

# Yogurt for Health

**10 evidence-based conclusions**

*to mark the 5th anniversary of the  
Yogurt In Nutrition Initiative*



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# Yogurt from Science to Health

## Introduction from the YINI Chairs

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The Yogurt In Nutrition Initiative (YINI) was established in 2013 with the overall goal to achieve scientific knowledge on the health effects of yogurt and to share the findings with a broad audience.

The YINI represents a unique collaboration between two international scientific organisations - the American Society for Nutrition (ASN) and the non-profit organisation, Danone Institute International (DII). The activities of the initiative are guided by a Scientific Advisory Board of 15 world experts with a passion for advancing knowledge on the links between diet and health.

The goals of YINI are to:

- gather and evaluate current evidence on the health effects of yogurt,
- promote new research, and
- broadly disseminate the scientific knowledge among healthcare professionals and the public.

Over the past five years, the YINI has built a strong portfolio of resources: scientific meetings and proceedings, educational campaigns, printable and online materials. A YINI digital ecosystem includes the popular website, [www.yogurtinnutrition.com](http://www.yogurtinnutrition.com) that provides news and practical information, and social media interfaces, such as Twitter with nearly 17,000 followers of [@YogurtNutrition](https://twitter.com/YogurtNutrition).

### Inspiring events and supporting innovative research

Each year, the YINI highlights topical areas of research into the scientific and clinical links that are emerging between yogurt and health. Themes include weight management, the risk of diabetes, lactose intolerance, fermentation, and children's health. These themes are reflected in the annual YINI Global Summit on the Health Effects of Yogurt, the proceedings of which are published in peer reviewed journals.

In order to stimulate further research advances and support scientists from around the world, the YINI provides a grant each year (US \$30,000) and launches a Call for Research Proposals concerning a range of projects, focused on yogurt science. Find out how to apply at [www.yogurtinnutrition.com/category/grant-application/](http://www.yogurtinnutrition.com/category/grant-application/)

### Celebrating the 5th YINI anniversary

Today, as we celebrate the YINI's 5th anniversary, we can reflect on what has been achieved. In this document, the YINI board reviews the recent advances in scientific understanding about the health effects of yogurt and draws several evidence-based conclusions. Overall, substantial accomplishments have been made in the past five years, highlighting exciting potential developments in managing health through yogurt as part of our diet. Ongoing research is opening new doors – to a bright future.

Professor Sharon Donovan



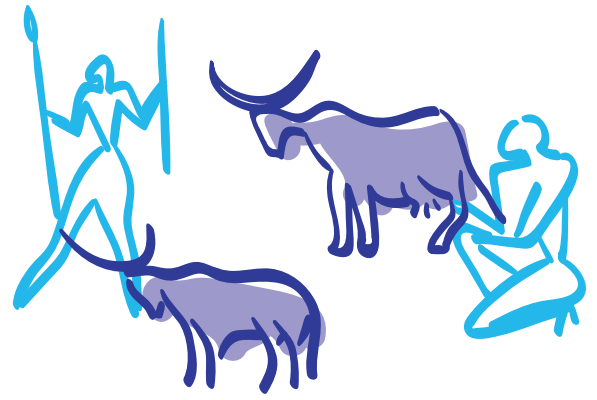
Professor Olivier Goulet



Co-chairs of the Yogurt In Nutrition Initiative

# The history of yogurt

Part of the human diet for thousands of years



Made by generations of people over thousands of years, yogurt has become an integral part of the diet in many cultures around the world. Only recently have scientists begun to understand the potential health benefits that yogurt may offer, largely thanks to the discovery of lactic acid bacteria.

## A way to preserve milk

- The first use of milk products in the human diet can be traced back to the Neolithic period between 10,000 and 5,000 BC, a time when nomadic people were settling down to an agricultural way of life. Simultaneously they were starting to domesticate milk-producing animals such as cows, goats, yaks, buffalo and camels.<sup>1</sup>
- At that time, herdsman in the Middle East carried milk in bags made of animal gut. Contact with intestinal enzymes may have caused the milk to curdle and sour.<sup>1</sup> This may have led to the realisation that a dairy product could be conserved for a relatively long period.<sup>1</sup>
- Yogurt was well known in the Greek and Roman empires, and it is even mentioned in the Bible.
- The word 'yogurt' is believed to stem from a Turkish word meaning to thicken, coagulate or curdle.

## Early associations between yogurt and health

- In the 11th century, the curative properties of yogurt were evaluated for the first time in Turkish literature, suggesting its use in conditions such as diarrhoea and stomach cramps.<sup>1</sup>

- According to legend, 12th century Mongolian ruler Genghis Khan fed his army yogurt, believing it instilled strength and bravery.<sup>1</sup>
- Yogurt was introduced into Western Europe in the 16th century by the King of France, François the 1st, after he was given it by a doctor from Turkey as a treatment for severe diarrhoea.<sup>1</sup>

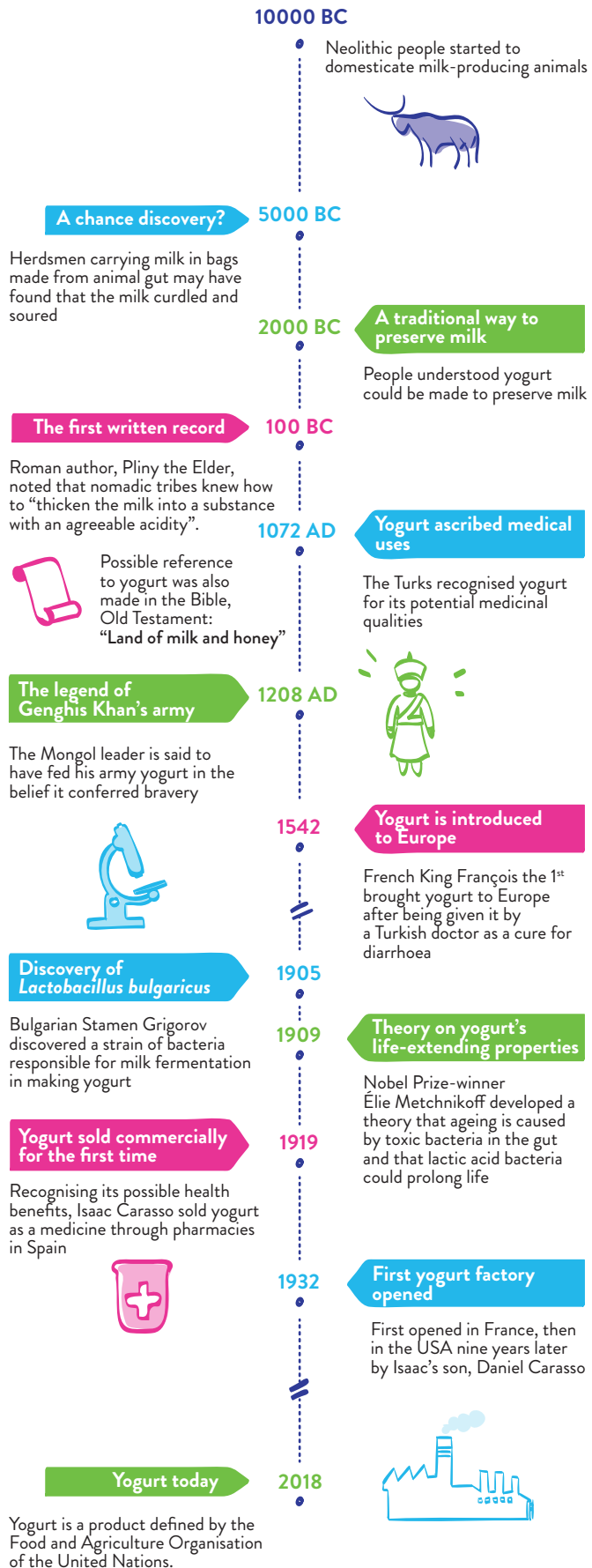
## Discovery of lactic acid bacteria

Starter cultures that convert lactose in milk to lactic acid have been used in the inoculation of fresh milk with small quantities of sour milk since long before anything was known about bacteriology.<sup>2</sup> For people living in primitive sanitary conditions, making fermented milk products offered a safe way of preserving dairy because the acidity of these products destroyed pathogens.<sup>2</sup>

- The first observation of bacteria in sour milk was made by Antonie van Leeuwenhoek in about 1675.<sup>2</sup>
- However, it was not until the 20th century that the first glimpse was caught of an explanation for the health benefits associated with yogurt consumption.
- In 1905 a Bulgarian medical student, Stamen Grigorov, described the lactic acid bacteria in yogurt, *Bacillus bulgaricus* – now *Lactobacillus bulgaricus* – which is still used in yogurt nowadays.<sup>1</sup>



# Yogurt through the ages



- Four years later, Nobel Prize-winner Élie Metchnikoff suggested that ageing is caused by toxic bacteria in the gut and that lactic acid could prolong life.<sup>1</sup>
- As the 20th century progressed, yogurt became known for its potential health benefits and it began to be sold commercially, first in pharmacies as a medicine.
- The first yogurt factory was opened in 1932, in France by Daniel Carasso.

**“Yogurt is an ancient food and has been part of our diet for thousands of years. It has been valued as a healthy food for much of that time but we’re only just beginning to understand how it might be good for us.”**

– Professor Mauro Fisberg

## What is yogurt?

Today, yogurt is described by the United Nations’ Food and Agriculture Organisation and the World Health Organization in their Codex Alimentarius as a fermented milk product containing two strains of live bacteria, *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus*. Both strains must remain active in the final product, with a total of at least 10 million bacteria per gram.<sup>1,3</sup>



# Yogurt is a nutrient-rich food



Yogurt contains both micronutrients – vitamins and minerals – and macronutrients, including proteins and fatty acids.

