

# FOODS THAT DO GOOD

## IT'S OK TO RECOMMEND CHEESE: HERE'S WHY

Opinions differ on the health effects of dairy foods, including cheese. Some people may feel the need to moderate cheese consumption due to its saturated fat, sodium and energy content, and concerns around heart health, blood pressure and the waistline. However, the 2013 Australian Dietary Guidelines classifies all cheese as a *five food group* food rather than a discretionary food.

Health professionals play an important role in educating consumers about good nutrition and providing accurate, evidence-based information.

The purpose of this paper is to provide a summary of the latest science on cheese consumption and conditions such as cardiovascular disease (CVD), blood pressure, type 2 diabetes, metabolic syndrome and obesity. It outlines findings of the latest systematic reviews and meta-analyses, and key studies published since they were compiled (up to 1 October 2016).

### How much cheese do Australians eat?

Almost one third of Australians eat cheese each day<sup>1</sup> and some people believe that Australians are eating more than enough cheese. However, according to the 2011–2012 National Nutrition and Physical Activity Survey (NNPAS), the mean daily intake of cheese was only 12g<sup>2</sup> – less than a third of the Australian Dietary Guidelines recommended serving size (40g).

Hard cheese was the most consumed type of cheese, accounting for 67% of consumption, followed by processed cheese (10%) and cream or cottage cheese (10%). Surface ripened cheese (e.g. camembert or brie) made up only 3% of the total cheese consumed.<sup>3</sup>

### What nutrients does cheese provide?

Cheese intake accounted for 7.2% of saturated fat and 3.9% of sodium intake, however it was the second largest provider of dietary calcium, contributing 9.6%.<sup>5</sup>

Other nutrients provided by cheese included protein, vitamin A, riboflavin, niacin, vitamin B<sub>2</sub>, vitamin K<sub>2</sub>, iodine, phosphorus, selenium and zinc.

### CHEESE CONSUMPTION IN AUSTRALIA

Cheese is part of the dairy food group, one of the

### FIVE FOOD GROUPS

recommended each day for optimum health.

**32%** of Australians **EAT CHEESE EACH DAY**

**BUT** the average intake is

**LESS THAN A THIRD**

of the Australian Dietary Guidelines recommended serving size (40g).

### HOW CHEESE IS CONSUMED<sup>4</sup>



sandwiches, rolls and on toast

**41%**



mixed dishes

**28%**



on its own

**18%**



pizza

**14%**

# NEW INSIGHTS ON THE IMPACTS OF CHEESE CONSUMPTION ON HEALTH

## Evidence from prospective cohort studies

In recent years a number of papers have provided new insights on the impacts of cheese consumption on health. The following is a summary of the latest systematic reviews and meta-analyses (up to 1 October 2016).

