

Balancing health and sustainability

The role of dairy in the UK diet



Foreword

The global food system must evolve to nourish a growing population, while operating within the limits of our environment. Achieving healthy and sustainable diets requires coordinated action across all parts of the food system.

Within this context, dairy plays a key role, having been an important part of the UK diet and food culture for generations. Milk and dairy products are nutrient-dense, providing high-quality protein and a range of key nutrients that support growth, development and lifelong health. For many people, dairy offers a practical, affordable and accessible source of nutrition, contributing to dietary quality in ways that are difficult to replicate.

At the same time, questions about the environmental impact of dairy production are a key part of the food sustainability discussion. UK dairy farmers are addressing these challenges through improving efficiency, reducing emissions, enhancing animal welfare and adopting land management practices that protect soil, water and biodiversity. The sector also benefits from the UK's favourable climate and geography, which supports sustainable production and food security.

This report sets out the evidence on the role of dairy in UK diets and food systems. It reviews milk and dairy products in terms of current intakes, nutritional contributions and health impacts, as well as their place within a balanced and sustainable diet. It also highlights progress in environmental stewardship across the sector and explores how ongoing innovation and collaboration can ensure dairy continues to support both public health and a sustainable food system.

Contents

Executive summary	5
How dairy fits within dietary guidelines.....	5
Dairy consumption in the UK.....	6
The contribution of dairy to nutritional intakes in the UK.....	6
Considerations when shifting to more plant-based dairy alternatives.....	7
How dairy consumption impacts health: the latest evidence.....	7
Farming practices and dairy production in the UK	8
Section 1: Nutrition	10
How dairy fits within dietary guidelines	11
Summary points.....	11
Current dietary recommendations for dairy consumption within the UK	12
Guidance on plant-based drinks.....	14
Food-based dietary guidelines around the world	14
Dairy consumption in the UK	16
Summary points.....	16
National Diet and Nutrition Survey data	16
UK dairy purchasing trends: Insights from national household data	19
Defra Family Food Survey Data	19
Changing consumer views on dairy and purchasing behaviour	20
The contribution of dairy to nutritional intakes in the UK.....	21
Summary points.....	21
Nutritional composition of milk and dairy.....	22
The dairy matrix.....	22
Macronutrients in milk.....	24
The protein transition: shifting from animal to plant proteins.....	29
Cow's milk protein allergy	31
Fat.....	31
Milk sugars (lactose).....	34
Key micronutrients	37
Other important micronutrients.....	48
Considerations when shifting to more plant-based dairy alternatives.....	50
Summary points.....	50
Fortification of plant-based alternatives.....	51
Nutrient bioavailability.....	51
Unintended consequences of less/no dairy.....	51
How dairy consumption impacts health: the latest evidence.....	53
Summary points.....	53
Bone health and osteoporosis	54
Cardiovascular disease (CVD)	60
Cancer	68
Weight control.....	74
Type 2 diabetes (T2D).....	77
Gut health	81
Glossary.....	83
References	85

Section 2: Environment	101
Farming practices and sustainable dairy production in the UK.....	102
Summary points.....	102
Introduction	103
What are we already doing?	105
Summary points.....	105
Accounting for GHGs of UK production.....	107
Global averages	108
Net zero, not gross zero	109
Livestock.....	111
Summary points.....	111
Animal health and welfare	112
Genetic developments.....	112
Beef from dairy	113
Land use	114
Summary points.....	114
Purchased feed	114
Grassland	115
Agroforestry	116
Circular farming	116
Renewable energy.....	117
Natural resource management.....	120
Summary points.....	120
Water	120
Air	122
Biodiversity	122
What next?	124
Summary points.....	124
Industry	124
Net zero vs zero hunger	125
Glossary.....	126
References	128