- Yogurt contains high-quality protein, including all nine essential amino acids in the proportions needed for protein synthesis.<sup>4</sup>
- Proteins in yogurt are more digestible than proteins in standard milk, probably because the fermentation process starts to break them down into smaller units.<sup>5</sup>
- Yogurt is a well-recognised source of calcium, but it also provides smaller amounts of many other micronutrients, including potassium, zinc, phosphorus, magnesium, vitamin A, riboflavin, vitamin B<sub>5</sub>, vitamin B<sub>12</sub> and in some countries, vitamin D.<sup>6,7</sup>

## Yogurt consumption helps meet nutrient intake requirements in adults and children

Yogurt and other dairy products contribute to key nutrient intakes for adults and children.<sup>6,8,9</sup> That is why most countries recommend the consumption of dairy products – and, when amounts are specified, two or three servings per day are typically recommended.<sup>10</sup>

For example, a 125-g pot of plain yogurt provides, among other nutrients, 20% of an adult's recommended daily intake (RDI) of calcium, 21% of vitamin B<sub>2</sub>, 11% of vitamin B<sub>12</sub>, and 16% of phosphorus (**Figure 1**).<sup>11,12</sup>

Good diet quality is especially important for children and adolescents to support growth and development. Yogurt is a valuable part of a balanced nutrient-rich diet during this period, contributing a substantial percentage of a child's needs for micronutrients and macronutrients.<sup>8</sup>

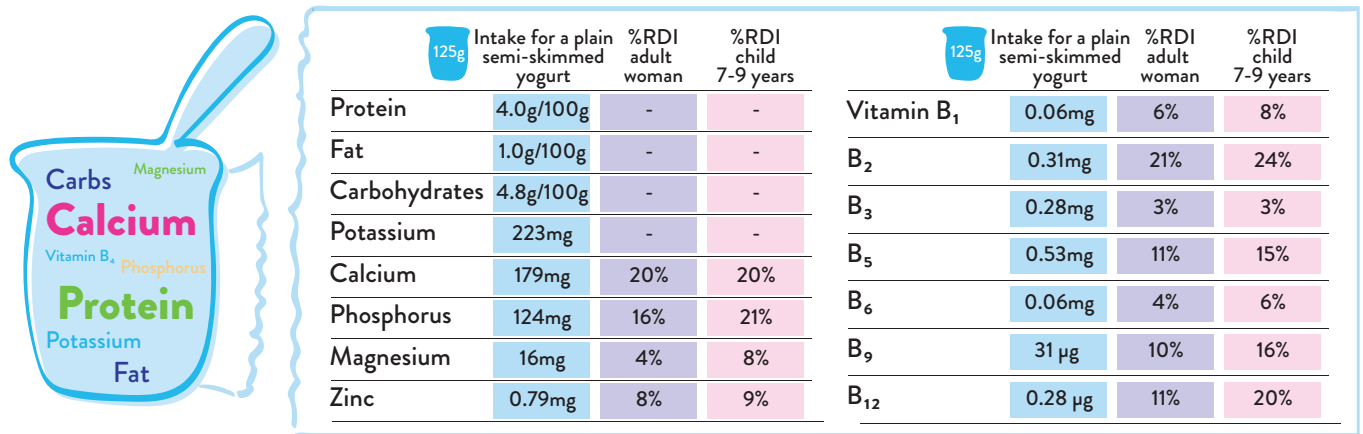
In fact, many people do not eat the recommended intakes of certain nutrients, which are therefore referred to as the 'shortfall nutrients'. Teenagers are especially at risk of nutrient shortfall, and vitamin D, calcium, potassium, fibre and iron are of particular concern.

- Data from the National Health Nutrition and Examination Survey (NHANES) show that increasing dairy food consumption (milk, cheese and yogurt) to meet the recommended level in the USA for adolescents of three servings per day can make up for the shortfall of three nutrients of public health concern – calcium, vitamin D and potassium.<sup>9</sup>

**“Nutrient density is a key feature of food that we should prefer in the context of a balanced diet, and yogurt is a nutrient-dense food containing a wide range of macro- and micro-nutrients.”**

– Professor Michele Sculati

**Figure 1. Nutrient content of yogurt**



Adapted from Table Ciqual des aliments 2008, ANSES; Directive européenne (90/496/CEE);<sup>11</sup> Martin A et al. 2007. Apports nutritionnels conseillés pour la population française, 3e édition, Ed. TEC&DOC. 605 pp.<sup>12</sup>

- The UK survey data suggest that adding a 125 g pot of low-fat fruit yogurt per day to adolescents' diets would increase mean calcium intake from below to above the Recommended Nutrient Intake.<sup>6</sup>

### Plain yogurt has a low energy density

Energy density is the amount of energy - or calories - per gram of food.<sup>13</sup> Lower energy density foods provide fewer calories per gram than higher energy density foods. Hence low energy dense foods allow satisfying portions with a relatively low calorie content to be eaten. Compared with other foods, plain low-fat yogurt has a low energy density of 0.6–1.5 kcal/g (Figure 2).<sup>14</sup>

### Yogurt's contribution to sugar intake is relatively low

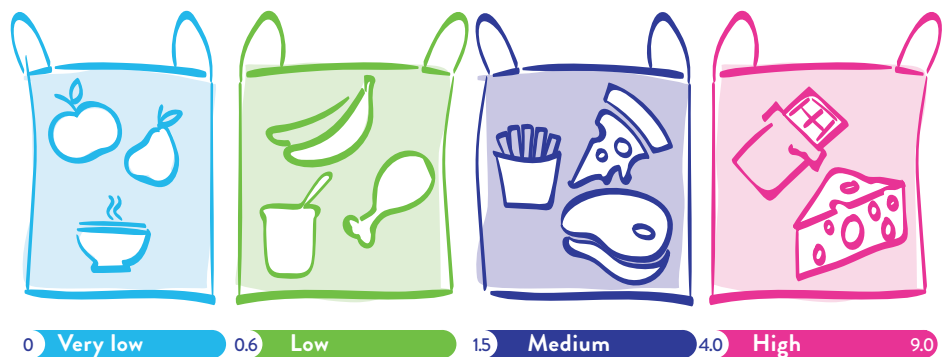
The World Health Organization recommends limiting the consumption of non-milk extrinsic sugars – which include those added to food by manufacturers or by consumers – to a maximum of 10% energy intake.<sup>15</sup> However, many people in Western societies, especially children, are exceeding this threshold.

Concerns that sweetened yogurt is contributing to these excess sugar intakes are not supported by the scientific data.

- While more than 50% of total sugars and 66% of added sugars in children's diets come from sweet products such as cakes, sweets and sugary drinks, yogurt accounts for only 1–8% of total sugars and 4–9% of added sugar to children's diets in Europe.<sup>16</sup>
- In the USA, a NHANES analysis found that flavoured yogurt contributes about 1% of added sugars to the diets of adults. This compared with 28.1% from soft drinks.<sup>17</sup>

As sugar may make a food more palatable for children, there is an argument that sweetness (consumed within recommended calorie amounts) may promote consumption of a nutrient-rich food.<sup>18</sup> The American Academy of Pediatrics comments that, while added sugars do not provide nutritional benefits, sugars themselves are not necessarily harmful.<sup>18</sup> It says, 'Used along with nutrient-rich foods and beverages, sugar can be a powerful tool to increase the quality of a child's diet.'<sup>18</sup>

**Figure 2. Energy density (kcal/g) of selected foods**



Adapted from British Nutrition Foundation Feed Yourself Fuller chart 2010<sup>14</sup>



# Yogurt consumption is linked with healthier diet and lifestyle



Regular yogurt consumers of all ages tend to eat and live healthily. They are less likely to consume junk foods, or smoke or drink alcohol to excess, and are more likely to exercise regularly.<sup>19,26,27,31-33</sup>

## Yogurt consumers are more likely to have adequate intakes of key nutrients

- Yogurt consumers are less likely than non-consumers to have an inadequate intake of certain vitamins and minerals, including vitamin B<sub>2</sub>, B<sub>12</sub>, calcium, magnesium and zinc.<sup>19</sup>
- In both children and adults (in Spain and the USA), swapping high-calorie, nutrient-poor snacks for full-fat yogurt with fruit could help boost key nutrients and improve dietary quality without contributing to dietary excess and obesity.<sup>20,21</sup>
- In French adults, rebalancing dairy intake to favour low energy-dense dairy products (milk and yogurt rather than cheese) can help improve dietary nutrient density without increasing calories or less desirable nutrients.<sup>22</sup>

## Regular yogurt consumers tend to choose healthier diets

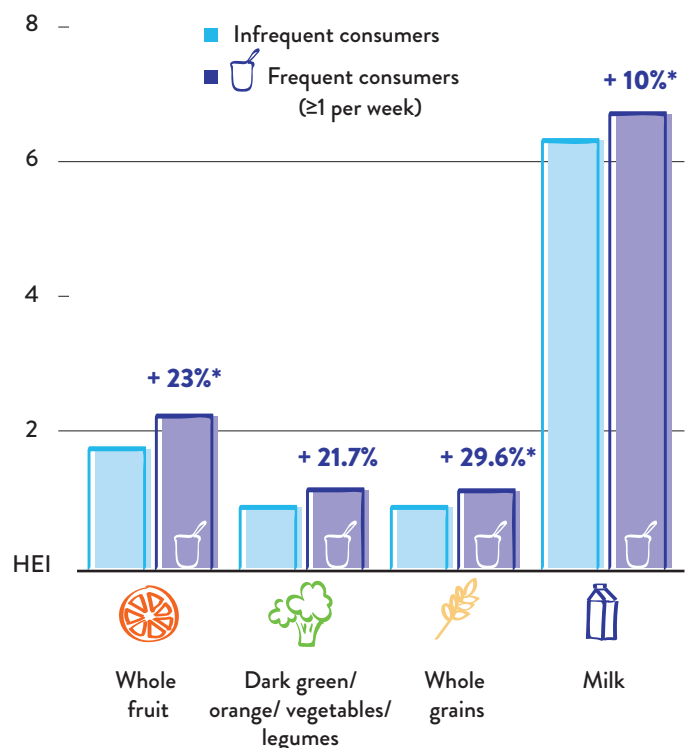
Regular yogurt consumers are less likely to consume junk food and more likely to stick to dietary guidelines.