<b>Coronary heart disease (CHD)</b>	A recent systematic review and meta-analysis by Alexander et al. <sup>6</sup> included data from five studies (194,911 individuals were followed for 10–23 years). <ul style="list-style-type: none"> <li>• Consumption of cheese was inversely associated with risk of CHD (0.82 95% CI 0.72, 0.93).</li> <li>• Cheese intake of at least 52.6g/d was associated with a 14% lower risk of CHD.</li> </ul>
<b>Stroke</b>	A systematic review and meta-analysis by de Goede et al. <sup>7</sup> included data from seven studies (272,368 individuals were followed for 10–17 years; there were 11,126 cases of stroke). <ul style="list-style-type: none"> <li>• Consumption of cheese was marginally inversely associated with risk of stroke (0.96 95% CI 0.94, 1.001 per 40g/d). This relationship was most pronounced at intakes above 25g/d (0.91; 95% CI 0.86, 0.96).</li> <li>• These results are consistent with the 2016 systematic review and meta-analysis by Alexander et al.<sup>8</sup> This showed an inverse relationship between cheese consumption and total stroke (0.87, 95% CI 0.77, 0.99). This relationship was non-linear and reduced stroke was observed at intakes over 18g/d.</li> </ul>
<b>Elevated blood pressure</b>	Soedamah-Muthu et al. <sup>9</sup> published a systematic review and meta-analysis in 2012. This included data from eight studies (51,007 individuals were followed for 5–10 years; there were 15,066 cases of hypertension). <ul style="list-style-type: none"> <li>• Results indicated no association between cheese consumption and hypertension (RR 1.00 95% CI 0.98, 1.03).</li> </ul>
<b>Type 2 diabetes</b>	Gijssbers et al. <sup>10</sup> examined the relationship between dairy consumption and type 2 diabetes, using data from 12 studies (369,697 individuals were followed for 4–30 years; there were 32,936 cases of diabetes). <ul style="list-style-type: none"> <li>• There was no association between cheese consumption and type 2 diabetes (RR 1.00 per 10g/d; 95% CI 0.99, 1.02).</li> </ul>
<b>Metabolic syndrome</b>	Kim and Je <sup>11</sup> looked at dairy consumption and the metabolic syndrome (not just cheese). This included data from eight studies (31,944 subjects, 6,870 cases of metabolic syndrome). <ul style="list-style-type: none"> <li>• Those with the highest intake of dairy foods had a 15% lower risk of developing the metabolic syndrome than those with the lowest intake (RR 0.85; 95% CI 0.73, 0.98).</li> <li>• The systematic review and meta-analysis included one study examining the relationship between cheese and the metabolic syndrome by Fumeron et al.<sup>12</sup> (2,576 men and 2,636 women were followed for nine years). Those with the highest cheese consumption had an 18% lower risk of developing the metabolic syndrome than those with the lowest level of cheese intake (0.82, 95% CI 0.71, 0.95).</li> </ul>
<b>Mortality</b>	A 2013 systematic review and meta-analysis by O’Sullivan et al. <sup>13</sup> included data from four studies (that included 33,716 individuals (18,092 cases of all-cause mortality and 4,777 cases of cardiovascular mortality)). <ul style="list-style-type: none"> <li>• There was no association between cheese intake and all-cause mortality (HR 1.03; 95% CI 0.97, 1.09) or cardiovascular mortality (HR 1.00; 95% CI 0.81, 1.24).</li> </ul>
<b>Body weight – adults</b>	The pooled analysis of prospective cohort studies with the longest follow up was conducted by Smith et al. in 2015. <sup>14</sup> Data on cheese consumption and body weight was collected every four years (120,784 individuals were followed for 16–24 years). <ul style="list-style-type: none"> <li>• There was no association between cheese consumption and weight gain (multivariable adjusted four-year mean weight change 0.10kg; 95% CI -0.03, 0.24).</li> <li>• An extra serve of cheese consumed in place of refined carbohydrates was associated with long term weight loss of around 85g per year.</li> </ul>
<b>Obesity risk – children</b>	In a systematic review and meta-analysis, Lu et al. <sup>15</sup> looked at dairy and the risk of childhood obesity (not just cheese). <ul style="list-style-type: none"> <li>• Data from four prospective cohort studies were pooled (22,505 children) with results showing children in the highest dairy intake group were 38% less likely to be overweight or obese (0.62; 95% CI 0.49, 0.80).</li> <li>• Risk of childhood overweight/obesity was 13% lower with each serving/d increment in dairy intake (0.87; 95% CI 0.76, 0.98).</li> <li>• One prospective cohort study considered cheese and showed no association between cheese consumption and risk of overweight/obesity (0.98; 0.89, 1.08).</li> </ul>



## CHEESE CONSUMPTION AND HEALTH

Systematic reviews and meta-analyses shows that consumption of cheese is associated with a

### REDUCED RISK OF

coronary heart disease and stroke

metabolic syndrome

childhood overweight and obesity

### HAD NO ASSOCIATION WITH

type 2 diabetes

hypertension

overweight and obesity in adults

Unlike saturated fat from other products, saturated fat from cheese is

**NOT ASSOCIATED WITH CARDIOVASCULAR DISEASE RISK**

The sodium in cheese

**HAS A LESS DETRIMENTAL IMPACT ON VASCULAR FUNCTION**

than an identical amount of sodium consumed in other non-dairy foods.

### Evidence from randomised controlled trials

While evidence from observational research is informative, it cannot establish cause and effect. A number of randomised controlled trials have provided additional insights into cheese and health.

