2007

Composition of Australian red meat 2002. 3. Nutrient profile

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Publication Details

This article was originally published as: Williams, PG, Droulez, V, Levy, G & Stobaus, T, Composition of Australian red meat 2002. 3. Nutrient profile, Food Australia, 2007, 59(7), 331-341.

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Keywords
red meat, nutrients, beef, lamb, mutton, veal

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Title: **Composition of Australian red meat 2002. 3. Nutrient profile**

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Word count: 4040
Version: 2-revised November 2006
Running title: Nutrients in Australian red meat

Abstract

Two 500g retail samples of thirteen beef, eleven lamb, four veal and two mutton cuts were purchased from 10 retail outlets (butchers and supermarkets) in different socio-economic areas of Sydney and Melbourne in 2002. One sample of each was cooked using standard low fat methods, and the lean and separable fat components of each raw and cooked sample were analysed by the National Measurement Institute in Melbourne for macronutrients, cholesterol, vitamins A, B1, B2, B3, B6, and beta-carotene as well as sodium, potassium, calcium, iron, zinc, magnesium, manganese, and phosphorus. This study also provides the first analyses of the vitamins pantothenic acid, B12, D, E and folate, and the minerals copper and selenium in Australian red meat. The nutrients in 100g of trimmed lean meat were compared to the new recommended dietary intakes for Australians. While there are some differences between the four meats, in general lean red meat is low in fat (<7%), and a particularly good source of protein, niacin, vitamin B6, vitamin B12, phosphorus, zinc and iron, with 100g providing more than 25% male adult RDI of these nutrients. Red meats also provide more than 10% RDI of riboflavin, pantothenic acid, and selenium.

Introduction

Red meat (defined as beef, lamb, veal and mutton) is frequently consumed by the majority of Australians and therefore plays an important role in the Australian diet (Baghurst and others 2000). Red meats are a significant contributor to the intake of key nutrients in a healthy diet (Biesalski 2005; Williamson and others 2005); they are a valuable source of dietary protein and the best sources of bio-available iron in the Australian diet (NH&MRC 2003). In the 1995 National Nutrition Survey, red meat consumption provided less than 5% of the average adult energy intake, but over 10% of the protein, and more than 13% of dietary zinc intake (McLennan and Podger 1998).

Analysis of nutrient intakes from the 1995 survey was based on analytical data that were collected in 1986. Since then, there have been changes in production, butchering and consumer preparation practices which may impact on the contribution of red meat to nutrient intake, including slaughter of younger animals, butchering practices that favour leaner meat cuts, and more trimming of meat by consumers after purchase - both in the UK (Higgs 2000) and in Australia (personal communication; J Hales Meat and Livestock Australia 2006). Research has shown that the separable fat content of red meat in Australia is now lower than previously reported (Williams and others 2006).

Furthermore, data are lacking on the content of many nutrients in Australian red meat, including pantothenic acid, vitamin B12, vitamin D, vitamin E, folate, copper and selenium. Most commonly UK data have been used to fill these gaps. Muscle meat has been thought to be a poor source of vitamin D, but analyses in Britain have found significant levels of Vitamin D3 and 25-hydroxycholecalciferol in meat, and it is now estimated that meat products provide around 20% of British intakes of vitamin D, compared to previous estimates of just 4% (Chan and others 1995; Gibson and Ashwell 1997). Selenium from meat is highly bio-available (Shi and Spallholz 1994) and in the US beef alone is estimated to provide 17% of the total selenium in the American diet (Holden and others 1991), but the effect of differing soil content on the selenium content of Australian meat is not well studied. Since the feed sources and animal production techniques for UK and US red meat differ from those for Australian red meat, there is need for Australian data on these nutrients in local meat.

This paper is the third in a series of papers on the composition of Australian red meat (Williams and others 2006; Droulez and others 2006) and provides information on the nutrient content of the raw and cooked lean and fat components of popular Australian beef, veal, lamb and mutton retail cuts.

Methods

Collection of meat samples

Duplicate samples of thirteen beef, eleven lamb, four veal and two mutton cuts were purchased from 10 retail outlets (6 supermarkets and 4 butchers) in different socio-economic areas of Melbourne and Sydney in June 2002. Samples were purchased anonymously and chosen to represent typical samples available on the day. Each duplicate sample was approximately 500g and they were chosen to be as similar as possible to each other in appearance and with the same use by date (if pre-packed). The samples were collected as part of a larger study of the gross composition of Australian red meat and the sampling, collection and cooking methods have been described in detail elsewhere (Williams and others 2006).

The thirteen beef cuts were round steak, rump steak, topside roast, silverside roast, fillet steak, sirloin steak (also called New York cut or Porterhouse steak), scotch fillet (also called cube roll, rib-eye, or rib fillet steak), T-bone steak, blade steak, chuck steak, diced beef, stir-fry beef and hamburger mince. The four veal cuts were leg steak, veal cutlet, stir-fry strips and diced veal. The eleven lamb cuts were leg (bone-in) roast, Easy Carve leg roast, lamb mini roast, chump chop, loin chop, Frenched cutlet, forequarter chop, Easy Carve shoulder, diced lamb, stir-fry lamb strips and lamb mince. The two mutton cuts were baking leg and casserole.

A supplementary collection of samples of three other types of beef mince – regular, premium (or choice) and low fat mince (also called diet, extra trim, and Heart Smart) – was undertaken from 9 retail outlets (6 supermarkets covering two different retail chains and 3 independent butchers) in high, medium and low socio-economic status suburbs of Melbourne in January 2003.

Preparation of meat samples for analysis

Samples were transported chilled to the National Measurement Institute (NMI) in Melbourne - called the Australian Government Analytical Laboratory (AGAL) at the time of the study - within 24 hours of purchase. One of the duplicate samples was dissected as previously described into separable lean, total separable fat, or into external and internal separable fat where appropriate, and waste/bone/heavy

connective tissue components. Dissection was conducted as quickly as possible to minimise moisture loss.

A trained home economist cooked the second purchase of each cut according to recommended cut-specific meat cooking protocols but with no addition of any fat, as previously described (Williams and others 2006). Roasts were cooked in an oven to an internal temperature of 70°C; diced meat, stir-fry strips and mince were cooked in a non-stick frying pan (3-5 minutes); steaks, chops and cutlets were grilled to medium doneness using an electric grill (6-10 minutes); mutton casserole and chuck steak were browned then simmered with minimal water for two hours.

Immediately following dissection, equal quantities from the lean component of each raw or cooked sample of each retail cut were combined to form a composite sample. Equal quantities from the fat component of each purchase for each cut were combined to form a composite fat sample. Analyses of moisture, protein and total fat were carried out individually on the composite raw and cooked samples of each meat cut. The following cuts, derived from similar parts of the carcase, were pooled to form one sample of muscle meat for analysis of most of the micronutrients: (1) beef diced and stir fry; (2) beef round and rump; (3) beef topside and silverside; (4) beef fillet steak, New York steak, scotch fillet, T-Bone steak; (5) veal leg steak, cutlet, stir-fry and diced; (6) lamb leg roast, Easy Carve leg roast, Trim Lamb mini-roast and chump chops; (7) lamb loin chops and Frenched cutlets; (8) lamb forequarter chop and Easy Carve shoulder; (9) mutton leg and casserole. Equal quantities of separable fat from all cuts were pooled to form one sample of beef, veal, lamb and mutton fat for analysis of micronutrients.

