are North Asia, particularly Japan and Korea, USA, Europe, South East Asia and the Middle East. The USA imports Australian manufacturing beef for its low fat content (approximately 90CL[†]). It is combined with US manufacturing beef (approximately 50CL) for the manufacture of hamburger patties to achieve the desired consistency.

Total meat consumption is highest in the USA and lowest in Europe:

- Per capita consumption in 2008 was 122.1kg in the USA, 110.8kg in Australia, 78.5kg in the UK and 70.2kg in the EU[22] [23] [24].

Australians eat more fresh meat, whereas Europeans eat more processed meat:

- Per capita pork consumption is highest in the EU (53.6kg/per capita), compared to 28.9kg/per capita in the USA and 22.5kg/per capita in Australia .
- Since a large proportion of pork is processed, more processed meat is consumed in European countries such as the Netherlands, Sweden and Germany (between 50 – 60g/day) compared to <20g/day in Australia[25].
- In 2009, the average Belgian purchased 32.1kg of fresh meat[26]. Total per capita meat consumption in 2002 (the latest available data) was 94kg of which 50kg was pork, 22kg poultry and 20kg beef.
- In the US, most pork is consumed as processed meat (79% of household pork consumption, mainly as ham, bacon, sausages)[27].

US beef tends to be higher in fat and lower in omega-3 than Australian beef:

- In the US, ground beef (i.e. mince) represents 44% of retail beef purchases, followed by steak (31%) and roast meats (17%). The most popular type of ground beef purchased is higher in fat (78 to 84 CL*) compared to Australian mince (average 90CL*) (Personal Communication, MLA). Top household consumption uses of ground beef include burgers, spaghetti, Mexican dishes, casseroles, meatloaf, chilli, meatballs, lasagne[28].
- US beef tends to be slightly higher in saturated fat and lower in long chain omega-3s than Australian beef (see Table 3, Appendix 1). These differences are largely explained by differences in grain-feeding practices. Unlike Australia, in the US, the

[†] Chemical Lean (CL) is a percentage of lean meat.

majority of cattle are grain-fed, mainly maize and soy. They enter feedlots at an earlier age and are fed for longer periods (approximately 150 days). In Australia, cattle are raised predominantly on grass. Depending on season and market requirements, some are fed a grain-based diet for the remaining 50 to 100 days (Personal Communication, MLA). Studies suggest that the variation in fatty acid profile between grass-fed and grain-finished (up to 80 days) livestock is not significant[29] [30].

A high proportion of meat is consumed from food service outlets in the US

- Beef consumption within the US foodservice sector is dominated by burgers, representing 72% of consumption[31].
- Fast food outlets (such as KFC and McDonalds) account for approximately 25% of total poultry products sold[32].

2.3 Red meat trimming practices in Australia

The nutrient composition of red meat is described in terms of visible fat (called separable fat in nutrient composition tables) to facilitate the selection of the most accurate data. In NUTTAB 2006 and AUSNUT 2007, "Lean" is defined as meat with external separable fat and internal separable fat removed; "Semi-trimmed" as meat with external separable fat removed but with internal separable fat retained; and "Untrimmed" as meat without removal of internal and external separable fats. "External separable fat" refers to selvedge fat or separable fat occurring on the outside of meat. "Internal separable fat" refers to intermuscular fat or separable fat occurring between muscles within a piece of meat that can be easily trimmed with a sharp knife. "Internal separable fat" should not be confused with marbling or intramuscular fat which cannot be trimmed.

Since separable fat is the greatest determinant of saturated fat, separable lean beef and lamb (muscle meat) contains less than 2% saturated fat[33]. There is evidence that the separable fat content of beef and lamb cuts has reduced substantially since the 1980s as a result of trimming by both retailers and consumers:

- The mean external fat width of raw beef and lamb cuts in the most recent retail survey which, was conducted in 2000, varied from less than 1mm to a maximum of 5mm[34].
- Several studies indicate that increasingly Australians report trimming the visible fat off meat prior to consumption. The latest evidence indicates that 89% of Australians report either purchasing beef or lamb trimmed or that they trim it prior to consumption. Separable fat in some retail cuts have reduced by 70% since the 1980s[35].
- Red meat's (beef and lamb) contribution to total saturated fat intake has decreased from 12% in 1983 to 9% in 1995.

- In the 2007 ANCNP, contribution of red meat to overall saturated fat intake ranged from 4 to 7% in boys and from 4 to 5% in girls aged 2 to 16 years.

Consequently, use of “lean” beef and lamb data rather than the combination of “lean” and “semi-trimmed” which was used in the modelling of the Foundation Diet to reflect “healthy practices” does not reflect the current food supply and consumption practices (p.126).