- The most recent systematic review and meta-analysis of randomised controlled trials was undertaken by Goede et al.<sup>16</sup> Five studies were included, with a mean cheese intake of between three and five servings/day. It demonstrated that cheese has different effects on blood lipids to those predicted.
- Since then, four additional randomised controlled trials investigating the effects of cheese on blood lipids have been published.<sup>17, 18, 19, 20</sup> They consistently indicate that high cheese intake (60–120g/day) does not cause detrimental changes in blood lipid concentrations, even in people with risk factors for CVD.
- Three of these randomised controlled trials lasted between five and 12 weeks and also monitored blood pressure and body weight.<sup>21, 22, 23</sup> Eating large quantities of cheese for one to three months did not adversely impact blood pressure, body weight or waist circumference.
- In another study, an amended DASH diet that included regular-fat dairy food has been shown to be as effective for lowering blood pressure as one with reduced-fat dairy.<sup>24</sup>

## PERCEIVED BARRIERS TO CHEESE CONSUMPTION

About two thirds (21.6g/100g serve) of the fat in cheese is composed of saturated fatty acids<sup>25</sup>, so concerns that consumption might be linked with negative health effects are understandable. Excess consumption of saturated fat has traditionally been linked with a rise in LDL cholesterol levels and this explains why worldwide, national nutrition guidelines often advise the consumption of reduced-fat dairy over regular-fat dairy.

## FOODS VERSUS NUTRIENTS

When nutrients such as saturated fat and sodium are consumed as part of a food, together with other essential nutrients and bioactive components, they work synergistically to affect health rather than how you would expect them to act as nutrients on their own.

An example of this is cheese, which is composed of a highly complex matrix of nutrients. Cheese is recognised as a *five food group* food in the Australian Dietary Guidelines which make recommendations based on whole foods, as opposed to single nutrients.



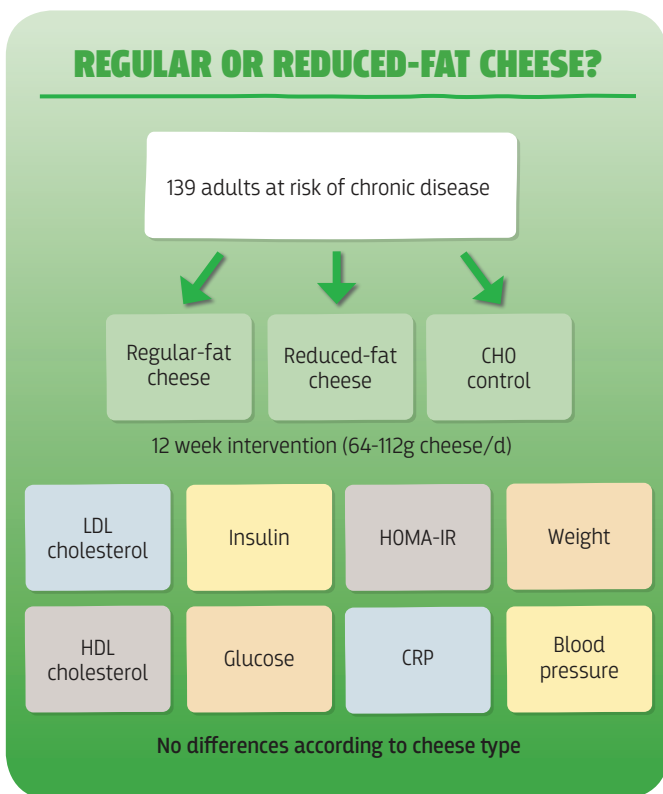
### Saturated fat: not all fats are equal

There is now substantial scientific evidence indicating that, unlike saturated fat from other animal products, consumption of saturated fat from dairy foods such as cheese is not associated with CVD risk.<sup>26</sup> Similarly, a 2015 study assessing the relationship between dietary fat intake and type 2 diabetes incidence concluded that total intake of regular-fat dairy products was inversely associated with incidence of type 2 diabetes whereas intakes of both high-fat meat and low-fat meat were associated with increased risk.<sup>27</sup> It is important to note that dairy fat has the most complex profile of all the fats, containing more than 400 different fatty acids (e.g. short, medium and long-chained fatty acids).<sup>28</sup>

Just as not all types of carbohydrate have the same impact on health, not all types of saturated fat are associated with the same health effects.