Samples were homogenized quickly to keep chilled (approximately 4°C) in a heavy-duty blender and stored in plastic samples containers with screw top lids, filled to a minimum headspace, in a –18°C freezer prior to analysis. Each sample container was labelled with a sample description and a unique AGAL Laboratory Registration Number.

Analytical methods

Samples were analysed for moisture, protein, fat, cholesterol and 11 vitamins and 10 minerals. Total ash was not analysed and has not been reported. For budgetary reasons, not all samples were analysed

for all micronutrients, especially where there was analytical data available from other surveys (Lewis and others. 1993; Sadler and others 1993; Sinclair and others 1999).

Table 1 summarises the nutrients analysed, the methods employed, the limits of detection and reporting and the recovery rates for each nutrient. Most samples were analysed by staff of the Melbourne laboratories of the NMI, which is accredited by the National Association of Testing Authorities (NATA) and holds quality systems certification with AS/NZS ISO 9001. All analytical methods are validated and NATA accredited for determination in meats. A regimen of Quality Control (QC) criteria was applied to each set of analytical determinations. QC included measurement of recoveries, duplicates and Standard Reference Materials (SRMs). More details on methods and QC procedures are available on request from the author TS at NMI. A factor of 6.25 was used for nitrogen to protein conversion. Microbiological analyses of folate, pantothenic acid and vitamin B12 were undertaken at an accredited pathology laboratory of Royal Perth Hospital, after overnight transportation of frozen samples (-18°C) to preserve vitamins during travel and storage. Recoveries between 80-120% were regarded as acceptable, and levels of agreement between duplicates were all within 10% (most were within 5%).

Results and discussion

Proximates and cholesterol

Tables 2 and 3 show the moisture, protein, total fat and cholesterol contents of the beef and veal cuts separately, along with the vitamins analysed. Table 4 shows the same results for lamb and mutton. Where pooled values have been presented for some of the micronutrient values of lean meat samples (as described in the Methods section), superscript letters are used in the tables to indicate this. The sum of the measured proximate values (moisture, protein and fat, but excluding ash) for all cuts ranged between 95.2 and 102.7 g/100g. Previous analyses have reported average values of ash in lamb and beef of 1.1g/100g (lean) and 0.25g/100g (fat) (Greenfield and others 1987a; Greenfield and others 1987b). The total proximate values, assuming these estimated average ash values, therefore showed acceptable accuracy. Including the imputed ash values, only 8 of the 74 results were just slightly outside of the acceptable range of 97-103% (Greenfield and Southgate 2003): beef diced cooked lean (103.6), beef stir-fry raw lean (103.5), beef round steak raw lean (96.3), beef fillet cooked lean (96.6), and beef scotch fillet cooked lean (96.3), veal stir-fry raw lean (103.5), lamb cutler raw lean (103.7), mutton casserole cooked lean (103.8). The protein content of the lean meat cuts ranged from 19.3 to 27.9/100g for beef and veal and from 18.2 to 28.6g/100g for lamb and mutton. These values are mostly similar to those reported in 1987 (Greenfield and others 1987a; Greenfield and others 1987b). In those few cuts where the value is significantly higher in these most recent analyses (eg lamb loin chop: 28.6 vs 22.6g/100g), the moisture is proportionally lower than in the earlier results.

The total fat values in the raw lean beef cuts were all less than 6g/100g, but in mince ranged from 6.8g/100g (low fat mince) to 16.4g/100g (hamburger mince). In the raw lean meat samples of the veal cuts the fat content ranged from 1.1-2.0g/100g. The beef values are generally similar or lower than those previously reported in the lean component for most cuts (Hutchison and others 1987; Greenfield and others 1987b; Lewis and others 1993), indicating that beef may have become somewhat leaner since 1980s and 1990s. One exception to this trend was beef fillet, where the fat content of lean muscle meat (5.2g/100g) was slightly higher than reported in 1987 (4.2g/100g). Samples were retested for fat content and similar results were obtained. The reason for this difference is not known.

The fat content of lean muscle lamb and muscle meat (ranging from 3.2-6.7g/100g) was slightly higher in 2002 compared to 1987, particularly in the Trim Lamb cuts. The higher fat content of lamb muscle

meat may be explained by changes in the sheep industry. According to information from Meat and Livestock Australia, carcases were smaller with less muscle and hence less intramuscular fat in the early 1980s. Since then, the lamb industry has developed and there has been progress in genetics with the production of larger lambs with an emphasis on putting on muscle and thus more intramuscular fat. The fat content of lamb mince was 6.9g/100g, similar to that of low fat beef mince, but lower than regular and premium beef mince.

The values for total fat in the lean meat samples reported here, analysed using the Soxhlet method, are slightly lower but similar to the values from the pooled samples of meat cuts calculated from the sum of fatty acids analysed by gas liquid chromatography reported previously (Droulez and others 2006). However, the values for the separable fat components were significantly different with the two methods, and those reported in this paper are generally higher. The difference is likely to be due to problems in the complete homogenization of the fat samples in the previous study. The pooled values for total fat reported here are similar to those reported previously in Australian separable meat fat: beef 61.4g/100g versus 57.5 in 1982 (Hutchison and others 1987); lamb 57.6g/100g versus 53.8 in 1992 (Sadler and others 1993) and veal 29.0/100g versus 31.3 in 1986 (Greenfield and others 1987b). Total cholesterol varied from 35-67mg/100g in raw lean beef and veal, and 54-78mg/100g in raw lean lamb and mutton and these values are similar to those reported in 1993.

Vitamins

The levels of retinol in the lean meat are similar to those reported previously – with negligible levels in the beef but small amounts in lamb and mutton meat (around 8µg/100g), similar to that reported in British lamb (Chan and others 1995). The levels in the beef and lamb fat are higher than that in the UK. Beta-carotene has previously been reported to be absent in both beef and lamb meat and fat, but small quantities were found in the beef samples analysed here, both in the lean and fat components, possible due to the use of a different analytical method. The alpha-tocopherol levels in the Australian lean beef and veal (0.5-0.9mg/100g) are higher than the UK average lean beef values (0.13mg/100g), as are the values in Australian lamb and mutton (0.2-0.5mg/100g, compared to the UK average values of 0.09/100g). This is a somewhat surprising finding, since it might have been expected that lot-fed animals in the UK would be consuming more fortified feed.

Vitamin D was not analysed in Australian meats in the 1987 or 1993 studies, however UK trimmed lean beef and lamb contain on average 0.5µg and 0.4µg /100g respectively – where Vitamin D activity is reported as the sum of cholecalciferol (D3) and 25-hydroxycholecalciferol (the five times more metabolically active form of the vitamin (Chan and others 1995). There was no cholecalciferol or 25-hydroxycholecalciferol found in any of the Australian cuts. However it should be noted that the method used for these analyses had a reporting limit of only 5µg/100g and lower values could have been present. However it should be noted that the method used for these analyses had a detection limit of only 0.2 µg/100g and lower values could have been present. A Danish paper on pork cuts (Clausen and others 2003) suggests that the higher the fat content of the meat analysed, the higher the vitamin D content, so the lower fat content of Australian meats may be related to these findings. The differences could also be due to feeding: Australian red meat is mostly range fed while UK and US stock could have fortified lot feeding. There is a need to develop national expertise in vitamin D analysis of foods in Australia as there appear to be few analytical vitamin D data for Australian foods.