### Children

- Young children who regularly consume yogurt have a better diet quality and the overall nutrient content of their diets is higher.<sup>23,24</sup>

- The diets of children who eat yogurt regularly are better overall – they consume more fruit, whole grains and milk (**Figure 1**)<sup>25</sup> and less total and saturated fat.<sup>7</sup>

**Figure 1. Diet quality among children who are frequent vs infrequent yogurt consumers**



HEI: The Healthy Eating Index 2005 is a measure of diet quality that assesses compliance with the US Dietary Guidelines for Americans. A 24-hour dietary recall is used to compare intakes with recommendations for various food groups. Higher HEI scores for dietary components such as fruits, vegetables and grains suggest a diet that more closely follows the Guidelines than one with lower HEI scores.

\*Statistically significant

Adapted from Zhu Y, Wang H, Hollis JH et al. Eur J Nutr. 2015 Jun;54(4):543-50.<sup>25</sup>

## Adults

- People who frequently consume yogurt have higher nutrient intakes than those who do not often eat yogurt – even when yogurt is not a source of these nutrients.<sup>6,26</sup> Hence frequent yogurt consumers (at least one serving per day) have been found to have higher intakes of folic acid, copper, manganese and iron.<sup>26</sup>
- Compared with low- or non-consumers, frequent yogurt consumers tend to follow dietary guidelines more closely.<sup>6,26</sup>
- Yogurt consumers are more likely to consume a prudent diet with more fruits, vegetables, nuts, legumes, fish and seafood, and fewer fast foods such as French fries and fried foods, processed and red meats, pizza, snacks, soft drinks, alcohol and hard liquor.<sup>27</sup>

## Yogurt consumption is a marker of a healthier diet and lifestyle

Numerous studies suggest yogurt consumption is a signature of a healthy diet and lifestyle (Figure 2).<sup>6,19,25,27-30</sup> Compared with people who do not eat yogurt, those who do consume yogurt:

- are generally healthier, leaner, more highly educated and of higher socio-economic status<sup>30,31</sup>

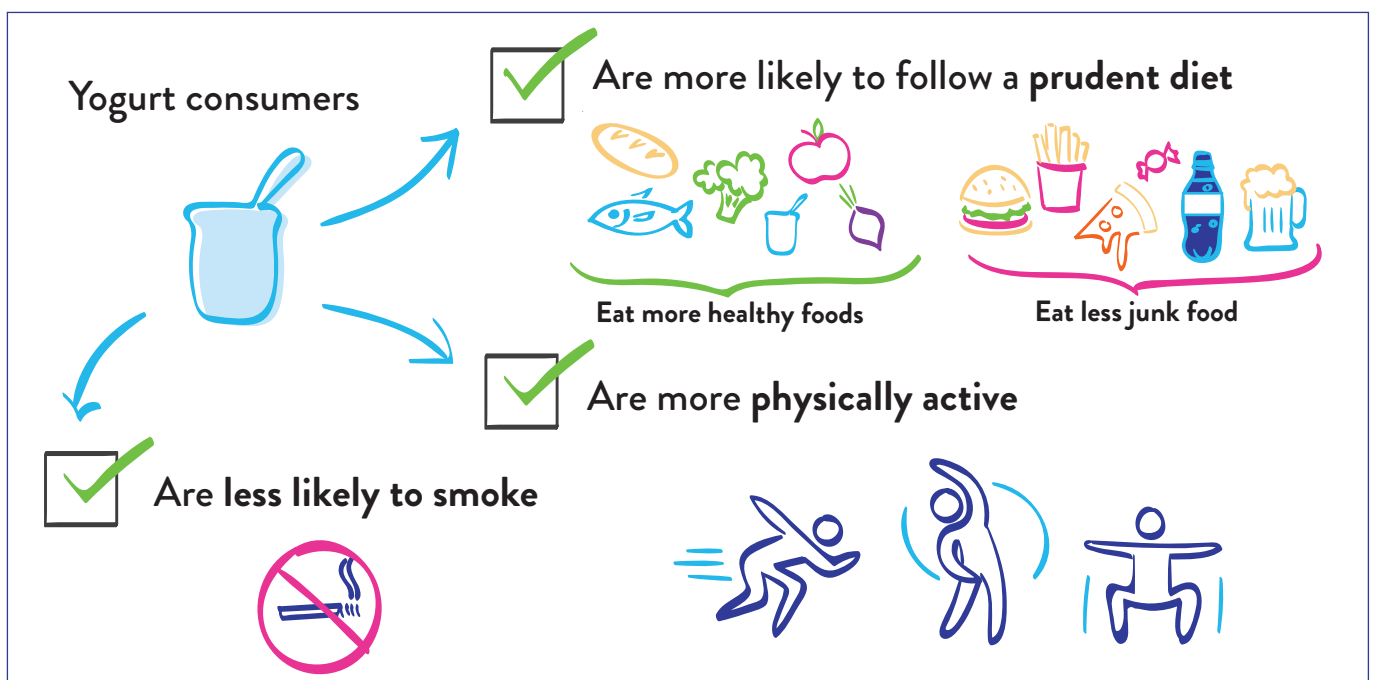
- show healthier non-nutritional behaviour than non-consumers: they are less likely to smoke,<sup>19,26,31-33</sup> tend to drink less alcohol and are more likely to be physically active in their leisure time than non-consumers<sup>32</sup>
- are more aware of the links between food and health, and are more likely to read food labels and less likely to go to fast food restaurants<sup>33</sup>
- tend to have a better health-related quality of life and mental health.<sup>34</sup>

Yogurt consumption is linked with a lower risk of a variety of chronic diseases.<sup>35</sup>

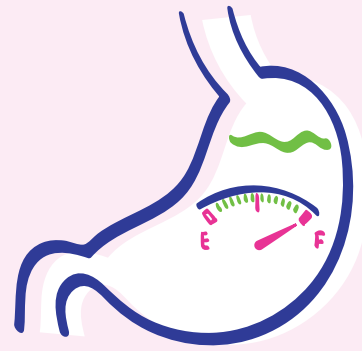
**“Yogurt consumers are characterised by healthier dietary habits than non-consumers and are also known to display healthier non-nutritional behaviours. This has led to the proposal that yogurt consumption may represent the signature of a healthy diet and lifestyle.”**

– Dr Angelo Tremblay

Figure 2. Yogurt consumption is linked to a healthier diet and lifestyle<sup>19,26,27,31-33</sup>



# Yogurt can enhance satiety and help to manage energy intake



Consuming yogurt can increase the feeling of being full and this effect on the appetite may help reduce calorie intake.<sup>36-39</sup>

## Yogurt consumption decreases the feeling of hunger more than other dairy products

In a study of dairy snacks, the greatest appetite suppression was seen with yogurt.

- Hunger was 8% lower when participants consumed yogurt as a mid-morning snack than when they ate a portion of cheese matched for calorie content and volume.<sup>36</sup>
- Hunger was 10% lower after the yogurt snack than after a matched serving of milk (**Figure 1**).<sup>36</sup>

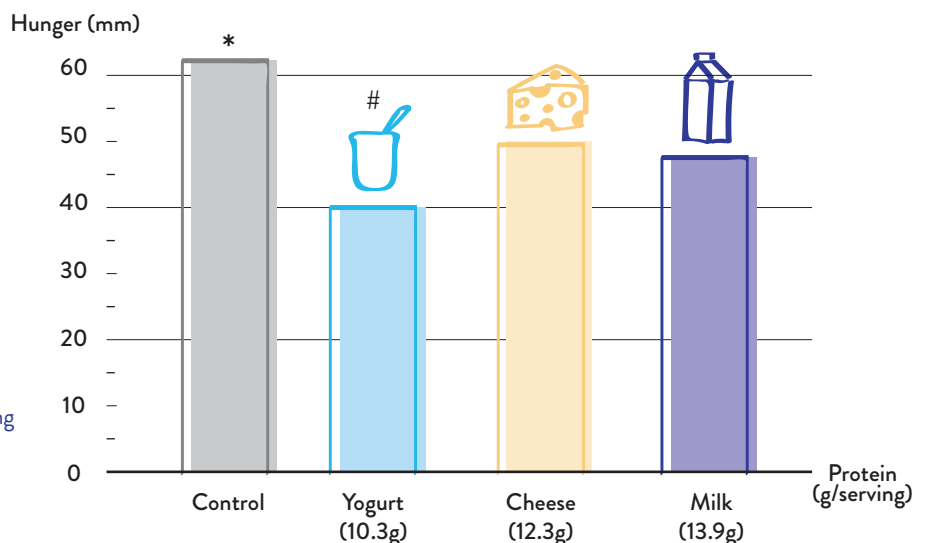
## Low-fat yogurts increase feelings of fullness more than fruit-based drinks

A similar pattern of results was drawn from a study comparing low-fat yogurts with fruit drinks containing the same amounts of calories.<sup>37</sup>

**“The low energy density of yogurt means that, as a snack or part of a meal, it can be consumed in satisfying portions that help to manage hunger and reduce energy intake.”**

– Professor Barbara Rolls

**Figure 1. Hunger rating 45 minutes after dairy snacks**



\*Significantly different from the other snacks tested

# Significantly different from milk and cheese  
Protein content is for the following serving sizes: 410 g of milk, 278 g of yogurt + water to complete the volume, 49 g of cheese + water to complete the volume. Hunger was measured using subjective visual analogue scale

Adapted from Dougkas A, Minihane AM, Givens, DI, et al. Br J Nutr. 2012 Dec 28;108(12):2274-85.<sup>36</sup>

Yogurt containing peach – whether in a pot eaten with a spoon or in drinkable form – was more satiating than a peach-flavoured dairy drink and a peach juice drink. Both the yogurts were associated with less hunger and higher fullness ratings.<sup>37</sup>