## Regular or reduced-fat cheese?

A randomised controlled trial published in the American Journal of Clinical Nutrition looked at the effect of regular versus reduced-fat cheese on cholesterol levels and metabolic syndrome risk factors.<sup>29</sup> Subjects recruited for this study were required to have a large waist circumference and one or more metabolic syndrome risk factors. Subjects were randomised to one of three 12-week intervention diets; regular-fat or reduced-fat cheese (approximately 80g per day), or a non-cheese, carbohydrate control (90g of bread and jam). Subjects were asked to live as they normally would, but were asked to replace normal foods in their diet with the test foods. They found no differences in health outcomes between the three diets (Figure 1).



**Figure 1** A randomised controlled trial indicates high daily consumption of regular-fat cheese does not negatively affect health outcomes compared to consumption of reduced-fat cheese or a carbohydrate control in an at risk adult population.

## Sodium and heart health

With coronary heart disease leading as our major cause of death,<sup>30</sup> consumers are often advised to limit cheese consumption due to concerns about its sodium content.

The 2011–2012 Australian Health Survey revealed that only 4% of the total sodium consumed in the Australian diet comes from cheese (the major source being cereal-based products and dishes, followed by meat and poultry).<sup>31</sup> Cheese also supplies significant amounts of calcium (9.6%), as well as magnesium and potassium – minerals known to reduce blood pressure.<sup>32</sup>

Salt plays an important role in the cheese making process, improving flavour, inhibiting growth of undesirable microorganisms and impacting on texture, stability and ripening. Even small reductions in salt can result in poor quality cheese and noticeable ‘off’ flavours.<sup>33</sup>

Since cheese consumption is associated with a reduced risk of both coronary heart disease<sup>34</sup> and stroke,<sup>35</sup> its consumption should not be discouraged due to concern about its sodium content.

## POSSIBLE REASONS WHY CHEESE IS ATTRIBUTING TO HEALTH BENEFITS

More work is needed to understand the reasons for the positive effects of cheese on health, but the following mechanisms have been proposed:

### HOW CHEESE MAY AFFECT HEALTH

#### A COMPLEX MIX OF NUTRIENTS

Cheese is composed of a complex matrix of nutrients and other bioactive components that **work together to positively impact on health.**

#### FAT EXCRETION

**Not all of the fat consumed in cheese is absorbed.**<sup>36</sup> This may be due to the presence of calcium, which increases fecal fat excretion.<sup>37,38,39</sup>

#### DISPLACING LESS HEALTHY FOODS WITH A PROTEIN FOOD

When people eat cheese (a five food group food) they are likely to have less appetite for unhealthy, discretionary foods. The protein in cheese may also increase satiety.

#### FERMENTATION AND RIPENING PROCESS

Fermented and ripened dairy foods (such as cheese) have been found to have a **favourable effect on biomarkers** associated with inflammation,<sup>40</sup> oxidative stress or atherogenesis in overweight and obese adults.<sup>41</sup>

#### GUT MICROBIOTA

Cheese may be associated with **positive health effects** by modifying gut microbiota.<sup>42,43</sup>