Executive summary

How dairy fits within dietary guidelines

- To tackle climate change, food security and public health, we need a balanced approach that values dairy's nutritional benefits and promotes sustainable farming. By encouraging sustainable diets and improving agricultural practices, we can protect human and planetary health for future generations
- A sustainable healthy diet is essential for health and the environment, and it must be accessible, affordable, safe, equitable and culturally acceptable. The UK's Eatwell Guide outlines a framework for this, recommending dairy and fortified alternatives as important sources of protein, calcium and vitamins, within a diverse, plant-rich diet to support health and environmental goals
- In the UK, transitioning to a diet in line with the Eatwell Guide could substantially improve public health outcomes and reduce greenhouse gas (GHG) emissions by up to one-third. However, adherence to these dietary guidelines is extremely low (less than 0.1%)
- Sustainable diets must balance health, environmental, economic and social factors to avoid unintended consequences. In line with the United Nations Sustainable Development Goal 2, the Food and Agriculture Organization (FAO) recommends dietary diversity across ten key food groups, including dairy, to ensure adequate nutrient intake and to combat hunger
- Dairy products provide high-quality protein, calcium, iodine and several essential vitamins, which play an important role in supporting bone and muscle health throughout life. International organisations, including the FAO, recognise dairy as a nutrient-dense food that is widely accessible and affordable in many populations. In the UK, milk and dairy foods are relatively low-cost sources of key nutrients and are included in national dietary guidance as one of the five essential food groups that support health across the life course
- Global food-based dietary guidelines are increasingly advocating for a reduction in animal-sourced foods for health and sustainability. However, this often overlooks local diet composition, cultural acceptability and key nutritional factors, such as essential amino acid intake, micronutrient bioavailability and overall dietary adequacy. Significant reductions in animal-sourced foods may worsen existing protein and micronutrient deficiencies, particularly among vulnerable groups such as young children, adolescents, pregnant and breastfeeding women and older adults. Dairy supports nutrient adequacy in these vulnerable groups, while aligning with FAO/World Health Organization (WHO) principles of health, affordability and cultural acceptability

Dairy consumption in the UK

- National Diet and Nutrition Survey (NDNS) data (2019–2023) provides the most recent insights into UK dairy consumption, though methodological changes limit comparability with earlier years
- Milk consumption patterns vary: whole milk is most common among toddlers (1.5–3 years), while semi-skimmed milk dominates in older children and adults. Flavoured milk drinks (e.g. milkshakes, hot chocolate and coffee-based beverages) are commonly consumed across all age groups, particularly among teenagers and adults
- Purchasing trends show a long-term shift from whole to semi-skimmed milk since the 1990s, with recent renewed interest in whole milk and block butter. Yogurt and fromage frais have grown steadily, driven by consumer interest in gut health, protein and bone health
- Consumer choices are increasingly shaped by wider concerns: 72% of consumers agree that too many foods contain added ingredients that make them unhealthy, while environmental and ethical considerations are also driving demand for plant-based alternatives

The contribution of dairy to nutritional intakes in the UK

- Milk and dairy products are nutritionally dense, providing a concentrated source of essential nutrients including high-quality protein, calcium, iodine, potassium, vitamin B2 and B12, contributing significantly to UK dietary intakes across all age groups
- There is a growing understanding that certain foods may offer distinct nutrition and health benefits. These effects are influenced not just by individual nutrients, but by the combined action of nutrients and non-nutrient components within the food matrix. Milk and dairy foods have a unique food matrix, where the unique structure and interaction of nutrients in dairy enhances nutrient absorption and may offer health benefits beyond individual nutrients
- Dairy proteins are high quality, easily digestible and rich in branched-chain amino acids, supporting muscle growth, maintenance and recovery – especially important for children and older adults. Milk is a key contributor to protein intake, particularly in young children (up to 24%) and older adults
- Although milk and dairy contribute saturated fat, especially in young children, they also provide beneficial monounsaturated and polyunsaturated fats. Government advice is to choose lower-fat and lower-sugar dairy products where possible
- Accepted and familiar, milk and milk products offer a simple and affordable solution to addressing micronutrient shortfalls. In the UK, 17% of adolescent children (11–18 years old) fall below the lower reference nutrient intake (LRNI) for calcium and 21% fall below the LRNI for iodine, highlighting a critical need to address this age group. Additionally, vitamin B2 deficiency is also prominent among adolescents and adults, with 23% of those aged 11–18 and 15% of those aged 19–64 also falling below the LRNI

- Dairy contributes significantly to daily intakes of key nutrients: calcium: 33–50% depending on age group; iodine: 34–54%, with milk being the primary source in the UK; vitamin B2 and B12, 26–43% across age groups
- Switching from dairy to plant-based alternatives may reduce intakes of calcium, iodine, vitamin B2 and B12, especially if alternatives are unfortified or consumed in low quantities. Shortfalls in these key micronutrients particularly affect adolescents, women of childbearing age and vegans without fortified foods or supplements.