2.4 Red meat eating patterns in Australia

Evidence from diverse sources indicates that red meat in Australia is associated with healthy eating habits, in particular, increased consumption of vegetables:

- A survey of 1000 respondents, commissioned by MLA, indicate that the most popular red meat meals include beef steak, spaghetti bolognaise, beef casserole/stews and lamb roast. More respondents prepared beef steak at least once a week (73%) compared to spaghetti bolognaise (38%). At least 3 different vegetables (not including potato) were eaten as part of the red meat meals[36].

- Increased intake of vegetables associated with red meat is reflected in the 1995 national nutrition survey .

- A study of shopping habits, reported that 66% of meat purchases are bought with fresh vegetables and 28% of meat shoppers say they would not have bought meat if the fresh vegetables “were not good enough”[37].

- A secondary analysis of the 2007 ANCNP identified popular red meat (beef, veal, lamb) cuts as steaks/chops/cutlets (37%), mince (20%), leg roast (10%), processed (7%) and miscellaneous (26%). Mean intake of total vegetables was highest when red meat was consumed and red meat was more likely to be consumed with potatoes cooked with no oil than with potato chips/wedges/gems.

- Dietary and lifestyle patterns amongst girls aged 9 to 16 years, identified using a cluster analysis of the 2007 Australian National Children’s Nutrition and Physical Activity Survey identified a “Meat and vegetable” cluster in approximately a third of girls. They had the highest intakes of red meat and vegetables, and tended to have higher intakes of fruit, whole grain breads and low fat yoghurt and lower intakes of take-away foods and soft drinks. They also had the highest intakes of protein, fibre and some key micronutrients; and tended to perform more physical activity, compared to girls in the remaining clusters[38].

- A dietary pattern characterized by vegetables, fruit, meat, fish, and whole grains was identified using a diet quality score in 1,046 Australian women aged 20 to 63 years. This dietary pattern was associated with lower risk of major depression[39] than a “western” diet of processed or fried foods, refined grains, sugary products and beer.

2.5 Australian red meat and health outcomes

- Whilst beef fat is associated with elevations in cholesterol concentrations, beef trimmed of all visible fat can be included in cholesterol-lowering diets provided the overall diet is low in saturated fat[40].
- Several intervention studies have shown that dietary strategies which include trimmed Australian red meat (i.e. beef, lamb and veal) as part of a healthy diet (based on general dietary guidelines), are suitable for managing weight, lipidaemia, glycaemia[41] [42] [43] [44] and blood pressure[45] [46].
- In these studies, amounts of trimmed red meat varied from 180 - 250g raw/day for 8 weeks ; 200g raw/> 6 times a week; 600g/week cooked for 14 weeks; and 3-4 times a week as per the Australian Guide to Healthy Eating for 12 months .
- After 12 months, there were no adverse effects on bowel, renal and bone health markers[47] [48] [49]; bone mineral density[50] and after 8 weeks, markers of oxidative stress or inflammation[51].
- Whilst these studies were designed to address specific research questions and amounts in some studies are higher than those generally recommended as part of a healthy, balanced diet, this evidence does suggest that red meat, when trimmed and consumed as part of a healthy diet, does not appear to contribute to adverse health outcomes.
- Instead, the evidence suggests that trimmed red meat can, as part of a total dietary and lifestyle approach, contribute to the management of risk factors for chronic diseases including overweight, blood pressure and metabolic markers of glycaemia and lipidaemia.

3. Environmental sustainability

Whilst the focus has been on greenhouse gas emissions (GHG), other environmental factors, such as water, soil and biodiversity, are also important. Producers recognise the importance of environmental sustainability and the majority of farmers are involved in natural resource management activities. Many are active members of Landcare which was established jointly by the National Farmer Federation and the Australian Conservation Foundation more than 20 years ago.

For the Australian red meat industry, environmental sustainability is a serious concern. MLA has and continues to invest extensively in research to better understand the environmental

impact of Australian red meat production and to develop programs for implementing sustainable agricultural practices.

The livestock industry has made the single most significant contribution to emissions mitigation of any sector in Australia. Since 1990, emissions from livestock have been reduced by 7.5%[52]. Production efficiencies have delivered a 5.3% reduction in emissions per tonne of beef produced (calculated from and [53]). Land Use Change (predominantly deforestation) has reduced emissions by 55 m tonnes per annum. A recent analysis of GHG emissions from the Queensland beef industry showed that when reduced tree clearing and sequestration from regrowth of vegetation is taken into account, the industry's contribution to GHG emission would be close to carbon neutral[54]. Opportunities for contributing to further reductions continue to be sought.

3.1 Environmental sustainability of Australian red meat production

The meaning of the comment "pasture-fed varieties are more environmentally sustainable" is unclear (p.29, Table 14). Assuming the alternative to 'pasture-fed' is grain-fed or intensive livestock production using grain feeding, the statement is too simplistic. The relative environmental impacts of fully grass-fed vs feed-lot finishing depends on several factors. Greenhouse gas production is just one environmental impact and there may be 'trade-offs' with other factors such as water use or biodiversity. It is therefore necessary to understand how Australian red meat production practices impacts on the Australian environment.