The levels of the water soluble vitamins thiamin and riboflavin in these 2002 meat samples are slightly lower in some beef cuts compared to those from 1986, while the values for niacin are higher, possibly due to differences in analytical methods (Greenfield and others 1987b). For veal, thiamin values were lower in 2002 but similar or higher for riboflavin and niacin to the earlier analyses. There are no earlier studies to use for comparison for mutton, but the values for thiamin are comparable to those for lamb reported in 1987 (Greenfield and others 1987a).

Pantothenic acid levels in lean lamb ranged from 0.68-0.92mg/100g and were significantly higher in mutton at 1.3mg/100g, being more than twice as high in the lean meat compared to the fat component. These values are higher than those reported from 1997 in Australian lamb cuts which are exported to the US (and which may not be representative of Australian retail cuts) (Hoke and others 1999), but similar to those in British lamb (Chan and others 1995). The vitamin B6 level in mutton was also more than twice that previously reported British and Australian lamb, suggesting that the older meat may be nutritionally richer in this vitamin.

Vitamin B12 in beef and lamb mince and veal and mutton ranged from 1.6-2.8µg/100g, similar to the UK values (2µg/100g) which have generally been used for Australian meat in dietary analyses until now. These values are somewhat lower than those reported from 1997 in Australian lamb cuts which

are exported to the US – which ranged from 1.82 to 3.01/100g (Hoke and others 1999). Folate was largely undetectable in the Australian meat (except in some cooked lamb samples at 17µg/100g), although small levels have been reported in UK meat (Chan and others 1995). It is possible that this result was affected by losses during the handling procedure. Ideally it is recommended that chilled fresh samples are analysed. In this case, for logistical reasons, samples were frozen and transported by air before analysis, but not stored at -70°C, which is regarded as optimal (Greenfield and Southgate 2003). Differences in analytical methods might also explain the differences compared to UK results.

Minerals

Tables 5 and 6 show the mineral contents of the beef and veal cuts separately. Table 7 shows the same results for the lamb and mutton samples. For each cut the individual raw and cooked lean values are presented, as well as a single pooled result for raw and cooked fat for beef, veal, lamb and mutton.

The levels of sodium, potassium, calcium, zinc, magnesium, and phosphorus were similar for both beef and lamb cuts to the values reported for Australian meat in 1993 and 1987 (Greenfield and others 1987a; Greenfield and others 1987b; Lewis and others 1993; Sadler and others 1993). Lean red meat is low in sodium with a potassium/sodium ratio of greater than five. The copper content in raw lean cuts ranged from 0.055 to 0.190mg/100g in beef and veal, 0.090 to 0.140mg/100g in lamb, and 0.190 to 0.240mg/100g in mutton, all significantly higher than values reported in British meat (Chan and others 1995) but similar to values reported in Australian export lamb (Hoke and others 1999).

Iron levels varied from 1.2-2.2mg/100gin lean beef, 0.7-1.5mg/100g in veal, 1.6-2.2mg/100g in lamb and 2.2-4.3mg/100g in mutton. These values are lower than those reported by Lewis and other (1993) for some beef cuts (topside, silverside, rump, and fillet) but the levels in some other cuts (round, sirloin) were higher. Diced and stir fry beef were not analysed in 1987, however, their iron levels were found to be moderate in these analyses (1.7mg/100g). Compared to iron levels reported in UK trimmed lean beef, iron levels in Australian meat were generally similar: 1.9mg/100g in Australian versus 1.8mg/100g in UK beef (Chan and others 1995). The iron levels found in the lamb samples are similar to those reported in 1987 and 1993 and it is noteworthy that the level in mutton leg is significantly higher than any other red meat (4.3mg/100g), whereas consumer preference has moved away from mutton to lamb.

It has been reported previously that the selenium levels in Australian meat ranges from 7-12 µg/100g in beef and 13-22 µg/100g in lamb (McNaughton and Marks 2002). The levels for beef and lamb reported here are similar (10-20 µg/100g), however the values in veal and mutton were all very low. It is likely that selenium values in meat are significantly affected by where animals feed and the time of the year of sampling. Therefore apparently large differences may reflect the true variation in content in the food supply by time or location. None of the meat samples had detectable levels of manganese (<0.05mg/100g).

Cooked versus raw values

In general the values of cooked products are higher than the raw values, due to the concentration of nutrients during the normal moisture loss with most cooking methods. In some cases a nutrient is apparently absent (ie, below the level of detection) in the raw product, but present at detectable levels in the cooked products, presumably because of the concentration effect on cooking (eg, selenium in round steak and lamb mince).

In a few instances the values of the cooked product were unexpectedly less than the raw values. This could be due several reasons:

1) the cooked samples were different purchases to the raw samples, and so the differences may reflect real variability between samples,

2) the cooking process may result from losses of some heat sensitive nutrients such as thiamin, pyridoxine and alpha-tocopherol, or

3) limitations of the analytical method may be the cause, particularly when the analysed contents were near the limits of reporting (eg selenium in round steak).

Deriving values for food composition databases

Cost constraints precluded analysis of each retail cut for all nutrients. However many cuts represent components derived from the same primal carcase cuts. Butchery techniques, which carefully separate the muscles and remove all possible fat from between them, are know as ‘seamed butchery’ and are being used increasingly. Seamed cuts are typically very low in fat and the micro-nutrient analysis of the

lean only components of the original cuts should represent the content of these sub-fractional cuts. Based on an understanding of the butchering specifications, values can therefore be assumed to be close to identical for many cuts from similar parts of the animal carcase. For example,

- values from analysis of sliced rump steak can be used to derive values for rump medallions and rump roast
- Topside roast can be used to derive values for topside steak
- Silverside roast can be used to derive values for silverside minute steak.
- Round steak can be used for the values for round medallion (which is one of the two muscles within round steak).

Comparison to nutrient reference values

Table 8 shows the contribution of the average nutrient values of 100g of lean red meat from these analyses compared to the new Australian recommended dietary intakes of an adult male (NH&MRC 2006), excluding those nutrients which contribute less than five percent of the RDI (calcium, manganese, sodium, vitamin A, vitamin D and folate). While there are some differences between the four meats, in general lean red meat is a particularly good source of protein, niacin, vitamin B6, vitamin B12, phosphorus, zinc and iron, with 100g providing more than 25% RDI of these nutrients. It also provides more than 10% RDI of riboflavin, pantothenic acid, and selenium. Of the four meats, mutton is particularly nutrient dense, and the richest source of thiamin, vitamins B6 and B12, phosphorus, iron and copper.

Conclusion

The results presented here update information on the nutrient content of popular retail cuts of Australian red meat and provide new data on the pantothenic acid, vitamin B12, vitamin D, vitamin E, folate, copper and selenium content. When combined with the results of the study of gross composition (Williams and others 2006) they can be used to calculate the nutrient content of red meat as purchased, semi-trimmed or fully trimmed, for use in food composition tables. Lean Australian red meat is generally low in fat, and a good source of protein, niacin, vitamin B6, vitamin B12, phosphorus, zinc and iron.

Acknowledgements

This research was funded by Meat and Livestock Australia. Our thanks to Judy Cunningham, Luisa Trevisan and Greg Milligan from the Food Composition Program of Food Standards Australia New Zealand for advice on the study design.