## REFERENCES

- <sup>1</sup> Australian Bureau of Statistics. Australian Health Survey: Nutrition First Results – Foods and Nutrients, 2011-2012; Cat No. 4364.0.55.007. Australian Bureau of Statistics: Canberra, Australia, 2014.
- <sup>2</sup> Australian Bureau of Statistics. Australian Health Survey: Nutrition First Results – Foods and Nutrients, 2011-2012; Cat No. 4364.0.55.007. Australian Bureau of Statistics: Canberra, Australia, 2014.
- <sup>3</sup> Australian Bureau of Statistics. Australian Health Survey: Nutrition First Results – Foods and Nutrients, 2011-2012; Cat No. 4364.0.55.007. Australian Bureau of Statistics: Canberra, Australia, 2014.
- <sup>4</sup> Australian Bureau of Statistics. Australian Health Survey: Consumption of Food Groups from the Australian Dietary Guidelines, 2011-12; Cat No. 4364.0.55.001. Australian Bureau of Statistics: Canberra, Australia, 2016 and personal communication.
- <sup>5</sup> Australian Bureau of Statistics. Australian Health Survey: Consumption of Food Groups from the Australian Dietary Guidelines, 2011-12; Cat No. 4364.0.55.001. Australian Bureau of Statistics: Canberra, Australia, 2016 and personal communication with ABS.
- <sup>6</sup> Alexander DD et al., (2016) Dairy consumption and CVD: a systematic review and meta-analysis. *Br J Nutr* 115, 737-50.
- <sup>7</sup> de Goede et al., (2016) Dairy consumption and risk of stroke: a systematic review and updated dose-response meta-analysis of prospective cohort studies. *J Am Heart Assoc* 5. pii: e002787. doi: 10.1161/JAHA.115.002787.
- <sup>8</sup> Alexander DD et al., (2016) Dairy consumption and CVD: a systematic review and meta-analysis. *Br J Nutr* 115, 737-50.
- <sup>9</sup> Soedamah-Muthu SS et al., (2012) Dairy consumption and incidence of hypertension. A dose-response meta-analysis of prospective cohort studies. *Hypertension* 60, 1131-37.
- <sup>10</sup> Gijssbers L et al., (2016) Consumption of dairy foods and diabetes incidence: a dose-response meta-analysis of observational studies. *Am J Clin Nutr* 103, 1111-24.
- <sup>11</sup> Kim Y and Je Y (2016) Dairy consumption and risk of metabolic syndrome: a meta-analysis. *Diabet Med* 33, 428-40.
- <sup>12</sup> Fumeron F et al., (2011) Dairy consumption and the incidence of hyperglycemia and the metabolic syndrome: results from a French prospective study. Data from the Epidemiological Study on the Insulin Resistance Syndrome (DESIR). *Diabetes Care* 34, 813-17.
- <sup>13</sup> O'Sullivan TA et al., (2013) Food sources of saturated fat and the association with mortality: a meta-analysis. *Am J Public Health* 103, e31-42.
- <sup>14</sup> Smith JD et al., (2015) Changes in intake of protein foods, carbohydrate amount and quality, and long-term weight changes: results from 3 prospective cohorts. *Am J Clin Nutr* 101, 1216-24.
- <sup>15</sup> Lu L et al., (2016) Long-term association between dairy consumption and risk of childhood obesity: a systematic review and meta-analysis of prospective cohort studies. *Eur J Clin Nutr* 70, 414-23.
- <sup>16</sup> Goede J (2015) Effect of cheese consumption on blood lipids: a systematic review and meta-analysis of randomized controlled trials. *Nutr Rev* 73, 259-75.
- <sup>17</sup> Thorning TK et al., (2016) Diets with high-cheese, high-meat, or carbohydrate on cardiovascular risk markers in overweight postmenopausal women: a randomized crossover trial. *Am J Clin Nutr* 102, 573-81.
- <sup>18</sup> Nilsen R et al., (2015) Effect of a high intake of cheese on cholesterol and metabolic syndrome: results of a randomized trial. *Food Nutr Res* 59, 27651 doi: 10.3402/fnr.v59.27651.
- <sup>19</sup> Raziani F et al., (2016) High intake of regular-fat cheese compared with reduced-fat cheese does not affect LDL cholesterol or risk markers of the metabolic syndrome: a randomized controlled trial. *Am J Clin Nutr*, epub ahead of print.
- <sup>20</sup> Schlienger JL et al., (2014) Effect on blood lipids of two daily servings of Camembert cheese. An intervention trial in mildly hypercholesterolemic subjects. *Int J Food Sci Nutr* 65, 1013-8.
- <sup>21</sup> Thorning TK et al., (2016) Diets with high-cheese, high-meat, or carbohydrate on cardiovascular risk markers in overweight postmenopausal women: a randomized crossover trial. *Am J Clin Nutr* 102, 573-81.