3.1.1 Greenhouse gas emissions

New evidence from Life cycle assessments (LCA) studies conducted in two different Australian beef production systems have reported emissions of 11.6 – 18.1 kg CO_2-e/kg of carcase weight (CW). For Australian lamb, emissions are estimated at 10.2 – 10.8 kg CO_2-e/kg CW[55]. All emissions associated with the supply chain from farm to processor (abattoir) were estimated in these LCAs.

- Emissions from livestock, energy used on farm and during transport of livestock, and energy 'embedded' in inputs such as fertilisers and other emissions associated with feed production where the animals were not fully grass-fed were all included.
- This evidence indicates that emissions attributed to Australian beef and lamb production are at the lower range of those reported in the LCA literature (8.4 to 28.7 kg CO_2-e/kg carcass weight (CW) for beef and from 10.2 to 20.1 kg CO_2-e/kg CW emissions for lamb, when no burden was allocated to by-products).
- Although fertilisers, pesticides, irrigation water and fuel for transport in feed production produce more GHG emissions than natural pastures, the more digestible and higher quality feeds result in less rumen methane production per kg of intake. In general, grain-

finished cattle or sheep are likely to produce more GHG emissions per head but less emissions per kilogram of product compared with fully grass-fed animals.

The following characteristics of red meat production in Australia contribute to emissions being in the lower range of those reported in the literature and also to the lower impact for other environmental impact categories such as water.

- Use of predominantly low intensity feeds (such as low input native grasses; crop stubble after grain is harvested; legume-based pastures grown in rotation with grain crops) which require little or no fertiliser or irrigation.
- Grain feeding of short duration (on average, 50 to 100 days) and use of low input feed-grade grains (not suitable for human consumption and often grown without fertilizer or irrigated water) such as wheat, barley, sorghum, triticale which is supplemented with protein meals, lupins, field peas; by-products of oilseed grains such as cottonseed and canola; and hay or silage (fermented grass).
- Predominance of extensive grazing systems where waste (dung and urine) are naturally recycled into the soils on-farm.
- In feedlots and processing plants, monitoring and improvement programs to minimize and re-use waste.
- Low energy (fossil fuel) use since housing of livestock and intensive feeding during winter as required in northern hemisphere production systems is not required in Australia.
- Efficient production systems in terms of yield and lifespan of stock, and a process of continual improvement based on investment in R&D.
- Low levels of deforestation due to introduction by State governments of legislation limiting land clearing and low levels of arable land required for production of grains for feed, thus contributing to protection of biodiversity values.

3.1.2 Water

- Water usage for Australian lamb and beef production is far lower than estimates reported in the literature.
- For Australian beef, water use is estimated at 27 to 540L/kg CW and for Australian lamb, at 18 to 214L/kg CW[56].
- Water usage in red meat processing is mainly for cleaning, ranging from between 4 and 15L/kg HSCW, with an average of 7 L/kg HSCW.
- Most water is sourced from “green water” (defined as soil stored moisture, derived from rainfall) and use of “blue water” (i.e. water from dams, rivers and groundwater) is small (estimated from 5 to 12%), contributing little to water supply problems, such as over-allocation in the Murray-Darling Basin.
- Since red meat production occurs predominantly on non-arable land, there is a low degree of transferability of the green water used with other products.

- Eutrophication (leakage of nutrients from agricultural chemicals into waterways causing excessive plant growth), particularly in northern Australia where low impact management of livestock is common, is not a concern for red meat production since use of fertilizer is relatively low.

3.1.3 Soil

- Mixed farming (wheat, sheep for wool and meat) is common in the wheat-sheep zone of southern Australia. It is one of the most efficient and sustainable farming methods, both environmentally and economically. Australian soils are generally poor and cannot sustain continuous cropping. Rotation of crops and resting land used for cropping after 2-3 crop rotations is essential in many areas to prevent run-down of nutrients removed in the crops and prevent soil degradation; prevent disease build up; and to build up soil moisture for preparation for the next crop. Integrating paddock use in this way maintains soil health and at the same time, provides a source of income for the farmer during times when there are no crops. In addition, sheep eat germinating weeds, reducing herbicide use.
- Extensive grazing systems in the pastoral zones of northern Australia have low stocking rates, generally resulting in little land disturbance[57]. Cattle properties in these regions carry from one to ten beef cattle per square kilometre or approximately 33 hectares per animal. In contrast, mixed farming systems have approximately 6 hectares per animal. Lightly grazed grasslands have been shown to have higher soil organic carbon and nitrogen than ungrazed or heavily grazed areas. Stimulation of aboveground vegetation growth results in better incorporation of aboveground plant residues and increased soil organic matter. The combination of trampling, defecated material and partial decomposition of plant material by livestock increases the breakdown of lignin, contributing to soil health and at the same time, soil carbon storage[58].