Table 1. Analytical methods, limits of reporting[a], limits of detection[b] and recovery

Determination	Method	Reference	Limit of Reporting per 100g	Limit of Detection per 100g	Measured recovery %
Moisture	Oven drying of sample at 102°. Gravimetric determination.	(Cunniff 1995) AOAC methods 934.06, 964.22	0.5 g	0.1 g	n/a*
Protein	Total nitrogen by Kjeldahl method Conversion factor for protein of 6.25.	(Cunniff 1995) AOAC methods. 981.10, 920.152, 990.03, 920.87	0.2 g	0.01	97.5-99.6
Fat	Soxhlet extraction with gravimetric determination.	(Cunniff 1995) AOAC methods 920.39, 960.39, 948.22	0.2 g	0.05 g	n/a*
Cholesterol	Solvent extraction. Gas chromatography with Flame Ionisation detection of cholesterol acetate.	(Cunniff 1995) AOAC method 976.2	1 mg	0.5 mg	88-111
Thiamin	Enzymatic digestion. Separation by HPLC with post column derivatisation to thiochrome. Fluorescence detection.	(Cunniff 1995) AOAC method 942.23 (Wehling and Wetzel 1984)	0.025 mg	0.01 mg	104-115
Riboflavin	Enzymatic digestion. Separation by reverse phase HPLC with fluorescence detection.	(Cunniff 1995) AOAC method 970.65 (Wehling and Wetzel 1984)	0.05mg	0.02 mg	95-100
Niacin	Alkaline digestion followed by extraction and clean-up using Solid Phase C18 & SCX cartridges. HPLC Separation with Photo Diode Array (PDA) detection as nicotinic acid.	(Horwitz 1984) AOAC method 43.025 (Ward and Trenerry 1997) (Ward, Trenerry et al. 1997)	0.5 mg	0.2 mg	98-125
Pyridoxine	Acetate extraction of B6 compounds followed by conversion to a single form, pyridoxol. Separation by reverse phase HPLC with fluorescence detection.	(Wehling and Wetzel 1984)	1 mg	0.5 mg	96-104
Retinol	Alkaline digestion followed by solvent extraction. Separation by reverse phase HPLC with Photo Diode Array (PDA) or UV detection.	(Brubacher, Muller-Mulot et al. 1985)	5 ug	1 ug	89-100
Beta-Carotene	Alkaline digestion followed by solvent extraction. Separation by reverse phase HPLC with Photo Diode Array (PDA) or UV detection.	In house validated method based on (Brubacher, Muller-Mulot et al. 1985)	5 ug	1 ug	89-100
Cholecalciferol and 25 OH Vitamin D3	Alkaline digestion followed by solvent extraction. Vitamin D fraction collection by HPLC. Separation by reverse phase HPLC with Photo Diode Array (PDA) or UV detection.	(Jones, Seamark et al. 1985)	5 ug	0.2 ug	80-87
Alpha-tocopherol	Alkaline digestion followed by solvent extraction. Separation by HPLC with fluorescence detection.	(Nelis, Veerle et al. 1985)	0.1 mg	0.05mg	92-100
Cobalamin	Extraction by autoclaving in acidified acetate buffer. Innoculation with *Euglena gracilis* with a 5 day growth period. Determination made by absorbance at 640nm.	(Andersen 1983)	0.1 ug	0.02 ug	80-120

Pantothenic Acid	Extraction by autoclaving in acidified acetate buffer. Innoculation with *Lactobacillus planatarum* with a 20hr growth period. Determination made by measuring turbidity at 550nm.	AOAC (1990) Method 945.74	0.1 mg	0.01 mg	96-119
Folate	Extraction in acidified acetate buffer followed by 3 enzyme treatments. Innoculation with *Lactobacillus Casei*. Determination made by turbidity.	(Angyal 1996)	10 ug	1 ug	100-114
Sodium	Inductively Coupled Plasma (ICP) - Atomic emission spectrometry	(US Environmental Protection Agency 2003) Methods 6020A, 6010B	1 mg	0.1 mg	85-115
Potassium	Inductively Coupled Plasma (ICP) - Atomic emission spectrometry	(US Environmental Protection Agency 2003) Methods 6020A, 6010B	1 mg	0.1 mg	85-115
Calcium	Inductively Coupled Plasma (ICP) - Atomic emission spectrometry	(US Environmental Protection Agency 2003) Methods 6020A, 6010B	0.5 mg	0.1 mg	85-115
Iron	Inductively Coupled Plasma (ICP) - Atomic emission spectrometry	(US Environmental Protection Agency 2003) Methods 6020A, 6010B	0.2 mg	0.01 mg	85-115
Magnesium	Inductively Coupled Plasma (ICP) - Atomic emission spectrometry	(US Environmental Protection Agency 2003) Methods 6020A, 6010B	0.5 mg	0.1 mg	85-115
Zinc	Inductively Coupled Plasma (ICP) - Atomic emission spectrometry	(US Environmental Protection Agency 2003) Methods 6020A, 6010B	0.1 mg	0.01 mg	85-115
Copper	Inductively Coupled Plasma (ICP) - Atomic emission spectrometry	(US Environmental Protection Agency 2003) Methods 6020A, 6010B	0.05 mg	0.01 mg	85-115
Manganese	Inductively Coupled Plasma (ICP) - Atomic emission spectrometry	(US Environmental Protection Agency 2003) Methods 6020A, 6010B	0.05 mg	0.01 mg	85-115
Phosphorus	Inductively Coupled Plasma (ICP) - Atomic emission spectrometry	(US Environmental Protection Agency 2003) Methods 6020A, 6010B	0.5 mg	0.1 mg	85-115
Selenium	Inductively Coupled Plasma (ICP) - Atomic emission spectrometry	(US Environmental Protection Agency 2003) Methods 6020A, 6010B	0.01 mg	0.001 mg	85-115

[a] Limit of Reporting (LOR): the minimum level of analyte which can be reported to a satisfactory level of precision. Typically the LOR is 2 to10 times greater than the Limit of Detection (LOD).

[b] Limit of Detection (LOD): the minimum level at which the presence of analyte is consistently and definitively observable relative to background.

[c] Recovery is not applicable to these analyses and was not measured.

Table 2. Beef – Proximates and vitamins (per 100g edible portion)