- <sup>22</sup> Nilsen R et al., (2015) Effect of a high intake of cheese on cholesterol and metabolic syndrome: results of a randomized trial. *Food Nutr Res* 59, 27651 doi: 10.3402/fnr.v59.27651.
- <sup>23</sup> Raziani F et al., (2016) High intake of regular-fat cheese compared with reduced-fat cheese does not affect LDL cholesterol or risk markers of the metabolic syndrome: a randomized controlled trial. *Am J Clin Nutr*, epub ahead of print.
- <sup>24</sup> Chiu S et al., (2016) Comparison of the DASH (Dietary Approaches to Stop Hypertension) diet and a higher-fat DASH diet on blood pressure and lipids and lipoproteins: a randomized controlled trial. *Am J Clin Nutr* 103, 341-7.
- <sup>25</sup> NUTTAB 2010 – Australian Food Composition Tables: Food Standards Australia New Zealand, Canberra.
- <sup>26</sup> Chen M et al., (2016) Dairy fat and risk of cardiovascular disease in 3 cohorts of US adults. *Am J Clin Nutr* doi 10.3945/ajcn.116.134460.
- <sup>27</sup> Ericson U et al., (2015) Food sources of fat may clarify the inconsistent role of dietary fat intake for incidence of type 2 diabetes. *Am J Clin Nutr* 101, 1065-80.
- <sup>28</sup> Jenson RG (2002) The composition of bovine milk lipids: January 1995 to December 2000. *J Dairy Sci* 85, 295-350.
- <sup>29</sup> Raziani F, Tholstrup T, Kristensen MD, Svanegaard ML, Ritz C, Astrup A, et al., (2016) High intake of regular-fat cheese compared with reduced-fat cheese does not affect LDL cholesterol or risk markers of the metabolic syndrome: a randomized controlled trial. *Am J Clin Nutr* DOI 10.3945/ajcn.116.134932.
- <sup>30</sup> Australian Institute of Health and Welfare (AIHW) 2017. Leading causes of death. Available: <http://www.aihw.gov.au/deaths/leading-causes-of-death/>
- <sup>31</sup> Australian Bureau of Statistics. Australian Health Survey: Nutrition First Results – Foods and Nutrients, 2011-2012; Cat No. 4364.0.55.007. Australian Bureau of Statistics: Canberra, Australia, 2014.
- <sup>32</sup> Houston MC & Harper KJ (2008) Potassium, magnesium, and calcium: their role in both the cause and treatment of hypertension. *J Clin Hypertens* 10, 7 suppl 2, 2-11.
- <sup>33</sup> International Dairy Federation (2014) The importance of salt in the manufacture and ripening of cheese. Special issue of the International Dairy Federation 51-1401. Brussels: Belgium.
- <sup>34</sup> Alexander DD et al., (2016) Dairy consumption and CVD: a systematic review and meta-analysis. *Br J Nutr* 115, 737-50.
- <sup>35</sup> de Goede et al., (2016) Dairy consumption and risk of stroke: a systematic review and updated dose-response meta-analysis of prospective cohort studies. *J Am Heart Assoc*. pii: e002787. doi: 10.1161/JAHA.115.002787.
- <sup>36</sup> Thorning TK et al., (2016) Diets with high-cheese, high-meat, or carbohydrate on cardiovascular risk markers in overweight postmenopausal women: a randomized crossover trial. *Am J Clin Nutr* 102, 573-81.
- <sup>37</sup> Lorenzen JK and Astrup A (2011) Dairy calcium intake modifies responsiveness of fat metabolism and blood lipids to a high-fat diet. *Br J Nutr* 105, 1823-31.
- <sup>38</sup> Lorenzen et al., (2014) Milk minerals modify the effect of fat intake on serum lipid profile: results from an animal and human short-term study. *Br J Nutr* 111, 1412-20.
- <sup>39</sup> Soerensen K et al., (2014) Effect of dairy calcium from cheese and milk on fecal fat excretion, blood lipids, and appetite in young men. *Am J Clin Nutr* 99, 984-91.
- <sup>40</sup> Bordoni A et al., (2015) Dairy products and inflammation: a review of the clinical evidence. *Crit Rev Food Sci Nutr* DOI 10.1080/10408398.2014.96738519:0
- <sup>41</sup> Nestel PJ et al., (2013) Effects of low-fat or full-fat fermented and non-fermented dairy foods on selected cardiovascular biomarkers in overweight adults. *Br J Nutr* 110, 2242-9.
- <sup>42</sup> Zheng H et al., (2015) Metabolomics investigation to shed light on cheese as a possible piece in the French Paradox puzzle. *J Agric Food Chem* 63, 2830-9.
- <sup>43</sup> Zheng H et al., (2016) Metabolic effects of a 24-week energy-restricted intervention combined with low or high dairy intake in overweight women: an NMR-based metabolomics investigation. *Nutrients*. 8, 108.