3.1.4 Biodiversity

- Well-managed permanent natural pastures can have a less negative effect on biodiversity than cultivation for crops. Australian producers have recognised the value of biodiversity to ecosystem health and many have now moved to conserve sensitive habitats, plant trees and allow regrowth in some areas[59]. These practices are having a positive impact on increasing biodiversity in grazing lands[60].
- Producers, particularly in the extensive northern regions and remote areas of Australia, are important environmental stewards. They manage weeds and pest, animals, helping to maintain biodiversity and reduce the risk of destructive wildfires. Management of wild fires is particularly important for climate change mitigation since hot fires late in the season release more carbon and nitrous oxide[61].

3.2 Appropriate use and interpretation of the available evidence

Much of the evidence to date assessing the environmental impact of food has been based on assumptions and derived or imputed data requiring adjustments for differences in methodologies[62]. There is as yet no standardised, validated methodology for measuring greenhouse gas emissions and other environmental indicators. Care is therefore required in the use and interpretation of the data.

3.2.1 Reducing red meat consumption may not be effective

The rationale and evidence for restricting red meat for environmental reasons in the food guidance system is unclear. Some comments (p.28 and in Table 4) suggest the intent is to reduce its contribution to GHG emissions, as suggested by McMichael et al (2007)[63]. It is therefore worth considering the following evidence suggesting that reduced consumption patterns for red meat may not be effective in climate change mitigation.

- Use of global estimates of livestock GHG emissions is inappropriate when assumed to apply on a particular region, such as Australia. The greenhouse efficiency of livestock production varies dramatically between regions and production systems, depending on such factors as whether animals are raised on rangelands or are housed and grain-fed, and, in some regions, on the extent of deforestation to improve pasture or grow grain or soy bean for feed[64].
- Analyses which use data from the 2006 United Nations' "Livestock's Long Shadow"[65] overestimate the contribution of livestock relative to other sectors such as transport. The emissions estimate for livestock is based on a life cycle assessment approach rather than the IPCC sectoral reporting definitions used for other sectors. This inflates the emissions from livestock and risks double counting of sources such as on-farm energy use. Comparisons and percentages in the report, such as the often-quoted estimate that livestock is responsible for 18% of total global greenhouse gas emissions are, therefore, not valid. Use of this data will therefore overestimate the potential of red meat reduction as a climate change mitigation strategies. Concern has therefore been expressed that the focus on red meat may distract from more effective solutions to global climate change[66].
- Rather than applying a uniform percentage abatement target across products, the most effective climate change mitigation strategies will target the most efficient and cost-effective options considering the whole supply chain for products from cradle to grave. The products contributing more to the total emissions profile may not have the greatest potential to reduce emissions without negative economic, social or health impacts and without perverse outcomes for other environmental indicators. This is also the principle underpinning cap-an-trade emissions reduction schemes.

- The concentration of methane in the atmosphere does not appear to be directly related to livestock numbers. Despite an increase in livestock ruminant numbers[67] [68]. Other contributions to global atmospheric methane include emissions from the drying of wetlands and volcanic emissions.

3.2.2 Environmental sustainability should also consider nutrient requirements

The environmental benefits of reducing red meat consumption will depend on how consumers compensate for lower intakes of red meat. Studies, such as Friel et al (2010)[69], have not taken into account emissions and other environmental impacts associated with substituting red meat and its co-products with suitable alternatives.

Furthermore, it is appropriate to consider the availability, accessibility and nutritional profile of replacement foods together with its environmental sustainability when developing dietary recommendations.

Care is required to avoid shifting the environmental burden to other foods and ensuring environmental concerns do not outweigh nutritional needs.

The following highlights issues which should be considered:

Nutritional equivalence

- Studies that have considered protein equivalence indicate that emissions associated with many plant-based meals are not that much lower than animal-based meals since more food is required to achieve nutritional equivalence[70] [71] [72]
- No studies have considered nutritional equivalence of distinguishing nutrients, particularly iron, which is a limiting nutrient in the Foundation Diet. To achieve equivalence, plant-based meals will require higher amounts of foods to address bioavailability issues.

Deforestation

- Red meat substitutes require arable land for their production. Land use change (mainly deforestation), driven by agricultural expansion, is a significant source of GHG emissions.
- Few studies have taken into account the impact of land use change (both domestically and overseas) associated with the need for arable land required to produce red meat substitutes.
- A UK analysis estimated that a switch from beef and milk to highly refined livestock product analogues such as tofu and Quorn (textured fungal food made from molasses) could lead to increased imports from sources closer to active land use

change[73]. Similarly, switching from red to white meat would substantially increase reliance on arable land required to produce high value feeds, and consequently imported soy meal.