Considerations when shifting to more plant-based dairy alternatives

- Plant-based diets are rising in the UK, but replacing dairy with plant-based dairy alternatives raises concerns about iodine, calcium, vitamin B2 and B12 intake, already low in parts of the population
- Cow's milk provides substantial nutrients (200 ml serving delivers 43% iodine, 33% calcium, 40% vitamin B2, 10% B12 recommendations for an adult woman), whereas plant-based drinks are inconsistently fortified (78% overall; 31% iodine) and often have lower bioavailability
- Plant-based milk alternatives (PBMA) if not fortified may pose risks for vulnerable groups, including children and older adults. Limited research exists on health outcomes of PBMA consumption, but current evidence suggests lower growth and micronutrient intake in children consuming PBMA compared with cow's milk
- PBMA are significantly more expensive than dairy, often costing nearly three times more due to processing and fortification. Most are classified as ultra-processed foods (UPFs), raising concerns about their health impact, though evidence is still emerging
- Reducing dairy may not improve environmental impact if nutrient adequacy relies on other foods; diet-based strategies are needed to balance health, sustainability and affordability

How dairy consumption impacts health: the latest evidence

- Dairy provides key nutrients (calcium, protein, phosphorus, vitamin K2) that support bone strength. Strong evidence shows dairy, particularly milk and yogurt, improves bone mineral density and reduces fracture risk, especially in older adults. Fermented dairy may enhance calcium absorption and support gut health, further benefiting bone health
- Overall, dairy, especially fermented products like yogurt and cheese, is neutral or beneficial for cardiovascular disease (CVD) risk. Evidence links total and low-fat dairy to reduced risk of hypertension, stroke and CVD mortality, with potential added benefits from vitamin K2 and probiotics

- Strong evidence supports dairy's protective role against colorectal cancer, mainly due to calcium. There is limited evidence of reduced breast cancer risk (notably in pre-menopausal women) and possible increased prostate cancer risk with very high dairy/calcium intake, suggesting moderation for men at higher risk
- Dairy is not linked to increased obesity risk and may support healthier body composition. Whole milk may lower childhood obesity risk, while fermented dairy, particularly yogurt, reduces abdominal fat and helps preserve lean mass, important for people on GLP-1 medications for weight loss
- Moderate intake of low-fat dairy, especially yogurt, consistently lowers risk of type 2 diabetes (T2D). Fermented dairy improves insulin sensitivity and reduces metabolic syndrome risk. Evidence also supports benefits for body composition and glucose control in early stages of T2D
- Fermented dairy (e.g. yogurt, kefir) is a key source of probiotics that support gut microbiome diversity, digestion and lactose tolerance. Lactose itself may act as a prebiotic, further supporting gut health. Fermented dairy improves lactose digestion and tolerance, supported by approved health claims in the UK and EU

Farming practices and dairy production in the UK

- Agriculture plays a dual role in climate change, being both a source of GHG emissions and a provider of carbon sequestration and storage. Current reporting at a national level separates these elements, giving an incomplete picture. A whole-farm approach is needed so that net emissions and sequestration are consistently reflected in national inventories and product footprinting
- The UK dairy sector is often compared against global averages, but this is misleading. UK dairy systems are considerably more efficient than many international systems, and global averages overstate the UK footprint
- Agriculture contributed 12% of UK emissions in 2023 (UK GHG National Inventory), but this masks important nuances. Sequestration and renewable energy generated on farms are accounted for elsewhere in the inventory. In addition, the inventory equates all GHGs into carbon dioxide equivalents, whereas the majority of agriculture's emissions come from methane
- Milk production accounts for 2.8% of UK GHG emissions on a GWP100 basis, excluding any potential carbon sequestration
- UK dairy farmers are already focused on producing nutritious food alongside adopting practices and technologies to reduce methane emissions, aligning with the Global Methane Pledge and the FAO's Roadmap to Zero Hunger
- Methane is currently calculated using the GWP100 metric which calculates methane's warming potential over a period of 100 years, whereas emerging science indicates that this is unsuitable. Methane is a short-lived gas, breaking down between 7 and 12 years, meaning that carbon emissions associated with agriculture are greatly reduced under the alternative metric, GWP*