	Moisture (g)	Protein (g)	Total fat (g)	Sum of proximates (without ash)	Cholesterol (mg)	Vit A (µg)	β-carotene (µg)	B1 (mg)	B2 (mg)	B3 (mg)	B5 (mg)	B6 (mg)	B12 (µg)	25(OH) Vit D (µg)	α-Tocopherol (mg)	Folate (µg)
Diced																
Raw, lean	70.2	27.9	2.7	100.8	54 [a]	<5 [e]	10 [e]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.5 [a]	n/a
Cooked, lean	66.8	32.7	3.0	102.5	77 [a]	<5 [e]	12 [e]								0.7 [a]	n/a
Stir fry																
Raw, lean	73.2	27.2	2.0	102.4	54 [a]	<5 [e]	10 [e]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.5 [a]	n/a
Cooked, lean	65.9	30.9	3.2	100.0	77 [a]	<5 [e]	12 [e]								0.7 [a]	n/a
Round steak																
Raw, lean	72.5	21.0	1.7	95.2	62 [b]	<5 [e]	10 [e]	0.03 [f]	0.11 [f]	3.0 [f]	n/a	n/a	n/a	<5 [b]	n/a	n/a
Cooked, lean	66.8	31.8	2.0	100.6	75 [b]	<5 [e]	12 [e]	0.03 [b]	0.08 [b]	3.0 [b]				n/a	0.2 [b]	n/a
Rump steak																
Raw, lean	74.6	20.4	2.8	97.8	62 [b]	<5 [e]	10 [e]	0.03 [f]	0.11 [f]	3.0 [f]	n/a	n/a	n/a	<5 [b]	n/a	n/a
Cooked, lean	61.8	32.0	4.5	100.6	75 [b]	<5 [e]	12 [e]	0.03 [b]	0.08 [b]	3.0 [b]				n/a	0.2 [b]	n/a
Topside roast																
Raw, lean	72.6	19.3	4.7	96.6	35 [c]	<5 [e]	10 [e]	0.03 [f]	0.11 [f]	3.0 [f]	n/a	n/a	n/a	<5 [c]	n/a	n/a
Cooked, lean	63.4	32.7	2.8	98.9	62 [c]	<5 [e]	12 [e]	0.06 [c]	0.20 [c]	3.0 [c]				n/a	0.7 [c]	<10 [c]
Silverside roast																
Raw, lean	75.4	24.1	2.3	101.8	35 [c]	<5 [e]	10 [e]	0.03 [f]	0.11 [f]	3.0 [f]	n/a	n/a	n/a	<5 [c]	n/a	n/a
Cooked, lean	64.0	26.9	5.6	96.5	62 [c]	<5 [e]	12 [e]	0.06 [c]	0.20 [c]	3.0 [c]				n/a	0.7 [c]	<10 [c]
Fillet steak																
Raw, lean	73.2	22.2	5.2	100.6	58 [d]	<5 [e]	10 [e]	0.05 [d]	0.22 [d]	7.0	n/a	n/a	n/a	<5 [h]	0.9 [d]	n/a
Cooked, lean	58.1	31.9	5.5	95.5	70 [d]	<5 [e]	12 [e]	0.03 [h]	<0.05 [h]	1.0 [h]				n/a	0.7 [h]	<10 [h]
Sirloin steak																
Raw, lean	72.8	24.1	1.9	98.8	58 [d]	<5 [e]	10 [e]	0.05 [d]	0.22 [d]	7.0 [d]	n/a	n/a	n/a	<5 [h]	0.9 [d]	n/a
Cooked, lean	62.4	30.5	3.8	96.7	70 [d]	<5 [e]	12 [e]	0.03 [h]	<0.05 [h]	1.0 [h]				n/a	0.7 [h]	<10 [h]
Scotch fillet steak																
Raw, lean	72.9	23.8	2.8	99.5	58 [d]	<5 [e]	n/a	0.05 [d]	0.22 [d]	7.0 [d]	n/a	n/a	n/a	<5 [h]	0.9 [d]	n/a
Cooked, lean	58.8	31.9	4.5	95.2	70 [d]	<5 [e]	12 [e]	0.03 [h]	<0.05 [h]	1.0 [h]				n/a	0.7 [h]	<10 [h]
T-bone steak																
Raw, lean	72.9	24.4	2.0	99.3	58 [d]	<5 [e]	10 [e]	0.05 [d]	0.22 [d]	7.0 [d]	n/a	n/a	n/a	<5 [h]	0.9 [d]	n/a
Cooked, lean	64.7	29.2	3.8	97.7	70 [d]	<5 [e]	12 [e]	0.03 [h]	<0.05 [h]	1.0 [h]				n/a	0.7 [h]	<10 [h]
Blade steak																
Raw, lean	72.8	22.2	2.6	97.6	45	<5 [e]	10 [e]	0.05 [g]	0.20 [g]	3.0 [g]	n/a	n/a	n/a	<5 [h]	0.5 [g]	n/a
Cooked, lean	65.0	31.9	2.9	99.8	81	<5 [e]	12 [e]	0.03 [h]	<0.05 [h]	1.0 [h]				n/a	0.7 [h]	<10 [h]
Chuck steak																
Raw, lean	74.1	23.0	3.4	100.5	67	<5 [e]	10 [e]	0.05 [g]	0.20 [g]	3.0 [g]	n/a	n/a	n/a	<5	0.5 [g]	n/a
Cooked, lean	57.7	33.0	10.6	101.3	54	<5 [e]	12 [e]	0.04	<0.05	1.0				n/a	n/a	<10
Mince -Hamburger																
Raw	65.1	19.9	16.4	101.4	63	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Cooked	60.2	26.7	12.1	99.0	110											
Mince -Regular																
Raw	69.4	20.1	10.8	100.3	76	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Cooked	61.9	24.6	12.7	99.2	99											
Mince -Premium																
Raw	71.0	21.5	8.7	101.2	74	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Cooked	65.4	24.9	9.9	100.2	89											
Mince –Low fat																
Raw	72.0	21.0	6.8	99.8	61	8.8	26	0.03	0.14	6.9	0.73	0.30	1.9	<5	1.6	n/a
Cooked	65.0	25.3	9.0	99.3	81	<5	40	0.03	n/a	5.3	0.53	0.35	2.4	<5	2.5	<10
Fat (pooled data)																
Raw fat	25.4	12.1	61.4	101.9	73	40	13	<0.025	0.05	2.0	0.28	0.30	2.9	<5	0.7	n/a
Cooked fat	27.7	15.3	55.6	98.6	65	20	13	<0.025	0.08	1.4	0.23	0.40	2.1	n/a	1.3	<10

Footnotes to Tables 2 & 5

[a] Pooled Diced and Stir-fry

[b] Pooled Round and Rump steak

[c] Pooled Topside and Silverside roast

[d] Pooled Fillet, Sirloin, Scotch fillet and T-Bone steak

[e] All cuts pooled

[f] Pooled Round, Rump, Topside and Silverside

[g] Pooled Blade and Chuck steak

[h] Pooled Fillet, Sirloin, Scotch fillet, T-Bone and Blade steak

n/a not analysed

Table 3. Veal – Proximates and vitamins (per 100g edible portion)