- The authors therefore concluded that mitigation measures in relation to food must be made to the entire diet to reflect increases in some components in response to decreases in others. No single measure or combination of similar measures was capable of reducing emissions by more than about half
- Whilst the analyses can't be used to predict consequences of mitigation strategies and the results cannot be extrapolated to the Australian food supply chain, it is interesting to note that decarbonisation of energy and energy efficiency offered the single most effective mitigation measure.

Availability of arable land in Australia

- Competition for arable land, resulting from increased demand for alternative products which are reliant on cultivation, is particularly pertinent in Australia.
- Red meat production in Australia is predominately grass-fed and mainly occurs in the arid and semi-arid rangelands of Australia. Consequently, little arable land is used for the production of feeds. In contrast to the situation in many overseas countries, emissions due to the production of feed grains for livestock are not applicable to the same extent in Australian red meat production systems. In addition, a reduction in livestock production would not release much additional arable land for production of red meat substitutes.
- Arable land, required for the production of crops for both humans and high value feeds for poultry and pigs, is limited to approximately 7% of Australia's land mass where there is competition for agriculture, forestry and urban and commercial developments[74]. In addition, the proportion of arable land in Australia is predicted to decline with climate change and to face increased pressure from urban expansion and forestry[75].

  Consequently, overseas cultivation of red meat protein substitutes, particularly pulse-based substitutes, such as soy, will most likely be required to replace reduced red meat production in Australia.

Impact of processing and packaging

- Active land use change associated with their production, together with the impacts of packaging and processing, must be considered when assessing the the environmental benefits of restricting red meat consumption. These processes can be energy-intensive and emissions intensive for many protein substitutes and their impact may outweigh the reductions achieved by reducing red meat production.

Food security

- Climatic variability, including drought, which is predicted to increase, will have a major effect on food production[76]. Unlike crops, livestock can be mobilized to more favourable conditions to maintain production.
- The resilience of Australian red meat production to varying seasonal conditions was illustrated in the droughts of 2002-2003 and 2006-2007 when winter crop production was halved, whereas beef production was barely affected (see graph 2).
- According to Tim Flannery, “in a world facing food shortage and a climate crisis, livestock represent a potent weapon in the fight to stabilize our climate”[77].

Co-products

The Australian red meat industry supplies a wide range of products used commonly in daily living, including soap, synthetic rubber, glycerine, blood products, fertilizer, pet food, leather for furniture and car manufacture and wool for clothing. Little is wasted.

- Where foods associated with less valuable co-products (such as chicken and pork) replace red meat, additional agricultural production will be required to provide relevant substitutes and their environmental impact will need to also be accounted for[78].
- This is rarely considered in assessing the impact of mitigation strategies involving reduced red meat consumption.

3.3 Support for sustainable agricultural food production practices

Since all foods have some environmental impact, to effectively address environmental sustainability, improvements in the production, processing, packaging, preparation, consumption and waste management of all foods is relevant.

The environmental impact of primary foods, such as red meat, is greatest during its production, since the need for processing and packaging is limited. For primary foods, it is therefore more appropriate to support programs and policies encouraging use of agricultural management practices which address sustainability more broadly.

It is recognised that livestock make an important contribution to sustainability, including environmental, economic, social and health[79]. Consequently, the environmental sustainability of food production is best addressed via agricultural sustainable practices because its focus is on minimising the depletion and degradation of natural resources which is critical for securing a sustainable food supply and at the same time, optimising other aspects of public health (e.g. economic viability of rural communities; mental health of producers).

According to the FAO, application of technologies that improve the efficiency of land use and feed use can mitigate the negative effects of livestock production on biodiversity, ecosystems and global warming. Aspects of Australian red meat production indicated previously are consistent with recommendations by the FAO have been adopted in Australia:

The FAO indicates that the livestock sector has enormous potential to contribute to climate change mitigation. MLA has and continues to invest extensively in research and dissemination programs to reduce emissions as well as improve other aspects of sustainability, including relevant environmental, economic, social and health indicators. Key initiatives include:

- Management practices which optimize the health of animals helping to minimize disease and environmental stress and increase reproductive efficiency, reducing replacement rates and consequently, contributing to proportionately fewer animals producing methane. Breeding and management practices also improve yield (without jeopardizing animal welfare and health), contributing to reduced lifetime emissions per animal[80].

- The combination of feed quality, digestibility and how the feed is produced determines its overall environmental impact. Improving the digestibility of feed reduces the amount of methane produced. Low fibre forages with high soluble carbohydrates; a high content of plant compounds (e.g. tannins); dietary oils; and grains can reduce emissions by up to 20%.Improving feed quality, for example by finishing cattle in lot feeds, can reduce lifetime emissions. In Australia, where low input (i.e. fertilizer and water) broadacre production of feed for stock is more common, the impact of feed grain production tends to be low.

- Strategies, such as genetic selection and rumen manipulation, could in the long term (by 2050) potentially reduce emissions in the order of 40 – 80% to 70% but will require further development and innovation[81].