- Emissions intensity of UK milk has fallen by 22% since 1990. Productivity has increased, with more milk now produced from fewer cows
- UK farms have some of the highest standards of animal health and welfare in the world, much of it being underpinned in legislation. There is a distinct correlation between maintaining high animal health and welfare and the reduction of carbon emissions due to the impact of productivity, with high animal health being a key driver in sustainable livestock systems. Advances in genetics are also enabling farmers to lower gross GHG emissions
- UK dairy cows are predominantly forage-fed, with purchased feeds forming only a supplementary part of their overall diet. The UK imports just 1% of global soya, with 62% already from low-deforestation sources in 2019 and a goal of reaching 100%
- 56% of UK farmland is permanent grassland, unsuitable for cropping but essential for grazing livestock and carbon sequestration. Converting existing grassland to arable land is not a straightforward solution, taking into account soil quality, topography and unintended consequences, such as the release of carbon
- Farmers are adopting new land management practices, such as agroforestry, integrating trees and shrubs with grazing, using tree fodder where appropriate and developing circular livestock systems that recycle nutrients, minimise waste and optimise outputs
- Farms play a central role in managing natural resources and ecosystem services. Most water used in UK dairy comes from rainfall (green) rather than mains supply (blue), and farmers are actively reducing pollutants to air and water, such as ammonia, nitrogen and phosphorus, while also supporting biodiversity
- The UK dairy sector has worked collaboratively across the supply chain to progress sustainability through the Dairy Roadmap since 2008. It remains committed to producing nutrient-dense food for a growing global population while maintaining and enhancing the natural environment