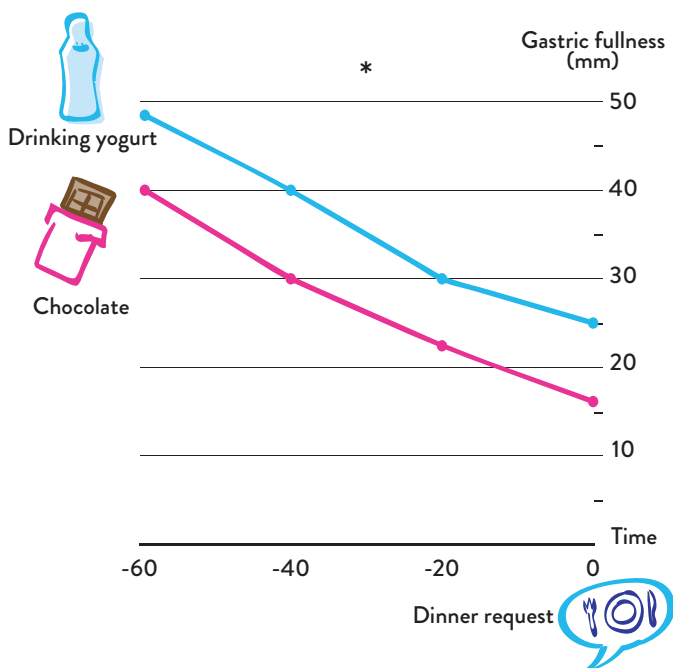
## Yogurt achieves greater satiety than high energy-dense snack foods such as chocolate

Among healthy young men, a yogurt drink taken as a mid-afternoon snack induced a greater feeling of fullness in the hour before a meal than a chocolate bar of the same calorie content (**Figure 2**).<sup>38</sup>

## High-protein yogurt could be a healthy replacement for high energy-dense snacks

Consuming yogurt as a high-protein, less energy-dense snacks instead of high-fat snack foods can improve appetite control and satiety, and reduce energy intake.

**Figure 2. Satiety rating of a yogurt drink versus a chocolate bar one hour before a meal**



\*Significant difference  
Gastric fullness was rated using visual analogue scales  
Adapted from Chapelot D, Payen F. Br J Nutr. 2010;103(5):760-7.<sup>38</sup>

- Women participating in a study were less hungry after consuming a mid-afternoon snack of high-protein yogurt than after consuming high-fat crackers or chocolate.<sup>39</sup>
- Despite having the same calorie content as the high-fat snacks, yogurt delayed the participants' desire to eat the next meal by around 30 minutes.<sup>39</sup>
- Moreover, the women consumed around 100 fewer calories after consuming yogurt than after eating crackers or chocolate.<sup>39</sup>

## How might yogurt exert its satiating effect?

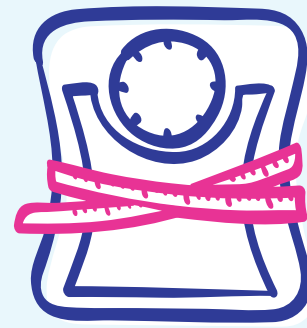
Several factors may account for the satiating properties of yogurt, including nutrient content and effects on appetite-regulating hormones.

- The high protein content of yogurt could partly account for the higher satiety effect of yogurt seen in these findings.<sup>38</sup>
- Protein 'preloading' – in which small amounts of protein are eaten at a set time before a meal – enhances satiety and reduces appetite.<sup>40</sup>
- Other factors that may influence the satiating effects of yogurt include its energy density, the way it is consumed (with a spoon or drunk), and its rate of passage through the digestive tract. The potential effects of fermentation may also play a role.<sup>36</sup>
- Yogurt may influence appetite-regulating hormones in the gut and brain. These may slow stomach emptying and communicate directly with the brain's appetite-regulation centre.<sup>40</sup>

**“Yogurt promotes satiety probably because of the satiating properties of dairy proteins. Its high calcium content might also facilitate appetite control in low-calcium consumers.”**

– Dr Angelo Tremblay

# Yogurt consumption is associated with reduced weight gain over time



The effect of yogurt on satiety may partly explain findings by recent reviews that yogurt consumption is associated with lower body mass index (BMI), lower body weight or weight gain, smaller waist circumference and lower body fat.<sup>41,42</sup>

## Yogurt is linked to reduced risk of overweight/obesity and smaller waist circumference

### Adults:

Yogurt consumption appears to protect against long-term weight gain, according to pooled results from cohort studies.<sup>43</sup> This effect is doubled with plain or artificially sweetened yogurt compared with flavoured sweetened yogurt.

These results support those of an earlier analysis in which eating more yogurt was associated with less weight gain per 4-year period among 120,877 US healthy non-obese adults followed up for 12–20 years. For each additional serving of yogurt per day there was 372 g less weight gain (**Figure 1**).<sup>44</sup>

- In the US Framingham Heart Study Offspring Cohort, predominantly overweight people who ate three or more servings of yogurt per week gained about 55% less weight over a year than those who ate less than one serving per week.<sup>45</sup> When it came

**“In terms of obesity, dairy products in general, and yogurt in particular, have either a neutral or a positive association with reduced body fat both in adults and in children.”**

– Professor Luis Moreno

to waist size, high-yogurt consumers gained 20% less than low-yogurt consumers.

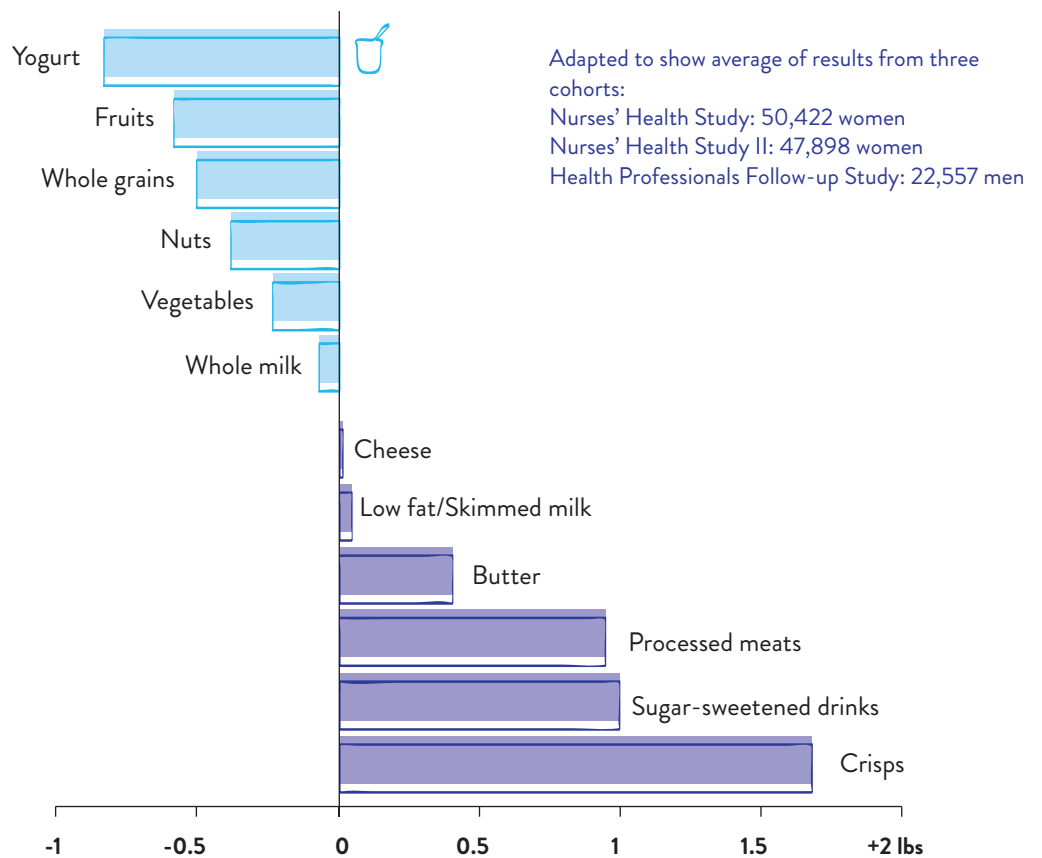
- A large Spanish cohort study in non-overweight adults found that high-yogurt consumption (seven or more servings per week) was associated with a 20% lower risk of overweight or obesity after six years when compared with low-yogurt consumption (two or more servings per week).<sup>46,47</sup>
- In a Canadian study, yogurt consumption was associated with lower body weight, waist-to-hip ratio and waist circumference, and tended to be associated with a lower BMI when compared with no yogurt consumption.<sup>27</sup>

### Children:

Results from the NHANES in US children aged 8–18 years (NHANES 2005–2008) and the Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study showed that yogurt consumption was associated with less body fat.<sup>7,48</sup>



**Figure 1. Weight change associated with increased consumption of yogurt or other foods**



4-year weight change (in lb) per one serving per day increase in foods  
 Adapted from Mozaffarian D, Hao T, Rimm EB, et al. N Engl J Med 2011;364:2392-404.<sup>44</sup>

### Yogurt may help when dieting

- Some evidence exists to suggest that including yogurt in a calorie-controlled diet leads to greater weight loss.<sup>49,50</sup>
- A 3-month trial in 34 obese people found that those including three servings of fat-free yogurt daily as part of an energy-restricted diet lost 22% more body weight and 61% more body fat than those not eating yogurt.<sup>51</sup>

### How might yogurt influence weight and body fat?

Several theories have been put forward.