- Technologies are rapidly developing for converting by-products from meat processing and lot feeding, such as manure, wastewater and tallow, into energy. Some processing plants and feedlots that use anaerobic lagoons to digest organic wastes are now producing biogas, a methane-rich gas, as a substitute for fossil fuels in boilers.

- Research is also being conducted to develop technologies for converting tallow into biodiesel – an alternative to petrol diesel which is biodegradable, non-toxic and produces minimal GHG. Other opportunities for producing energy from renewable resources include solar and wind energy where on-farm fuel is used for pumping; pyrolysis (production of charcoal) and second generation farm-based biofuels (e.g. char).

- Land management strategies (including revegetation of previously cleared land; use of deep rooted perennial pastures for grazing livestock; and converting manure into humus and spreading it on paddocks), can increase carbon storage and also provide a positive effect for biodiversity conservation, efficient use of water and nutrients, control of erosion (preventing runoff) and salinity and provision of shelter for livestock. A worldwide analysis on the effects of land management on soil carbon showed that if forests are converted to pastures there is, on average, an 8% increase in the total amount of soil carbon[82].

4. **The final food selection guide should provide meaningful advice**

4.1 Frequency of consumption

- Since red meat is rarely consumed daily, weekly frequency best represents current consumption practices.
- The Foundation Diet included approximately 400g/week of cooked beef/lamb/veal (on average, 58g x 7 = 406g/week) (see Table 2, Appendix 1).
- Recommending red meat 3 to 4 times a week, as per the current Australian Guide to Healthy Eating[83], is consistent with current consumption patterns.
- Since red meat is consumed as either a cut or mixed meal , reported serves based on cuts do not necessarily represent mixed meals which contain red meat.
- Providing a range offers flexibility - either 3 times a week (135g/week) or 4 times a week (100g/week), depending on whether red meat is consumed as a cut (larger serves) or in a mixed meal (smaller serves).

4.2 Serve sizes

We suggest serve sizes be described in meaningful portion sizes such as cups, number of slices and cutlets and a steak and chop, the “size of the palm of your hand” (see Table 4, Appendix 1).

4.3 Appropriate food exchanges

- The rationale for allocating foods within the same group should reflect similarities in nutrient density to ensure nutrient requirements are met. For instance, the nutritional profile of pork is similar to that of poultry, consequently it is not as red in colour (see Table 1). In addition, pork, like poultry and eggs, are produced under intensive production systems and consequently, have different environmental sustainability issues compared to beef, veal, lamb, venison and kangaroo which are produced using predominantly

extensive grazing systems. It would therefore be confusing for pork to be categorised as a “red meat” since pork is not referred to as “red meat” by Australians.

- The serve sizes and types of foods included in the food group should provide sensible exchanges. Exchange foods should be foods that are typically used as a core ingredient in a main meal, similar to current beef/veal/lamb consumption practices. For instance, nuts are unlikely to be consumed as a core ingredient in a main meal.
- Clarification is also required, with clear criteria, as to which meats are included in the food group i.e. fresh vs processed (small goods) vs value-added products (marinated or sauces) vs manufactured (lasagnes; pies).

4.4 The Total Diet should provide flexibility for replacing relevant “other foods” with red meat, similar to options provided for cheese.

- Clarity is required on which foods are included in the ‘other foods’ category. It appears to include meat-based foods including burgers and deli meats. Criteria for energy density, saturated fat and sodium content would provide clarity and consistency in approach, since there can be a wide variation in fat content of ready-to-eat retail products e.g. traditional fresh sausages in Australia can vary from the minimum requirement of 50% meat to levels of up to 95% meat.
- It is unclear whether the amount of red meat restricted in the Foundation Diet is based on evidence reflecting environmental or chronic disease concerns. It is therefore unclear why the approach adopted for foods in the ‘milks, yoghurts and cheese groups’ cannot apply to fresh red meat. Additional serves over those in the relevant Foundation Diets can be included instead of some of the ‘other foods’ allowances (one serve of dairy foods would equate to one ‘other food’ serve) (Fig 2. P.36).
- Since red meat consumed in Australia is commonly consumed fresh, trimmed and with vegetables, allowing those with higher energy requirements to replace an ‘other food’ with a healthy red meat and vegetable option would contribute to healthier eating patterns.

5. Conclusion

We have provided extensive information to support the need to refer to red meat as beef and sheep meat. We believe that the evidence supports the need to recommend trimmed beef and sheep meat 3 to 4 times a week to ensure iron and zinc requirements are met and to contribute to omega-3 requirements. There is little evidence that red meat trimmed of visible fat and consumed with 3 to 4 different vegetables, as consumed by many Australians, increases risk of chronic disease. Instead, there is evidence it can, as part of a healthy diet and lifestyle, contribute to management of risk factors for chronic disease. Finally, we believe that Australian red meat production is appropriate in Australia and by supporting sustainable agricultural practices, can contribute to environmental sustainability in Australia.