Section 1: Nutrition

How dairy fits within dietary guidelines

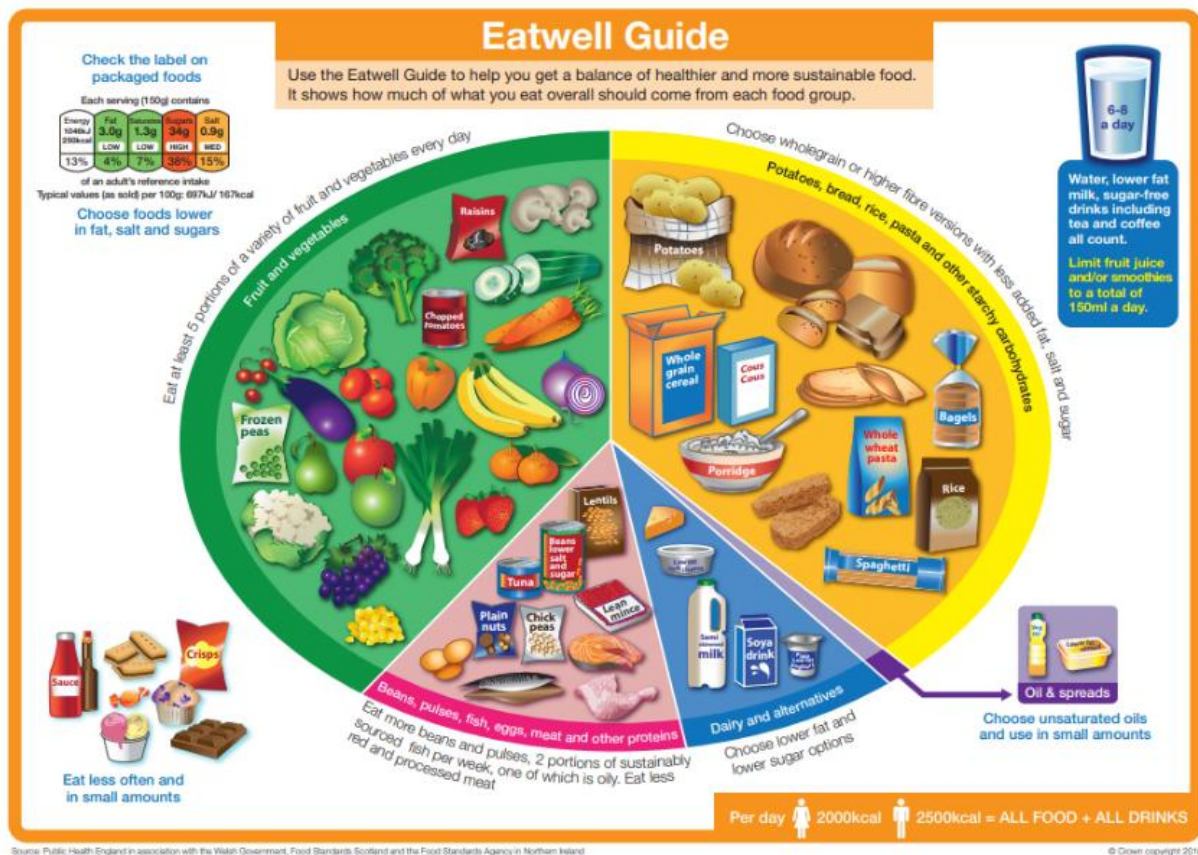
Summary points

- To tackle climate change, food security and public health, we need a balanced approach that values dairy's nutritional benefits and promotes sustainable farming. By encouraging sustainable diets and improving agricultural practices, we can protect human and planetary health for future generations
- A sustainable healthy diet is essential for health and the environment, and it must be accessible, affordable, safe, equitable and culturally acceptable. The UK's Eatwell Guide outlines a framework for this, recommending dairy and fortified alternatives as important sources of protein, calcium and vitamins, within a diverse, plant-rich diet to support health and environmental goals.
- In the UK, transitioning to a diet in line with the Eatwell Guide could substantially improve public health outcomes and reduce greenhouse gas emissions by up to one-third. However, adherence to these dietary guidelines is extremely low (less than 0.1%)
- Sustainable diets must balance health, environmental, economic and social factors to avoid unintended consequences. In line with the United Nations Sustainable Development Goal 2, the FAO recommends dietary diversity across ten key food groups, including dairy, to ensure adequate nutrient intake and to combat hunger
- Dairy products provide high-quality protein, calcium, iodine and several essential vitamins, which play an important role in supporting bone and muscle health throughout life. International organisations, including the FAO, recognise dairy as a nutrient-dense food that is widely accessible and affordable in many populations. In the UK, milk and dairy foods are relatively low-cost sources of key nutrients and are included in national dietary guidance as one of the five essential food groups that support health across the life course.
- Global food-based dietary guidelines are increasingly advocating for a reduction in animal-sourced foods for health and sustainability. However, this often overlooks local diet composition, cultural acceptability and key nutritional factors, such as essential amino acid intake, micronutrient bioavailability and overall dietary adequacy. Significant reductions in animal-sourced foods may worsen existing protein and micronutrient deficiencies, particularly among vulnerable groups, such as young children, adolescents, pregnant and breastfeeding women and older adults. Dairy supports nutrient adequacy in these vulnerable groups, while aligning with FAO/WHO principles of health, affordability and cultural acceptability

Current dietary recommendations for dairy consumption within the UK

In the UK, following the Government's dietary guidelines is essential for improving the nation's health. These guidelines advocate for a balanced diet that emphasises a wide variety of healthy plant-based foods, including fruits, vegetables, legumes, whole grains, nuts and seeds, while also accommodating animal-sourced foods, such as meat, fish, eggs and dairy products. This approach is visually represented in the Eatwell guide (Figure 1), which serves as a practical tool to help individuals and organisations make healthier food choices.

Figure 1. The UK Eatwell Guide



The UK Eatwell Guide¹ outlines recommended proportions of food and drink for a healthy, balanced diet. For dairy and alternatives, it advises to include some in the diet as they are “good sources of protein vitamins and calcium, which supports bone health”. It also recommends choosing “lower fat and lower sugar products where possible” and selecting “unsweetened, calcium-fortified versions” when opting for dairy alternatives. Notably, the guide does not specify exact quantities, instead encouraging individuals to “check labels and opt for healthier choices”.