- Calcium in yogurt may affect body fat by reducing its absorption from the intestine,<sup>52</sup> and causing less fat to be stored in fat cells.<sup>53</sup>
- Live bacteria in yogurt may beneficially alter the gut microbiota and influence weight, although the mechanism for this is as yet unclear.<sup>8,50,54</sup>

- Obesity is accompanied by chronic, low-grade inflammation in various tissues.<sup>55</sup> A recent Brazilian population-based study suggests that increasing yogurt consumption may protect against inflammation.<sup>56</sup>

**“Proteins may influence appetite-regulating hormones, calcium may affect fat absorption, and live bacteria may alter gut microbiota – all of which may explain the beneficial effects that yogurt may have on body weight.”**

– Professor Frans Kok

# Yogurt consumption is associated with reduced risk of Type 2 diabetes



Three meta-analyses have reported a consistent association between yogurt consumption and reduced risk of Type 2 diabetes (T2D) (Figure 1).<sup>57-59</sup>

Whole-fat yogurt appears to be best – contrary to the recommendations of most dietary guidelines advocating low-fat dairy products for adults.

- Results of a recent Danish study showed that whole-fat yogurt eaten in place of low- or whole-fat milk was associated with a lower rate of T2D during a median follow-up of 15.3 years in people aged 50–64 years at baseline (11–17% reduction per serving/day substituted).<sup>60</sup>
- In contrast, when low-fat yogurt was eaten in place of whole-fat yogurt, there was a 17% higher rate of T2D per serving per day substituted.<sup>60</sup>

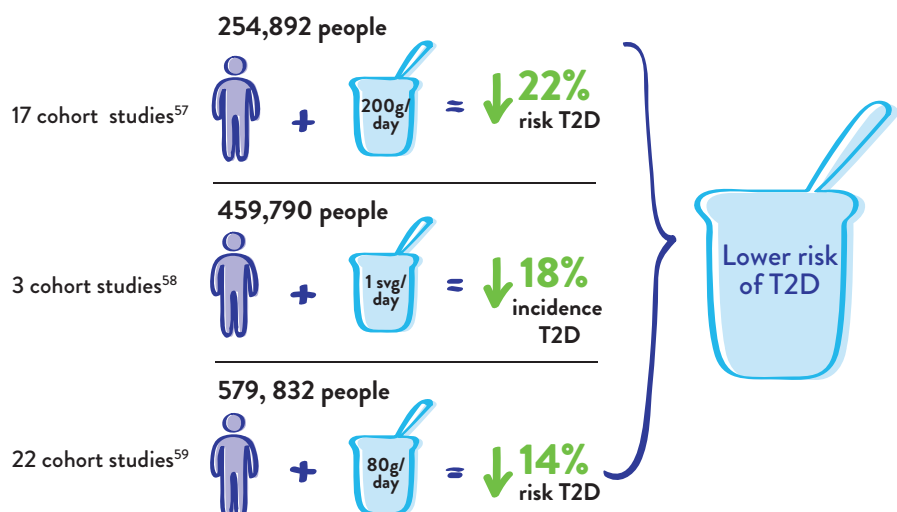
**“The evidence that regular yogurt consumers have about a 20% lower risk of Type 2 diabetes than non-consumers is really very persuasive.”**

– Professor Andrew Prentice

**Replacing less healthy snacks with yogurt is also associated with reduced risk of T2D**

- In an elderly Spanish population at high cardiovascular risk followed up for a median of 4.1 years, replacing one serving per day of snacks with a daily serving of yogurt lowered

**Figure 1. Consistent association between yogurt consumption and reduced risk of T2D in three meta-analyses**



Adapted from Aune D, Norat T, Romundstad P, et al. Am J Clin Nutr 2013;98:1066-83;<sup>57</sup> Chen M, Sun Q, Giovannucci E, et al. BMC Med 2014;12:215;<sup>58</sup> Gijssbers L, Ding EL, Malik VS, et al. Am J Clin Nutr 2016;103:1111-24.<sup>59</sup>

the risk of T2D (by 40% when replacing biscuits/ chocolate and 45% when replacing whole-grain biscuits and pastries).<sup>61</sup>

- Similarly, a UK study found substituting yogurt in place of snacks (crisps) was associated with a 47% fall in the risk of T2D in people aged 40–79 years who were followed up for 11 years.<sup>62</sup>

### The association between yogurt consumption and reduced risk of T2D is seen across populations and age groups

- The inverse association between yogurt consumption and T2D risk has been shown in populations in North America<sup>58</sup> and across Europe.<sup>61–63</sup>
- Chen et al reported that frequent yogurt intake was consistently and inversely associated with T2D risk in young, middle-aged and elderly adults.<sup>58</sup>
- Among US children and teenagers aged 2–18 years, frequent consumers of yogurt (at least one serving per week) had a healthier insulin profile, suggesting a reduced risk for T2D, compared with those who ate yogurt infrequently (**Figure 2**).<sup>25</sup>
- A study of young Canadian people of mean age 20 years, concluded that consuming yogurt may protect against insulin resistance more specifically among those at risk of obesity, in a relationship that appeared to be independent of lifestyle factors measured.<sup>64</sup>

### How might yogurt reduce T2D risk?

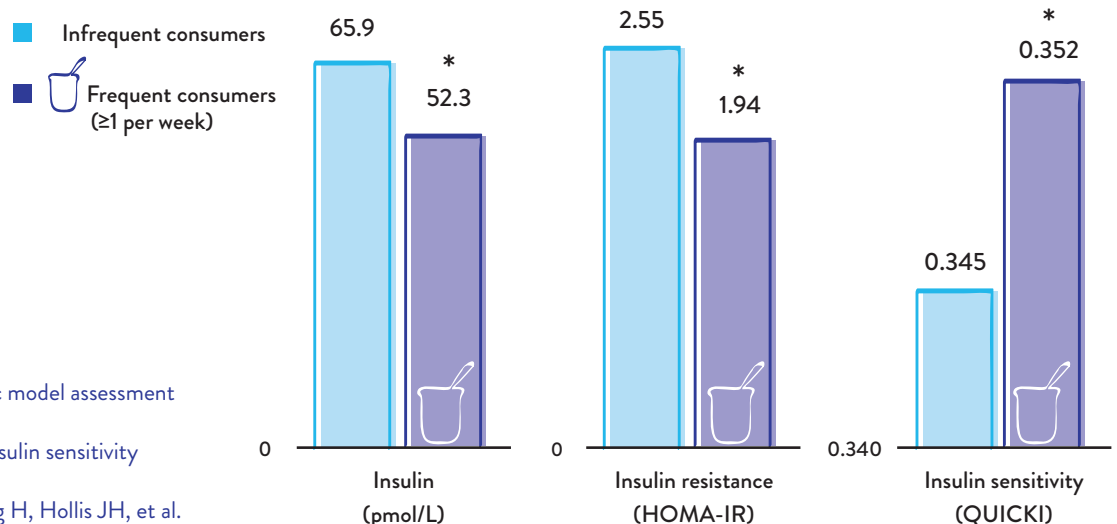
Several mechanisms may explain this relationship.

- Live bacteria in yogurt can improve the composition of the gut microbiota and this may help to reduce inflammation, which is linked to T2D.<sup>66,67</sup>
- Yogurt consumers are less likely to have unhealthy lifestyles that are linked to T2D.<sup>30,68</sup>
- The risk of T2D has been shown to fall by 7% for each 10 µg increase in dietary vitamin K<sub>2</sub>.<sup>69</sup> Whole-fat yogurt contains up to 28 µg of vitamin K<sub>2</sub> per 100 g serving.<sup>70</sup>
- Yogurt is a low glycaemic index food, suggesting that it does not cause a spike in blood glucose levels after a meal.<sup>71</sup>

### Increased yogurt consumption could reduce healthcare costs

Researchers analysing UK data have predicted that if the adult population increased the amount of yogurt they ate by one serving per day, they could generate savings to the National Health Service of £140 million over five years through reductions in the incidence of T2D.<sup>65</sup>

**Figure 2. Association of yogurt consumption with improved insulin profile in children and teenagers**



\*Statistically significant  
HOMA-IR – Homeostatic model assessment of insulin resistance  
QUICKI – Quantitative insulin sensitivity check index  
Adapted from Zhu Y, Wang H, Hollis JH, et al. Eur J Nutr 2015;54:543-50.<sup>25</sup>

# Yogurt consumption is associated with reduced risk of cardiovascular disease



Dairy products such as yogurt have repeatedly been found to have either neutral or beneficial effects on cardiovascular disease (CVD) risk, a finding highlighted by recent literature reviews and a meta-analysis (Figure 1).<sup>72-75</sup>

## Yogurt may reduce the risk of high blood pressure

A study among US adults found that greater intakes of total dairy foods, total low-fat/fat-free dairy foods, low-fat/skimmed milk and yogurt were associated with a smaller increase in systolic blood pressure and a lower risk of high blood pressure incidence per year.<sup>45</sup>

- This correlation seemed to lessen over time except for total dairy foods and yogurt.

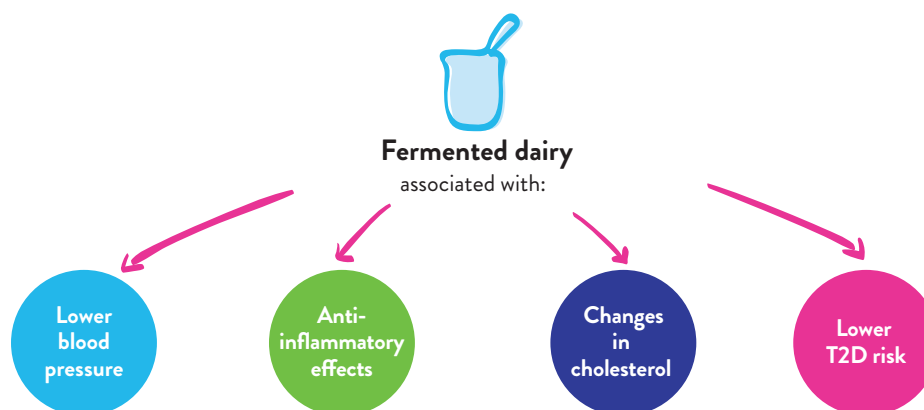
- Consuming one extra serving of yogurt per week was related to a 6% reduced risk of developing high blood pressure.<sup>45</sup>

## Yogurt may reduce risk of CVD

In people with high blood pressure:

- consuming two or more servings of yogurt per week, especially when part of a healthy diet, is associated with a reduced risk of heart attack or stroke compared with a consumption of less than one serving per month.<sup>76</sup>
- overall, among those eating two or more servings of yogurt per week, women had a 17% lower CVD risk and men had a 21% lower risk compared with those who consumed less than one serving per month.