Appendix 1: Tables and Graphs

Table 1: Nutrient density of foods with similar distinguishing nutrients

	Iron (mg)	Zinc (mg)	Omega 3 (DHA+EPA+DPA)	Vitamin B12 (ug)
Beef	3.0	7.0	99.0	2.0
Lamb	2.6	4.5	140.0	2.1
Veal	2.0	5.0	107.0	3.0
Venison	3.3	8.1	80.0	1.0
Pork	1.2	2.9	19.7	0.4
Poultry	0.7	1.6	11.0	0.7
Seafood	2.7	9.6	455.0	1.5
Fish	0.6	0.6	685.0	1.3
Legumes	2.0	1.0	43.0	
Kangaroo	4.2	3.6	48.0	2.5
Eggs	4.8	2.7	210.0	3.7

Beef: Topside steak, Topside roast, Silverside minute steak, Silverside roast, Strips, Round steak, Round medallion, Rump steak, Rump medallion, Diced, Fillet steak, Eye fillet, T-Bone steak, Sirloin steak, Scotch fillet steak, Blade steak, Chuck steak, mince.

Lamb: Mini roast, Lamb steak (round or topside), Leg roast (easy carve), Leg roast (bone-in), Diced, Rump, Chump chop, Strips, Tenderloin, Loin chop, Frenched cutlet/rack, Forequarter chop, Easy carve shoulder, Eye of loin, Butterfly steak, Drumstick.

Veal: Strips, Diced, Leg steak, Cutlet.

Venison: Venison, grilled or BBQ

Pork: Pork neck bakes, medallion steak grilled, loin chop grilled, leg diced boiled or simmered, leg strips stir-fried, leg steak microwaved, butterfly steak grilled, fillets, forequarter chop BBQ.

Poultry: Chicken breast lean baked, chicken thigh lean baked, turkey breast baked lean

Seafood: cooked king prawns, cooked lobster, Oysters, cooked crab, cooked muscles, cooked scallops, steamed squid

Fish: Snapper, Whiting, Flake, Atlantic salmon, tuna, trout and barramundi (all steamed or poached)

Legumes: Haricot bean, chickpea, Soya bean, kidney bean, lima bean, cannelloni bean

Kangaroo: loin fillet grilled, rump baked.

Eggs: chicken whole hard boiled

Table 2: Proportion of beef/veal/lamb in composite "red meat" group

	Men*	Women*	Boys**	Girls**
Beef	68	65	78	73
Lamb	2	3	13	16
Veal	18	20	1	1
Average beef/lamb/veal	88	88	92	90
Kangaroo & Venison	0	0	0	0
Pork	12	12	7	9

Average for men and women aged 19 to 70 years (p.99)

**Average for boys (p.103) & girls (p.107) aged 2 to 18 years

Table 3: Comparisons of fatty acid profile of Australian and USA beef

Beef fatty acids per 100g	Australia*	USA **
Total fat (g)	5.5	10.6
SFA (g)	1.9	3.9
MUFA (g)	2.2	4.6
PUFA (g)	0.6	0.4
Omega 3 total (EPA+DHA+DPA) (mg)	128	0

All cuts based on separable lean and cooked data

* Australia (average of following cuts): Blade, eye fillet, rump, low fat mince[84]

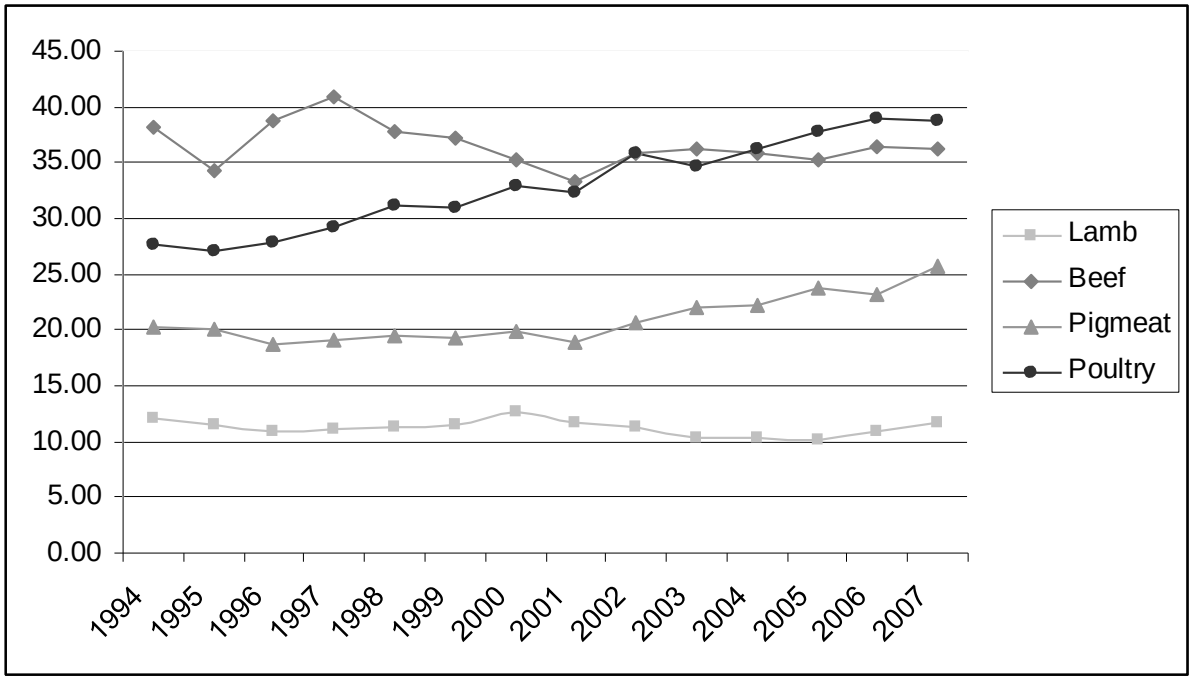
** USA (average of following cuts): Top blade, tenderloin, Top sirloin (equivalent to rump), ground beef (beef mince: 90% lean)[85]