	Moisture (g)	Protein (g)	Total fat (g)	Sum of proximates (without ash)	Cholesterol (mg)	Vit A (µg)	β-carotene (µg)	B1 (mg)	B2 (mg)	B3 (mg)	B5 (mg)	B6 (mg)	B12 (µg)	25(OH) Vit D (µg)	α-Tocopherol (mg)	Folate (µg)
Stir fry																
Raw, lean	73.2	27.2	2.0	102.4	55	<5 [a]	<5 [a]	0.06 [a]	0.2 [a]	16.0 [a]	1.50 [a]	0.8 [a]	1.6 [a]	<5 [a]	0.5 [a]	n/a
Cooked, lean	65.0	30.0	2.8	97.8	99	<5 [a]	9.2 [a]	0.10 [a]	0.2 [a]	9.0 [a]	0.66 [a]	1.0 [a]	3.0 [a]	n/a	0.3	<10 [a]
Diced																
Raw, lean	75.5	23.1	1.5	100.1	55	<5 [a]	<5 [a]	0.06 [a]	0.2 [a]	16.0 [a]	1.50 [a]	0.8 [a]	1.6 [a]	<5 [a]	0.5 [a]	n/a
Cooked, lean	63.9	31.9	3.0	98.8	110	<5 [a]	9.2 [a]	0.10 [a]	0.2 [a]	9.0 [a]	0.66 [a]	1.0 [a]	3.0 [a]	n/a	0.3 [a]	<10 [a]
Leg steak																
Raw, lean	75.8	24.4	1.5	101.7	57	<5 [a]	<5 [a]	0.06 [a]	0.2 [a]	16.0 [a]	1.50 [a]	0.8 [a]	1.6 [a]	<5 [a]	0.5 [a]	n/a
Cooked, lean	65.0	34.4	1.9	101.3	85	<5 [a]	9.2 [a]	0.10 [a]	0.2 [a]	9.0 [a]	0.66 [a]	1.0 [a]	3.0 [a]	n/a	0.3 [a]	<10 [a]
Cutlet																
Raw, lean	74.7	24.6	1.1	100.4	35	<5 [a]	<5 [a]	0.06 [a]	0.2 [a]	16.0 [a]	1.50 [a]	0.8 [a]	1.6 [a]	<5 [a]	0.5 [a]	n/a
Cooked, lean	68.1	28.1	2.0	98.2	41	<5 [a]	9.2 [a]	0.10 [a]	0.2 [a]	9.0 [a]	0.66 [a]	1.0 [a]	3.0 [a]	n/a	0.3 [a]	<10 [a]
Fat (pooled data)																
Raw fat	52.7	19.4	29.0	101.1	70	32	<5 [a]	0.03	0.3	3.0	0.99	0.4	3.0	<5	1.1	n/a
Cooked fat	46.4	20.7	33.0	100.1	39	30	9.0	<0.025	0.1	3.0	0.89	0.2	3.3	n/a	1.1	<10

[a] Pooled stir-fry, diced, leg steak cutlet

n/a not analysed

Table 4. Lamb and mutton – Proximates and vitamins (per 100g edible portion)

	Moisture (g)	Protein (g)	Total fat (g)	Sum of proximates (without ash)	Cholesterol (mg)	Vit A (µg)	B-carotene (µg)	B1 (mg)	B2 (mg)	B3 (mg)	B5 (mg)	B6 (mg)	B12 (µg)	25(OH) Vit D (µg)	α-Tocopherol (mg)	Folate (µg)
LAMB																
Diced																
Raw, lean	72.6	21.3	5.2	99.1	78[a]	8.6[b]	<5[b]	n/a(1)	n/a(1)	n/a(1)	0.92[c]	n/a(1)	n/a(1)	n/a(1)	0.40	n/a(1)
Cooked, lean	62.5	31.3	6.5	100.3	96[a]	7.6[b]	<5[b]				0.47[g]				0.20	n/a(1)
Stir-fry																
Raw, lean	73.7	21.9	4.2	99.8	78[a]	8.6[b]	<5[b]	n/a(1)	n/a(1)	n/a(1)	0.92[c]	n/a(1)	n/a(1)	n/a(1)	0.40	n/a(1)
Cooked, lean	62.5	28.1	7.7	98.3	96[a]	7.6[b]	<5[b]				0.47[g]				0.20	n/a(1)
Leg Roast																
Raw, lean	73.7	21.1	3.2	98.0	n/a(2)	8.6[b]	<5[b]	n/a(2)	n/a(2)	n/a(2)	0.92[c]	n/a(2)	n/a(2)	<5[c]	0.40[c]	n/a(1)
Cooked, lean	61.3	30.6	6.0	97.9		7.6[b]	<5[b]				0.47[g]			<5[c]	0.20[c]	<10[g]
Easy Carve Leg Roast																
Raw, lean	73.7	21.1	3.2	98.0	n/a(2)	8.6[b]	<5[b]	n/a(2)	n/a(2)	n/a(2)	0.92[c]	n/a(2)	n/a(2)	<5[c]	0.40[c]	n/a(1)
Cooked, lean	61.3	30.6	6.0	97.9		7.6[b]	<5[b]				0.47[g]			<5[c]	0.20[c]	<10[g]
Mini Roast																
Raw, lean	73.9	21.9	4.7	100.5	n/a(3)	8.6[b]	<5[b]	n/a(3)	n/a(3)	n/a(3)	0.92[c]	n/a(3)	n/a(3)	<5[c]	0.40[c]	n/a(1)
Cooked, lean	66.4	27.8	5.6	99.8		7.6[b]	<5[b]				0.47[g]			<5[c]	0.20[c]	<10[g]
Chump chop																
Raw, lean	73.4	22.5	4.3	100.2	n/a(2)	8.6[b]	<5[b]	n/a(2)	n/a(2)	n/a(2)	0.92[c]	n/a(2)	n/a(2)	<5[c]	0.40[c]	n/a(1)
Cooked, lean	57.7	34.1	10.2	102.0		7.6[b]	<5[b]				0.29[h]			<5[c]	0.20[c]	17[i]
Loin chop																
Raw, lean	64.4	28.6	5.0	98.0	n/a(2)	8.6[b]	<5[b]	n/a(2)	n/a(2)	n/a(2)	0.57[d]	n/a(2)	n/a(2)	<5[d]	0.50[d]	n/a(1)
Cooked, lean	61.1	29.8	9.1	100.0		7.6[b]	<5[b]				0.29[h]			n/a	0.20[d]	17[i]
Frenched cutlet																
Raw	74.0	21.9	6.7	102.6	n/a(2)	8.6[b]	<5[b]	n/a(2)	n/a(2)	n/a(2)	0.57[d]	n/a(2)	n/a(2)	<5[d]	0.50[d]	n/a(1)
Cooked	59.1	30.5	8.6	98.2		7.6[b]	<5[b]				0.29[h]			n/a(1)	0.20[d]	17[i]
Forequarter chop																
Raw	74.3	20.5	5.7	100.5	n/a(2)	8.6[b]	<5[b]	n/a(2)	n/a(2)	n/a(2)	0.79	n/a(2)	n/a(2)	n/a(1)	0.50[e]	n/a(1)
Cooked	60.3	28.0	11.4	99.7		7.6[b]	<5[b]				0.78				n/a(1)	17[i]
Easy Carve Shoulder																
Raw	75.5	18.2	4.3	98.0	54	8.6[b]	<5[b]	n/a(4)	n/a(4)	n/a(4)	0.68	n/a(4)	n/a(4)	<5	0.50[e]	n/a(1)
Cooked	64.2	29.6	5.4	99.2	86	7.6[b]	<5[b]				0.66			<5	0.20	<10
Mince																
Raw	71.5	20.4	6.9	98.8	61	12.1	<5	0.09	0.19	11.2	0.42	0.56	1.7	<5	0.74	n/a(1)
Cooked	65.6	24.4	8.5	98.5	93	11.4	<5	0.16	0.26	12.0	0.26	0.42	2.1	n/a(1)	0.43	<10
Fat (pooled data)																
Raw fat	31.0[b]	10.8[b]	57.6[b]	99.4	62[b]	34.0[b]	<5[b]	<0.025[b]	0.07[b]	2.0[b]	0.43[b]	0.10[b]	2.9[b]	<5[b]	1.10[b]	n/a(1)[b]
Cooked, fat	30.4[b]	16.2[b]	53.4[b]	100.0	74[b]	42.0[b]	<5[b]	<0.025[b]	<0.05[b]	7.0[b]	0.24[b]	0.10[b]	3.0[b]	n/a(1)	0.80[b]	<10[b]
MUTTON																
Leg Roast																
Raw, lean	73.2	21.3	4.2	99.0	76	7.8	<5[f]	0.16[f]	0.25[f]	8.0[f]	1.33[f]	0.80[f]	2.8[f]	<5[f]	0.20[f]	n/a(1)
Cooked, lean	50.9	36.4	11.4	98.7	130	8.4	<5[f]	0.03[f]	<0.05[f]	2.0[f]	0.31[f]	0.50[f]	1.9[f]	n/a(1)	0.80[f]	<10[f]
Casserole																
Raw, lean	73.2	21.6	3.8	98.6	56	7.8	<5[f]	0.16[f]	0.25[f]	8.0[f]	1.33[f]	0.80[f]	2.8[f]	<5[f]	0.20[f]	n/a(1)
Cooked, lean	65.2	29.8	7.7	102.7	63	8.4	<5[f]	0.03[f]	<0.05[f]	2.0[f]	0.31[f]	0.50[f]	1.9[f]	n/a(1)	0.80[f]	<10[f]
Fat (pooled data)																
Raw fat	28.8[f]	8.2[f]	64.4[f]	101.4	78[f]	64.0[f]	<5[f]	<0.025[f]	0.07[f]	5.0[f]	0.46[f]	0.10[f]	2.9[f]	<5[f]	0.70[f]	n/a(1)[f]
Cooked fat	23.3[f]	10.7[f]	67.9[f]	101.9	77[f]	n/a(1)	<5[f]	<0.025[f]	0.12[f]	4.0[f]	0.33[f]	0.30[f]	1.3[f]	n/a(1)	0.60[f]	<10[f]