Figure 1. Fermented dairy products such as yogurt are associated with improved CVD risk profile



Adapted from Lordan R, Tsoupras A, Mitra B, et al. Foods 2018;7:29.<sup>75</sup> <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5867544/>

Consuming 200 g of yogurt daily may reduce CVD risk:

- A meta-analysis of nine cohort studies (from the USA, Sweden, The Netherlands, Finland and the UK) did not observe a significant association between yogurt intake and CVD when comparing the highest yogurt consumption with the lowest intake.<sup>77</sup>
- However, in a subgroup analysis, consumption of  $\geq 200$  g/day was associated with a significantly reduced risk of CVD.<sup>77</sup>

### Children and teenagers could benefit too

- Among US children and teenagers, those who eat yogurt have a lower intake of saturated fat than non-consumers.<sup>7</sup>
- In European adolescents, consumption of milk and yogurt has been found to be inversely associated with being overweight and positively associated with cardiorespiratory fitness.<sup>48,78</sup>
- Dairy consumption was found to be inversely associated with CVD risk score in girls.<sup>78</sup>

### How might yogurt reduce CVD risk?

The association between yogurt consumption and reduced risk of CVD may be due to the protective properties of some components.<sup>73-75</sup>

- Yogurt and other dairy products are rich in micronutrients and proteins, some of which have been shown to lower blood pressure.
- Low-grade inflammation underlies the pathology of CVD, and some saturated fatty acids found in



**“There’s an inverse association between yogurt consumption and a composite cardiovascular risk factors score.”**

– Professor Luis Moreno

dairy products (e.g. lauric acid) may have anti-inflammatory effects.

- Calcium, potassium and magnesium found in yogurt have been linked to a reduced risk of stroke.
- Milk proteins may have a beneficial effect on blood lipids.
- The dairy matrix may contribute to the beneficial effects of yogurt and other dairy products and determine the fat bioavailability.

In addition, cheese and fermented milk products such as probiotic yogurts and semi-skimmed yogurts in particular have a high antioxidant potential i.e. the ability to combat oxidative damage,<sup>79</sup> and could play a part in healthy and active ageing.<sup>80</sup>

### Whole-fat or low-fat dairy products?

Although nutritional guidelines recommend consumption of low-fat rather than whole-fat dairy foods to reduce CVD,<sup>81</sup> recent findings suggest that this advice may need to be modified.<sup>75</sup>

A review of meta-analyses has found that the consumption of various forms of dairy products - including total dairy, cheese, yogurt, high-fat and low-fat dairy - shows either favourable or neutral associations with cardiovascular-related outcomes.<sup>72</sup>

Researchers conclude that the current scientific evidence calls into question the negative image of milk fat, and that consumers can continue to consume full-fat dairy products moderately as part of a healthy and balanced lifestyle, with fermented dairy products being preferable for optimum nutrient intake and potential cardiovascular health benefits.<sup>5</sup>



# Yogurt and other dairy products are recommended for bone health in dietary guidelines around the world

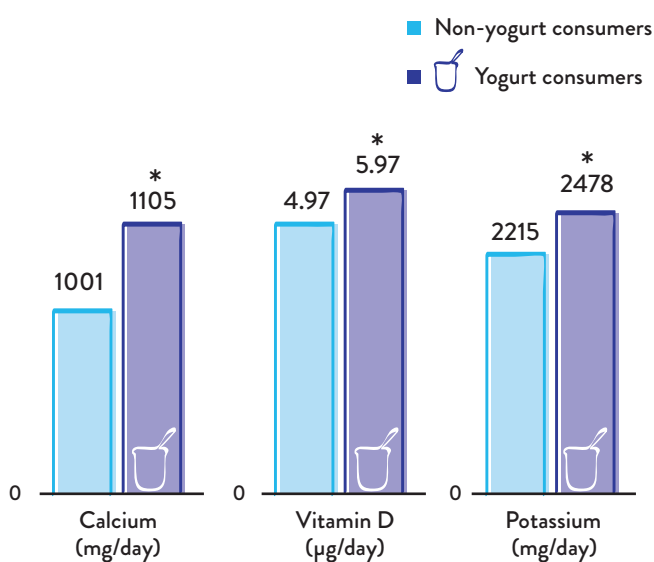


Yogurt (as part of the dairy product group) is recommended in many dietary guidelines because of its nutrient content essential for bone health.

## Yogurt is rich in nutrients essential for bone health

Yogurt is rich in protein and several micronutrients important for bone health, most notably calcium (Figure 1).<sup>7,82,83</sup>

**Figure 1. Yogurt consumption increases children’s intake of vital micronutrients for bone health**



\* Statistically significant  
Adapted from Keast DR, Hill Gallant KM, Albertson AM, et al. *Nutrients* 2015;7:1577-93.<sup>7</sup>

Yogurts containing live bacteria and those with added prebiotics may benefit bone health by modifying the gut microbiota and increasing calcium absorption.<sup>84</sup>

## Yogurt is linked to healthy growth of bones during childhood and adolescence

- In a study in China, adding one serving of yogurt to the usual diet of preschool children for 5 days each week over 9 months promoted growth (height and weight gain) and significantly increased bone mineral density compared with those seen in children not receiving yogurt supplementation.<sup>85</sup>
- Fermented dairy products, such as yogurt, are linked to improved bone health, particularly bone mineral density, in children and teenagers.<sup>84</sup>

**“Eating more yogurt and other dairy foods has the potential to improve bone health and prevent fractures during childhood, in adolescence, and later in life.”**

– Professor René Rizzoli

## Yogurt is associated with stronger bones and better physical function in older people

Increasing yogurt consumption could be a convenient way of improving the nutritional status and health of older adults, including their bone health.<sup>80</sup>

The association between yogurt consumption and bone health was investigated in a study of people aged over 60 years. Results showed:

- women who frequently ate yogurt (more than one serving/day) had stronger bones than those who rarely or never ate yogurt (less than one serving/week).<sup>86</sup> Total hip and femoral neck bone mineral density was 3.1–3.9% higher among frequent yogurt consumers
- in men, high-yogurt consumers were found to have 12.9% higher mean vitamin D concentrations than low/non-consumers. A protective effect on bone was also suggested by changes in levels of a marker for osteoclasts – bone cells involved in the maintenance and repair of bone<sup>86</sup>
- compared with low-/non-consumers, women who often ate yogurt had better scores for daily living activities and physical self-maintenance.<sup>86</sup>

## Yogurt may reduce the risk of hip fracture

Available evidence suggests that yogurt is linked to a lower risk of hip fracture in older adults.<sup>87</sup>

- A meta-analysis reported that a higher intake of yogurt was associated with a 25% reduction in hip fracture risk when compared with low intake.<sup>88</sup>
- A recent study in middle-aged and elderly Swedish women showed that low intake of fermented milk products (yogurt and soured milk) was linked to high rates of hip fracture.<sup>89</sup>
- Hip fracture rates were lowest among women with a high intake of fermented milk products in combination with a high intake of fruit and vegetables.<sup>89</sup>

## Yogurt could reduce the risk of osteoporosis

In people over the age of 60 years, statistical modelling of yogurt intake and bone health predicted that each increase of one serving per week of yogurt intake was associated with a 39% lower risk of osteoporosis in women and a 52% lower risk in men.<sup>86</sup>

Encouraging older people to eat yogurt more often, particularly vitamin D- and calcium-fortified yogurt, may be a valuable public health strategy to stave off osteoporosis.<sup>86,90-92</sup>

## Yogurt is recommended as part of a healthy diet

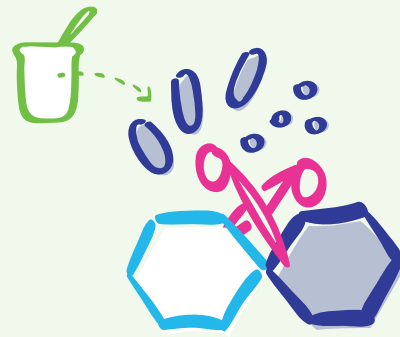
Many international advisory boards recommend the consumption of dairy products in amounts equivalent to 400–500 mL milk per day.<sup>93</sup>

Several countries include yogurt (as part of dairy products) in their dietary guidelines.<sup>94</sup> These include, among others, the USA, Canada, Japan, the UK, Australia, Switzerland, Sweden, and Portugal.