The Eatwell Guide's main food groups form the basis of a healthy, balanced diet, but can be adapted to personal preferences, dietary needs and cultural acceptability. This aligns with the FAO's and WHO's definition of healthy and sustainable diets, which are dietary patterns that promote individual health and wellbeing, minimise environmental impact and are accessible, affordable, safe, equitable

and culturally acceptable.² Drewnowski et al. (2020)³ further categorise these principles into four interconnected domains: health and nutrition, economy, society and culture and the environment (Figure 2).

Figure 2. Schematic representation of the key components of a sustainable diet



The increasingly popular term ‘plant-based diet’ refers to a diet mainly composed of plant foods, while still allowing some animal-sourced foods. Cutting out whole food groups may result in a lower intake of key nutrients and negatively impact health.⁴⁻⁶ Most healthy eating guidelines, including the Eatwell Guide, recommend a plant-rich diet, with the two largest food groups: fruit and vegetables and starchy foods being plant-based. Eating more in line with UK government guidelines would yield significant health and environmental benefits. However, full adherence to the Eatwell Guide remains extremely low (less than 0.1%).⁷ If these dietary patterns were widely adopted the UK could see a substantial reduction in diet-related disease and improved population health.⁸ Greenhouse gas (GHG) emissions would also be reduced by a third, suggesting that aligning our diets to these guidelines benefits both individual health and the environment.⁷

Guidance on plant-based drinks

The Eatwell Guide advises to consume milk or dairy alternatives as they are good sources of protein and vitamins. However, the recommendation when buying dairy alternatives is to go for unsweetened, calcium-fortified versions. Based on recent assessment of data, caution is advised as no almond, oat or soya drink currently available in the UK is nutritionally equivalent to cow's milk.⁹ The most appropriate plant-based drink alternative to cow's milk varies by age group and an individual's wider dietary intake and nutrient requirements.

The Eatwell Guide highlights that lactose-free dairy products are available for those who are lactose intolerant or have an allergy to cows' milk protein. Lactose-free products contain the same vitamins and minerals as standard dairy products, but they have the enzyme lactase added to them, which helps break down the disaccharide lactose into the monosaccharides glucose and galactose which do not trigger symptoms.¹⁰ For children aged 1–5 years, who consume animal products, whole or semi-skimmed cow's milk are preferable to plant-based drinks, though fortified and unsweetened almond, oat and soya drinks are an acceptable alternative.⁹ For children aged 1–5 years following a vegan diet, fortified and unsweetened soya drink is preferable as their main alternative to cow's milk, as it usually contains higher amounts of protein than almond or oat drinks. For the general population of children aged over five and all adults, fortified and unsweetened almond, oat and soya drinks are acceptable alternatives to cow's milk.⁹

Food-based dietary guidelines around the world

The World Health Organization (WHO) does not provide specific guidance for dairy consumption. However, one of the core principles of a healthy diet is that it provides “enough essential nutrients to prevent deficiencies and promote health, without excess”.⁶

In March 2025, the United Nations Statistical Commission officially adopted the Minimum Dietary Diversity for Women of Reproductive Age (MDD-W) as a global indicator under Sustainable Development Goal 2 (Zero Hunger), reflecting growing international focus on diet quality in sustainable food systems.¹¹ Developed by the FAO, MDD-W assesses whether women aged 15–49 consumed at least five of 10 food groups in the previous 24 hours, including milk and dairy products. Dairy's inclusion underscores its role in supporting diet diversity and nutrient adequacy. Complementary FAO and WHO guidance further emphasises dairy's value as a source of high-quality protein and essential micronutrients, with potential benefits for improved nutrition, gut health and chronic disease prevention when consumed as part of a balanced and varied diet.^{6,12} These international frameworks reinforce dairy's place in national dietary guidelines, including those in the UK, aiming to align public health and sustainability goals.