Footnotes to Tables 4 and 7

[a] Pooled diced and stir-fry

[b] Pooled diced, stir-fry, leg roast, easy carve leg roast, mini roast, chump chop, loin chop, forequarter chop, Frenched cutlet, easy carve shoulder

[c] Pooled leg roast, easy carve leg, mini roast, chump chop

[d] Pooled loin chop and Frenched cutlet

[e] Pooled forequarter chop, Easy Carve shoulder

[f] Pooled mutton leg and casserole

[g] Pooled leg roast, Easy Carve shoulder, mini roast

[h] Pooled loin chop, forequarter chop, Frenched cutlet

[i] Pooled loin chop, forequarter chop, chump chop, Frenched cutlet

n/a(1) not analysed

n/a(2) not analysed; data available from (Sinclair, Mann et al. 1999)

n/a(3) not analysed; data available from (Sadler, Lewis et al. 1993)

n/a(4) not analysed; data available from (Hoke, Buege et al. 1999)

Table 5. Beef – Minerals (per 100g edible portion)

	Na (mg)	K (mg)	Ca (mg)	Fe (mg)	Zn (mg)	Mg (mg)	Mn (mg)	P (mg)	Cu (mg)	Se (mg)
Diced										
Raw, lean	38 [a]	340 [a]	4.5 [a]	1.7 [a]	5.7 [a]	24 [a]	<0.05 [a]	240 [a]	0.080 [a]	0.019
Cooked, lean	47 [a]	360 [a]	4.4 [a]	2.8 [a]	7.2 [a]	23 [a]	<0.05 [a]	260 [a]	0.100 [a]	<0.010
Stir fry										
Raw, lean	38 [a]	340 [a]	4.5 a	1.7 [a]	5.7 [a]	24 [a]	<0.05 [a]	240 [a]	0.080 [a]	n/a
Cooked, lean	47 [a]	360 [a]	4.4 [a]	2.8 [a]	7.2 [a]	23 [a]	<0.05 [a]	260 [a]	0.100 [a]	
Round steak										
Raw, lean	50 [b]	370 [b]	4.0 [b]	2.1 [b]	4.1 [b]	26 [b]	<0.05 [b]	230 [b]	0.120 [b]	<0.010
Cooked, lean	43 [b]	350 [b]	6.0 [b]	3.3 [b]	8.2 [b]	27 [b]	<0.05 [b]	290 [b]	0.140	0.020
Rump steak										
Raw, lean	50 [b]	370 [b]	4.0 [b]	2.1 [b]	4.1 [b]	26 [b]	<0.05 [b]	230 [b]	0.120 [b]	n/a
Cooked, lean	43 [b]	350 [b]	6.0 [b]	3.3 [b]	8.2 [b]	27 [b]	<0.05 [b]	290 [b]	0.140	
Topside roast										
Raw, lean	44 [c]	360 [c]	4.0 [c]	1.2 [c]	3.0 [c]	24 [c]	<0.05 [c]	200 [c]	0.064 [c]	n/a
Cooked, lean	54 [c]	340 [c]	4.2 [c]	2.4 [c]	4.8 [c]	24 [c]	<0.05 [c]	220 [c]	0.124 [c]	
Silverside roast										
Raw, lean	44 [c]	360 [c]	4.0 [c]	1.2 [c]	3.0 [c]	24 [c]	<0.05 [c]	200 [c]	0.064 [c]	n/a
Cooked, lean	54 [c]	340 [c]	4.2 [c]	2.4 [c]	4.8 [c]	24 [c]	<0.05 [c]	220 [c]	0.124 [c]	
Fillet steak										
Raw, lean	57 [d]	380 [d]	5.8 [d]	2.2 [d]	3.8 [d]	27 [d]	<0.05 [d]	230 [d]	0.150 [d]	n/a
Cooked, lean	49 [d]	350 [d]	9.6 [d]	2.2 [d]	7.8 [d]	26 [d]	<0.05 [d]	270 [d]	0.100 [d]	
Sirloin steak										
Raw, lean	57 [d]	380 [d]	5.8 [d]	2.2 [d]	3.8 [d]	27 [d]	<0.05 [d]	230 [d]	0.150 [d]	<0.010
Cooked, lean	49 [d]	350 [d]	9.6 [d]	2.2 [d]	7.8 [d]	26 [d]	<0.05 [d]	270 [d]	0.100 [d]	n/a
Scotch fillet steak										
Raw, lean	57 [d]	380 [d]	5.8 [d]	2.2 [d]	3.8 [d]	27 [d]	<0.05 [d]	230 [d]	0.150 [d]	n/a
Cooked, lean	49 [d]	350 [d]	9.6 [d]	2.2 [d]	7.8 [d]	26 [d]	<0.05 [d]	270 [d]	0.100 [d]	
T-bone steak										
Raw, lean	57 [d]	380 [d]	5.8 [d]	2.2 [d]	3.8 [d]	27 [d]	<0.05 [d]	230 [d]	0.150 [d]	n/a
Cooked, lean	49 [d]	350 [d]	9.6 [d]	2.2 [d]	7.8 [d]	26 [d]	<0.05 [d]	270 [d]	0.100 [d]	
Blade steak										
Raw, lean	56	340	4.4	1.9	4.6	24	<0.05	200	0.120	n/a
Cooked, lean	48	400	5.8	2.6	6.0	30	<0.05	260	0.196	
Chuck steak										
Raw, lean	62	360	4.0	1.8	6.6	22	<0.05	190	0.190	0.020
Cooked, lean	53	300	5.9	3.2	5.3	24	<0.05	250	0.150	<0.010
Mince - Hamburger										
Raw	71	320	7.4	1.6	4.4	22	<0.05	200	0.080	0.013
Cooked	100	440	13	3.6	5.7	30	<0.05	280	0.150	<0.010
Mince - Regular										
Raw	64	330	8.3	1.7	4.5	23	<0.05	200	0.072	0.014
Cooked	70	440	7.7	2.6	5.9	28	<0.05	260	0.100	0.015
Mince - Premium										
Raw	63	323	8.1	1.7	4.4	23	<0.05	196	0.070	0.010
Cooked	70	440	7.7	2.6	5.9	28	<0.05	260	0.100	0.015
Mince – Low fat										
Raw	76	340	5.6	2.0	4.2	22	<0.05 [a]	200	0.069	n/a
Cooked	93	480	10.0	2.8	6.4	31	<0.05 [a]	280	0.110	
Fat (pooled data)										
Raw fat	25	150	6.5	1.3	0.9	9	<0.05	87	<0.05	<0.010
Cooked fat	29	160	7.7	1.0	1.3	11	<0.05	100	<0.05	<0.010