**“It is difficult to meet the nutrient requirements for healthy bones without three servings of dairy products each day for most age groups. Getting adequate calcium, magnesium, protein, and potassium are important at all life stages, but two critical periods where bone is rapidly turning over is during pubertal growth and after menopause.”**

– Professor Connie Weaver

# Yogurt improves lactose digestion in people with lactose maldigestion



Live yogurt has properties that improve digestion of lactose.<sup>95,100,103</sup>

## Lactose maldigestion is normal

Lactose is a natural sugar found in milk and other dairy products. It can be broken down by the enzyme lactase in the small intestine into glucose and galactose, two simpler sugars that are readily absorbed into the bloodstream.<sup>95</sup>

- After weaning, our ability to digest lactose declines because we produce less lactase.<sup>96,97</sup> Difficulty in digesting lactose due to this normal reduction in lactase production/activity is known as lactose maldigestion.<sup>97</sup>
- Undigested lactose reaching the colon is broken down by the resident microbiota, resulting in the

**“The living bacteria in yogurt allow people suffering from lactose maldigestion/intolerance to gain the nutritional benefits of dairy products.”**

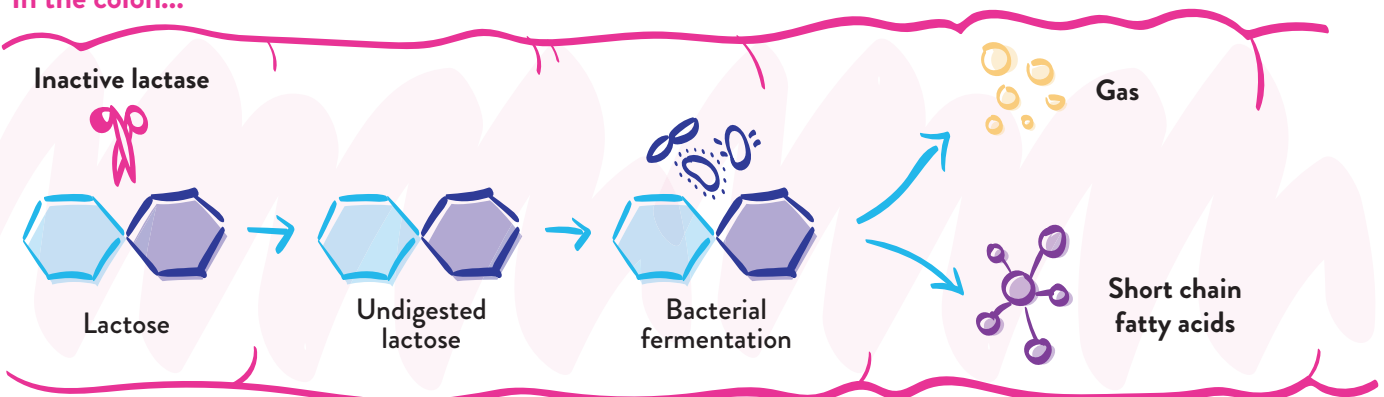
– Professor Naima Amrani

production of short-chain fatty acids (SCFAs) and gases (**Figure 1**).<sup>97</sup> In most people, this maldigestion produces no noticeable symptoms.

- When lactose maldigestion gives rise to symptoms such as bloating, cramps, diarrhoea and flatulence, this is called lactose intolerance.<sup>96,97</sup>
- Self-diagnosis of lactose intolerance is common, but it is often incorrect and in fact very few people have confirmed clinical lactose intolerance.<sup>82,98</sup>

**Figure 1. Lactose maldigestion: a difficulty in digesting lactose<sup>97</sup>**

**In the colon...**



## People with lactose intolerance can eat dairy products without experiencing significant symptoms

Dairy products are recognised as an important part of a healthy diet as they are a source of several nutrients (see page 8). Dairy products are particularly important for providing calcium, for which it is difficult to achieve the recommended daily intake from a dairy-free diet.<sup>82</sup>

It is therefore important that dairy products are part of everyone's diet, including people with lactose maldigestion or intolerance.

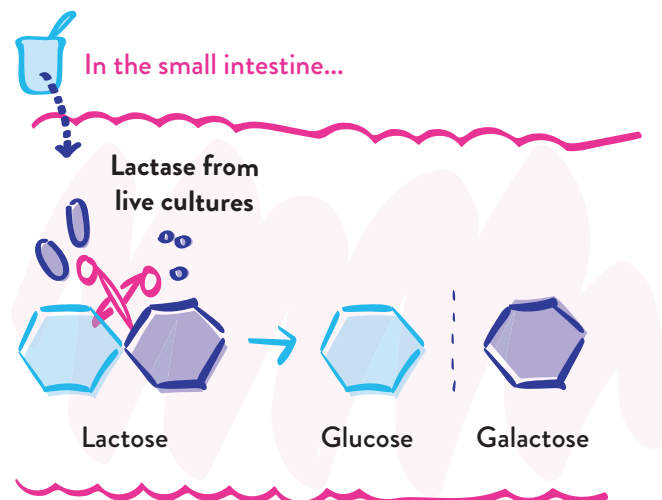
People with lactose intolerance or lactose maldigestion can generally tolerate a single intake of up to 12 g of lactose (equivalent to about one glass of milk), particularly when consumed as part of a meal, with no or minor symptoms.<sup>96,99</sup>

There is some evidence that a daily intake of 24 g of lactose can be tolerated if it is distributed throughout the day and consumed with other foods.<sup>96,99</sup>

## Choose yogurt for improved lactose digestion

Dairy products vary in the amount of lactose they contain. A reduced level of lactose is found in yogurt containing the two active bacterial cultures *L. delbrueckii* subsp. *bulgaricus* and *S. thermophilus*.<sup>82</sup> These live bacteria produce lactase which breaks down some of the lactose in yogurt (**Figure 2**).<sup>95,100</sup>

**Figure 2. Bacteria in yogurt aid lactose digestion<sup>95</sup>**



**“In countries where lactose maldigestion is common, consuming yogurt as part of one’s normal diet can reduce the risk of suffering from it.”**

– Dr Widjaja Lukito

- The bacteria survive their passage through the gut and the bacterial lactase helps further with digestion of lactose in the small intestine.<sup>101</sup>
- Unlike milk, yogurt’s semi-solid state benefits lactose digestion by slowing transit through the gut.<sup>100,102</sup>

## Yogurt is recommended for people with lactose maldigestion

The European Food Safety Authority (EFSA) has approved the claim that yogurt improves digestion of lactose<sup>103</sup>

- The EFSA’s conclusions were based on 13 studies showing that consumption of live cultures in yogurt improved digestion of lactose in yogurt among people with lactose maldigestion.<sup>103</sup>
- To qualify for this claim, yogurt must contain at least  $10^7$  live bacteria (*L. bulgaricus* and *S. thermophilus*) per gram of yogurt, and therefore fresh yogurt is best. Ultra-high temperature (UHT) yogurt or yogurt labelled ‘long-life’ has been heat-treated and this process kills the beneficial bacteria.

Several medical organisations recommend that people with lactose maldigestion – including those with lactose intolerance – consume yogurt as part of a balanced diet.<sup>95,100-103</sup>

**“... a cause and effect relationship has been established between the consumption of live yogurt cultures in yogurt and improved digestion of lactose in yogurt in individuals with lactose maldigestion.”**

– European Food Safety Authority<sup>103</sup>

# Yogurt with live cultures can contribute to gut health



Yogurt may beneficially alter the composition and function of the gut microbiota, and this may prove to lead to health benefits.<sup>107,111,112</sup>

## Diet can influence the diversity of the gut microbiota, which is important for health

The gut microbiota plays an important role in digestion.<sup>104</sup> It may also be essential for the normal development of the immune system and nerve function.<sup>105</sup>

- Maintaining the healthy diversity of the gut microbiota is important in preventing disease.<sup>104</sup>
- Recently, it has been proposed that there is a gut microbiota 'signature' that could promote intestinal inflammation and subsequent systemic low-grade inflammation, a condition that predisposes to T2D and obesity.<sup>67</sup>

**“I consider yogurt to be an important part of nutrition and dietary guidelines as it offers both a great nutrient density and also live bacteria to contribute to gut health.”**

– Professor Seppo Salminen

The composition of the gut microbiota can be influenced by our diet.<sup>67</sup> Moreover, in fermented foods such as yogurt, the products of fermentation and particularly the bacteria involved in the fermentation process, can provide additional properties to the food beyond basic nutrition.<sup>105,106</sup>

Hence, fermented foods such as yogurt are arousing research interest as potentially having benefits beyond an extended shelf life and improved texture and flavour.<sup>105,106</sup>

## Yogurt can deliver millions of live bacteria to the gut and may beneficially alter the gut microbiota

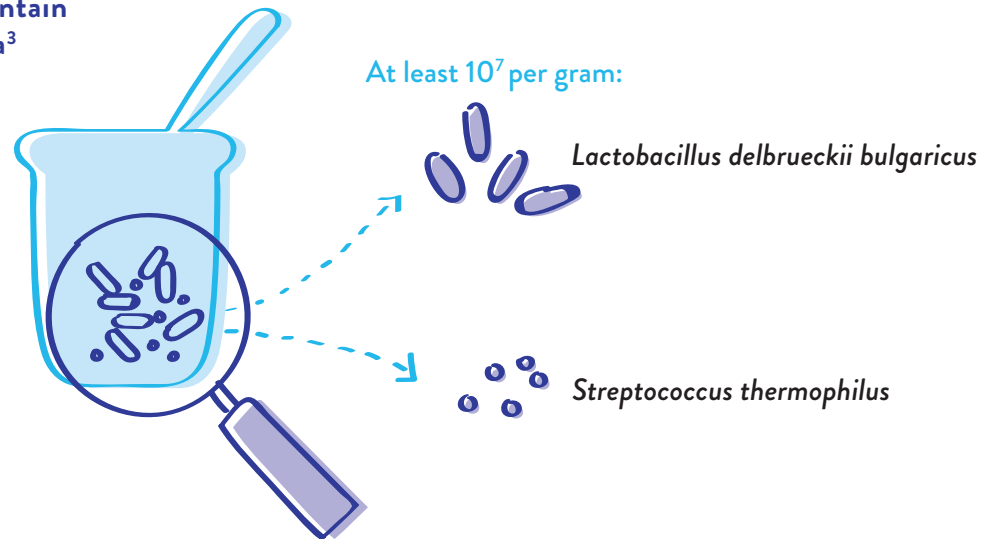
Live yogurt contains millions of bacteria (**Figure 1**) and eating yogurt could potentially increase the number of bacteria in the diet by up to 10,000-fold.<sup>105</sup>

- While probiotic bacteria are unlikely to have long-lasting effects on the gut microbiota,<sup>105</sup> regular consumption of live yogurt will at least temporarily bolster the live bacteria in the gut.
- In addition, prebiotics may be added to yogurt (often in the form of fruit) and these may stimulate the proliferation of beneficial bacteria in the gut.<sup>20</sup>

Lisko *et al* monitored the gut microbiota in healthy adult volunteers who ate 250 g of fat-free plain yogurt per day for 42 days.<sup>107</sup>



**Figure 1. Yogurt can contain millions of live bacteria<sup>3</sup>**



- Analysis of faecal samples showed that in yogurt consumers, microbial community composition began to change by day 7, with microbial communities clustering together by 14 days.
- Yogurt consumption appeared to boost the numbers of *Lactobacilli* in the gut, and was associated with a slight increase in microbial diversity.<sup>107</sup>

As well as beneficially altering the composition of the gut microbiota, probiotic bacteria in yogurt may alter the function of the existing resident bacteria by affecting the production of SCFAs;<sup>105</sup> these have beneficial effects on energy metabolism.<sup>108</sup>

### Yogurt may help to protect the intestinal barrier

Animal studies have suggested that a peptide found in yogurt,  $\beta$ -casein (94-123), increases the production of mucin, an essential component of the mucus layer that lines and protects the intestine.<sup>109,110</sup>

### Yogurt may protect against gastrointestinal disease

Research suggests that yogurt might play a role in the treatment and prevention of gastrointestinal disorders.