Table 4: Proposed red meat portion sizes

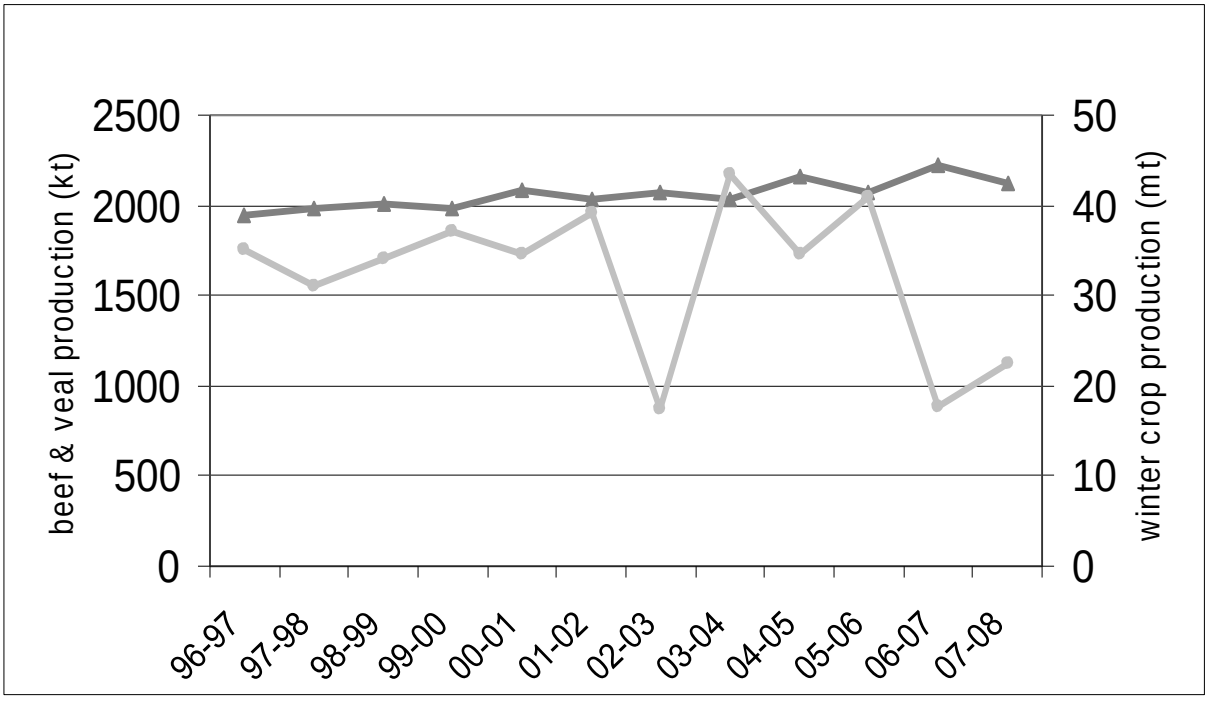
Cut	Measure	Cooked weight*	Uncooked weight
Mince	½ cup	100g	140g (3/5 cup)
Strips	½ cup	100g	140g (2/3 cup)
Roast	2 Slices	110g	160g
Steak	Small palm Large palm	100g 135g	150g 190g
Chops	Small palm Large palm	45g (minus bone) 110g (minus bone)	85g (with bone) 190g (with bone)
Cutlets	2-3 small cutlets	135g (minus bone)	220g (with bone)

* Based on 30% moisture loss with cooking

Graph 1: Per capita meat consumption (kg) in Australia (1994-2007)



Graph 2: Yields during time of drought



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