Table 6. Veal – Minerals (per 100g edible portion)

	Na (mg)	K (mg)	Ca (mg)	Fe (mg)	Zn (mg)	Mg (mg_	Mn (mg)	P (mg)	Cu (mg)	Se (mg)
Stir fry										
Raw, lean	56	420	6.6	1.5	4.7	28	<0.05	280	0.098	<0.01
Cooked, lean	79	530	8.5	2.1	5.8	37	<0.05	370	0.140	0.016
Diced										
Raw, lean	46	330	5.6	0.9	3.6	22	<0.05	220	0.073	<0.01
Cooked, lean	85	490	8.1	2.0	7.0	34	<0.05	360	0.150	0.015
Leg steak										
Raw, lean	56	366	6.2	1.4	4.7	31	<0.05	300	0.086	<0.01
Cooked, lean	49	380	6.2	1.7	4.9	28	<0.05	300	0.120	0.018
Cutlet										
Raw, lean	45	330	7.5	0.7	3.6	23	<0.05	240	0.055	<0.01
Cooked, lean	46	300	6.2	1.1	3.7	20	<0.05	210	0.052	0.014
Fat (pooled data)										
Raw fat	25	160	14.0	0.6	1.7	11	<0.05	110	<0.05	<0.01
Cooked fat	32	160	6.7	0.8	1.5	11	<0.05	98	<0.05	<0.01

Table 7. Lamb and mutton - Minerals (per 100g edible portion)

	Na (mg)	K (mg)	Ca (mg)	Fe (mg)	Zn (mg)	Mg (mg)	Mn (mg)	P (mg)	Cu (mg)	Se (mg)
LAMB										
Diced										
Raw, lean	53 [a]	340 [a]	5.4 [a]	2.2 [a]	4.3 [a]	27 [a]	<0.05 [a]	250 [a]	0.140 [a]	0.015 [a]
Cooked, lean	59 [a]	390 [a]	4.8 [a]	3.7 [a]	2.6 [a]	27 [a]	<0.05 [a]	290 [a]	0.170 [a]	0.017 [a]
Stir-fry										
Raw, lean	53 [a]	340 [a]	5.4 [a]	2.2 [a]	4.3 [a]	27 [a]	<0.05 [a]	250 [a]	0.140 [a]	0.015 [a]
Cooked, lean	59 [a]	390 [a]	4.8 [a]	3.7 [a]	2.6 [a]	27 [a]	<0.05 [a]	290 [a]	0.170 [a]	0.017 [a]
Leg Roast										
Raw, lean	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	0.020 [c]
Cooked, lean										0.030 [c]
Easy Carve Leg Roast										
Raw, lean	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	<0.05	n/a(2)	n/a(2)	0.020 [c]
Cooked, lean							<0.05			0.030 [c]
Mini Roast										
Raw, lean	n/a(3)	300	4.4	n/a(3)	n/a(3)	n/a(3)	<0.05	210	0.100	0.020 [c]
Cooked, lean		270	4.7				<0.05	230	0.170	0.030 [c]
Chump chop										
Raw, lean	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	0.020 [c]
Cooked, lean										0.030 [c]
Loin chop										
Raw, lean	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	n/a(2)	0.010.[d]
Cooked, lean										0.023 [d]
Frenched cutlet										
Raw	64	350	9.4	2.1	2.9	30	n/a(1)	230	0.120	0.010 [d]
Cooked	66	320	9.8	2.6	4.3	30		240	0.170	0.023 [d]
Forequarter chop										
Raw	72	330	10.0	1.6	5.4	27	n/a(1)	220	0.100	0.010 [e]
Cooked	67	350	7.5	1.5	5.0	28		210	0.100	<0.01 [e]
Easy Carve shoulder										
Raw	98	400	6.9	2.2	5.5	26	n/a(1)	250	0.140	0.010 [e]
Cooked	69	280	6.0	2.2	6.7	24		220	0.160	<0.01 [e]
Mince										
Raw	57	270	13.0	1.8	3.7	20	<0.05	195	0.090	<0.01
Cooked	74	290	10.6	1.9	4.8	28	<0.05	206	0.100	0.010
Fat (pooled data)										
Raw fat	22 [b]	91 [b]	5.1 [b]	0.4 [b]	0.5 [b]	6 [b]	<0.05	56 [b]	0.000 [b]	<0.01 [b]
Cooked fat	28 [b]	110 [b]	6.0 [b]	0.7 [b]	1.0 [b]	8 [b]	<0.05	82 [b]	0.000 [b]	<0.01 [b]
MUTTON										
Leg roast										
Raw, lean	80	450	8.2	4.3	4.9	35	<0.05	360	0.240	<0.01 [f]
Cooked, lean	56	280	8.0	3.4	5.9	24	<0.05	240	0.120	0.010
Casserole										
Raw, lean	61	280	5.0	2.2	2.9	21	<0.05	220	0.190	<0.01 [f]
Cooked, lean	66	350	20.0	5.7	8.9	32	<0.05	330	0.320	0.010
Fat (pooled data)										
Raw fat	33 [f]	130 [f]	10.0 [f]	0.8 [f]	1.0 [f]	8 [f]	<0.05 [f]	88 [f]	<0.05 [f]	<0.01 [f]
Cooked fat	64 [f]	310 [f]	8.1 [f]	3.4 [f]	5.9 [f]	26 [f]	<0.05 [f]	270 [f]	0.210 [f]	<0.01 [f]

Table 8. Percentage of male adult recommended dietary intake (RDI) or adequate intake (AI) provided by 100g lean meat

	RDI/AI for Male adult 31-50y [(a)]	Beef[b]	Veal[b]	Lamb[b]	Mutton[b]
Protein	64 g	36	39	34	34
Thiamin	1.2 mg	3	5	8	13
Riboflavin	1.3 mg	25	15	15	19
Niacin	16 mg	31	100	70	50
Vitamin B6	1.3 mg	23	61	43	61
Vitamin B12	2.4 µg	79	66	71	116
Pantothenic acid	6 mg	12	25	13	22
Vitamin E	10 mg	7	5	5	2
Phosphorus	1000 mg	22	26	23	29
Zinc	14 mg	30	30	31	28
Iron	8 mg	24	14	25	40
Magnesium	420 mg	6	6	6	7
Selenium	70 µg	29	0	21	0
Copper	1.7 mg	7	0	7	12
Potassium	3800 mg	9	10	9	10

(a) National Health and Medical Research Council 2006.

(b) Percentages calculated using average values of raw lean cuts in Tables 2-7, excluding mince: 12 beef cuts, 4 veal, 10 lamb, 2 mutton.

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