- For children with mild to moderate persistent diarrhoea, a yogurt-based diet may be

recommended as it has been shown to reduce stool output and the duration of diarrhoea.<sup>111</sup>

- Modulation of the gut microbiota by yogurt, particularly yogurt containing *Lactobacillus* and *Bifidobacterium*, might be of value in the treatment or prevention of gastrointestinal diseases such as irritable bowel syndrome, infectious diarrhoea and allergy gastroenteritis.<sup>112</sup> However, any potential benefits have yet to be proven.
- Yogurt may be used in the nutritional management of acute gastroenteritis in children, but data on this approach are limited and large randomised controlled trials are needed to provide evidence to support it.<sup>113</sup>

**“Yogurt, as it contains millions of bacteria and fermentation products, is beneficial for long-term health. Its short-term effects, other than its benefits in settling acute infectious diarrhoea, need to be established from large randomised controlled studies. A yogurt a day might help in preventing acute gastroenteritis.”**

– Professor Olivier Goulet

# Yogurt is part of a sustainable diet



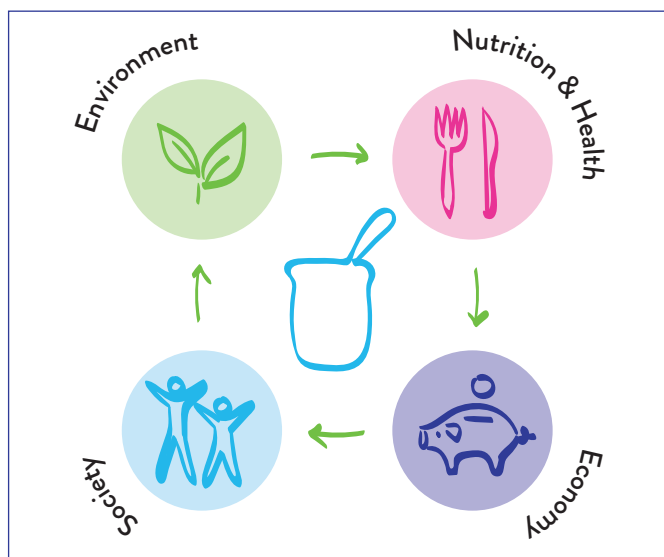
To be sustainable, foods must be environmentally friendly, high in nutrient value, affordable and culturally acceptable.

## Yogurt meets the four criteria for a sustainable food

Sustainability is more than just having a low carbon footprint. The environmental costs of food production and consumption must be balanced against nutrient value affecting health, affordability and cultural and social acceptability (Figure 1).

Yogurt's high nutrient density balances its environmental cost, while its affordability brings it into the reach of the general population.<sup>83</sup>

**Figure 1. Characteristics required for a sustainable food<sup>17</sup>**



## 1) Yogurt is a nutrient-dense food

Yogurt is well-positioned to be an integral part of a sustainable diets because of its high nutrient value (see page 8).

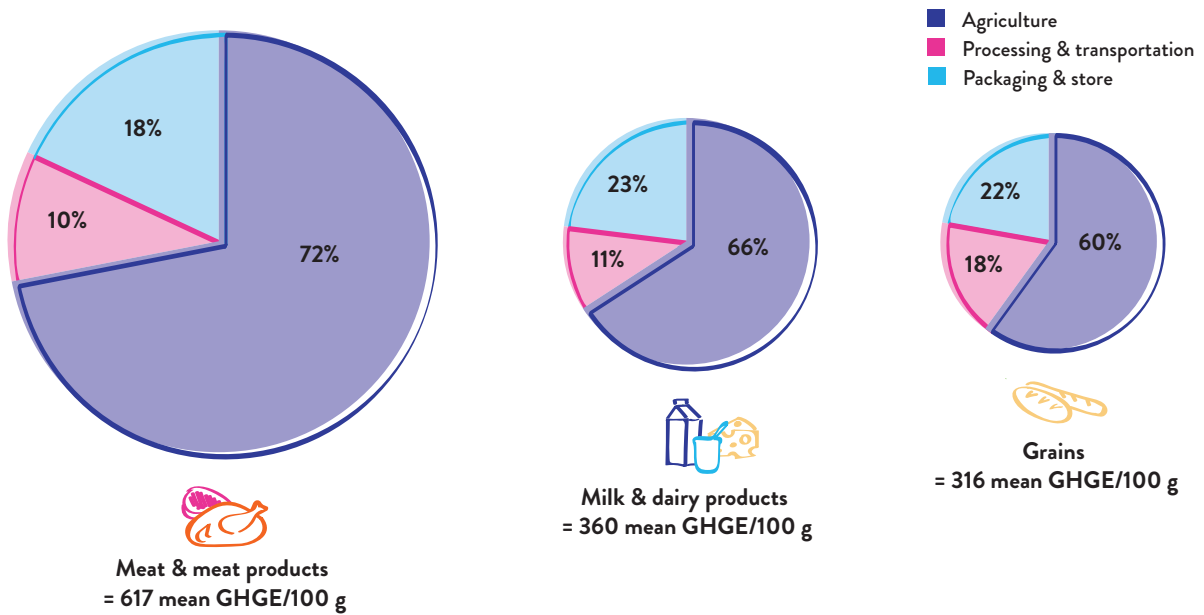
- In nutrient profiling models, some of the highest nutrient density scores are awarded to unsweetened and low-saturated fat yogurts.<sup>83</sup>
- Yogurt provides more nutrients than calories relative to the body's needs.<sup>83</sup>

## 2) Yogurt has a low environmental footprint

Typically, nutrient-rich foods have a higher environmental impact than those with a poor nutrient content.<sup>114</sup> However, the environmental cost must be weighed against nutrient needs for health.<sup>115</sup>

- Greenhouse gases – gaseous compounds in the atmosphere that trap and hold heat – are a major factor in global warming and climate change.
- Greenhouse gas emissions (GHGEs) occur at every stage of the food production and consumption cycle – from farming and agricultural practices to packaging, transport and storage in the supermarket and the home.<sup>115</sup>
- Milk and yogurt are higher in carbon cost than nutrient-poor foods such as sweetened drinks, sugar and sweets.<sup>114</sup>
- However, yogurt compares favourably with other healthy foods in terms of GHGE.<sup>114</sup> Yogurt's GHGE is lower than the level predicted by its nutrient density.

**Figure 2. Carbon cost by food category: mean greenhouse gas emissions (GHGE) per 100 g**



Adapted from Drewnowski A, Rehm CD, Martin A, et al. Am J Clin Nutr 2015;101:184-191.<sup>114</sup>

- In a UK diet-modelling study linking nutrient composition with GHGEs, the inclusion of yogurt was associated with a 36% reduction in GHGEs (based on emissions per person).<sup>115</sup>
- Similarly, yogurt and other dairy products had a relatively low carbon cost in a food labelling initiative from the French retailer, Casino, which combined GHGEs and nutrient data (Figure 2).<sup>114</sup>
- Modern farming practices are reducing the impact of dairy foods on natural resources and the environment.<sup>83</sup>

### 3) Yogurt is a low-cost source of nutrients

Nutritious foods such as meat, fish, poultry, fresh fruit and vegetables generally cost more than high energy-dense foods – grain snacks, sweets, chocolate and fatty, sugary foods. This remains true across different countries, age groups and indicators of diet quality.<sup>116</sup>

Achieving greater equality between people on high and low incomes requires foods to be high in nutrient quality, yet affordable for all.<sup>116</sup>

- Yogurt is the lowest-cost source of dietary calcium as well as a highly affordable source of high-quality protein.<sup>117</sup>

- Food profiling has suggested that low-fat yogurt and milk are roughly equivalent to sweets in terms of per-calorie cost, yet much higher in overall nutritional quality.<sup>83</sup>
- In terms of calories or nutrients per Euro, yogurt is less expensive than animal-derived foods, such as meat, poultry and fish, and is more comparable with beans and eggs.<sup>83</sup>

### 4) Yogurt is culturally acceptable

Not all nutrient-rich foods are socially acceptable. People in low- and middle-income countries, for example, often prefer traditional plant-based diets, with milk and dairy foods such as yogurt as their major source of animal protein on grounds of custom, religion or culture.<sup>83</sup>

**“Dairy foods, including yogurt, are an affordable source of high-quality protein, calcium and other essential nutrients.”**

– Dr Chris Cifelli

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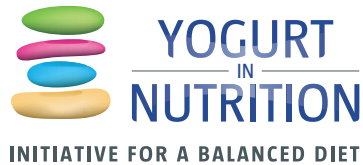
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**“Yogurt is a nutrient-rich food”**

**“Yogurt consumption is linked with healthier diet and lifestyle”**

**“Yogurt can enhance satiety and help to manage energy intake”**

**“Yogurt consumption is associated with reduced weight gain over time”**

**“Yogurt consumption is associated with reduced risk of Type 2 diabetes”**

**“Yogurt consumption is associated with reduced risk of cardiovascular disease”**

**“Yogurt and other dairy products are recommended for bone health in dietary guidelines around the world”**

**“Yogurt improves lactose digestion in people with lactose maldigestion”**

**“Yogurt with live cultures can contribute to gut health”**

**“Yogurt is part of a sustainable diet”**



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