Dietary guidelines across the globe recommend dairy as a source of calcium and other key nutrients, but the guidance on what to consume and in what amounts in national guidelines varies. A review of dietary guidelines in 90 countries¹³ found that 75% included dairy in their food-based dietary guidelines (FBDGs). In 64% of cases, dairy was presented as its own food group, while 31% grouped it with other protein sources, three countries (4%) did not visually represent dairy, and in China, dairy

is combined with soy.¹³ Of the 51 countries with dairy-specific messages, over half recommend daily dairy consumption.¹³

While national dietary guidelines vary, global frameworks continue to shape the conversation around sustainable eating. The EAT-Lancet Planetary Health Diet, published in 2019, recommends a moderate dairy intake of around 250 g per day, (range 0–500 g).¹⁴ Although no country has formally adopted it as official guidance, its principles have strongly influenced global discussions on healthy and sustainable diets. An updated review of the EAT-Lancet recommendations is expected in October 2025. The updated Nordic Nutrition Recommendations 2023 were influenced by the EAT-Lancet principles and considered both environmental and health impacts of food. Moderate intake of low-fat dairy products is now recommended as part of a predominantly plant-based diet. Milk and dairy are recognised as a source of high-quality protein and essential nutrients. The science suggests that intakes of between 350 ml to 500 ml milk and dairy product per day is sufficient to meet dietary requirements of calcium, iodine and vitamin B12 when combined with adequate intakes of legumes, dark green vegetables and fish. Consumption of predominately low-fat dairy products within an overall healthy diet is associated with favourable health outcomes.¹⁵

An important consideration for dietary guidelines that are based on transitioning to more plant-based foods is to consider the nutritional adequacy of plant drinks and dairy alternatives and existing nutritional inadequacies in the population. Focus should be given to nutritionally vulnerable groups of the population, such as children, women of childbearing age and older adults. Concerns have been raised over the nutritional adequacy of environmentally protective diets where animal-sourced foods, including dairy, have been reduced.¹⁶

A review by Comerford et al. (2021)¹⁷ noted that dairy foods are well recognised for their accessibility, affordability and acceptability, and while these qualities are often highlighted in publications on Sustainable Development Goals, they are rarely reflected in food-based dietary guidelines.

Dairy consumption in the UK

Summary points

- NDNS data (2019–2023) provides the most recent insights into UK dairy consumption, though methodological changes limit comparability with earlier years
- Milk consumption patterns vary: whole milk is most common among toddlers (1.5–3 years), while semi-skimmed milk dominates in older children and adults. Flavoured milk drinks (e.g. milkshakes, hot chocolate, coffee-based beverages) are commonly consumed across all age groups, particularly among teenagers and adults
- Purchasing trends show a long-term shift from whole to semi-skimmed milk since the 1990s, with recent renewed interest in whole milk and block butter. Yogurt and fromage frais have grown steadily, driven by consumer interest in protein and gut and bone health
- Consumer choices are increasingly shaped by wider concerns: 72% of consumers agree that too many foods contain added ingredients that make them unhealthy, while environmental and ethical considerations are also driving demand for plant-based alternatives

National Diet and Nutrition Survey data

Since 2008, the National Diet and Nutrition Survey (NDNS) has tracked what the UK eats. It is used to assess dietary trends, nutrient intake and overall nutritional health across the population aged 1.5 years and over living in private households in the UK. This large-scale continuous cross-sectional survey plays a critical role in shaping public health guidance and tackling nutritional challenges.¹⁸

The most recent report, published in June 2025,¹⁸ covers data collected between October 2019 to July 2023 (survey years 12–15). While the COVID-19 pandemic caused a brief pause in data collection, and recent methodological changes limit direct comparison with previous years' data (2016–2019)¹⁹, valuable insights remain. Due to these methodological updates, including how dietary information was collected and how blood samples were processed and transported, it is not possible to directly compare food consumption, nutrient intakes and blood-based nutritional status from 2019 to 2023 with findings from previous years. However, long-term trends in iodine status can be tracked reliably as they have been measured consistently via urinary iodine since 2013.

Accurate estimates of dairy are important for monitoring dietary targets for health and climate change. As dairy is often consumed as part of a dish, such as cheese in lasagne or milk in pancakes, disaggregating the dairy out of composite foods may improve the estimate of dairy consumption and the contribution of dairy to nutrient intakes. In Scotland, around a quarter of dairy is consumed in composite dishes.²⁰

Intake of milk and milk products in children

NDNS data reveals that whole milk is the most consumed type among children aged 1.5–3 years, averaging 251 g per day, well ahead of semi-skimmed milk at 143 g/day and flavoured milk at 100 g/day. In children aged 4–10, semi-skimmed milk is the most consumed (53% of consumers), with average intakes of whole and semi-skimmed milk being almost identical at 189 g/day and 184 g/day respectively. Flavoured milk that includes coffee beverages ranks third at 113 g/day. Among 11–18-year-olds, semi-skimmed milk remains the top choice (46% of consumers), followed by flavoured and whole milk. Whole milk has the highest average consumption across all age groups (see Table 1), except in 4–10-year-old boys, where consumption of semi-skimmed milk is slightly higher than whole milk, with an average of 195 g vs. 188 g/day.

Table 1. Milk intakes in children and teenagers, by age and gender (average; % consumers)

Milk intakes per day	AGE (YEARS)						
	1.5–3 (n= 342)	4–10 (n= 846)			11–18 (n= 755)		
	ALL	ALL	M	F	ALL	M	F
Whole milk: average (g) % consumers	251 56	189 38	188 40	191 36	192 23	228 28	135 19
Semi-skimmed milk (1.8% fat): average (g) % consumers	143 38	184 53	195 51	174 55	182 46	224 48	132 43
1% fat milk: Average(g) % consumers	* 4	* 3	* 2	* 3	* 3	* 3	* 4
Skimmed milk (0.5% fat): average (g) % consumers	66 7	94 7	113 8	68 6	72 7	69 8	* 6
Other milk and cream: average (g) % consumers	* 8	22 7	* 8	* 6	24 6	* 3	26 8
Flavoured milk drinks**: average (g) % consumers	100 13	113 19	116 21	110 17	143 24	157 23	130 25

Key: M = male; F = female; n = number; g = gram; % = percentage of consumers

Note: *= unavailable (where the number of consumers in any group is less than 30, the mean and percentage consumers are not presented); **flavoured milk includes: ready-to-drink and made-up flavoured milk drinks (e.g. milkshakes, hot chocolate, malted drinks, flavoured breakfast milk drinks such as Weetabix on-the-go drink), excluding powders and dry mixes; coffee beverages made with all dairy milk (with and without added sugar) bought at a cafe or shop (not sachets or capsules made up at home)

Source: OHID, (2025b)¹⁸

Intake of milk and milk products in adults

Semi-skimmed milk is the most widely consumed milk type among all adults, with 52% of those aged 19–64, 66% of 65–74 year-olds and 72% of adults 75+ years drinking it (see Table 2). Flavoured milk drinks have the highest average intake across all adult age groups – 194 g/day among 19–64-year-olds, (rising to 211 g/day for men), 179 g/day for 65–74-year-olds and 191 g/day for those aged 75+.

Among adults aged 19–64, average intakes of whole milk (124 g/day) and semi-skimmed milk (129 g/day) are similar. In older adults, average consumption of semi-skimmed milk continues to be higher than whole milk.

Table 2. Milk intakes in adults, by age and gender (average; % consumers)

Milk intakes per day	AGE (YEARS)								
	19–64 (n= 1551)			65–74 (n= 355)			75+ (n= 240)		
	ALL	M	F	ALL	M	F	ALL	M	F
Whole milk:									
average (g)	124	145	91	121	*	*	140	*	*
% consumers	19	23	14	16	17	15	22	22	21
Semi-skimmed milk (1.8% fat):									
average (g)	129	142	117	176	175	176	157	172	147
% consumers	52	53	51	66	70	63	72	70	73
1% fat milk:									
average(g)	105	103	*	*	*	*	*	*	*
% consumers	4	5	3	5	5	4	4	6	3
Skimmed milk (0.5% fat):									
average(g)	98	83	109	117	108	123	110	*	*
% consumers	14	12	16	30	27	32	26	26	26
Other milk and cream:									
average (g)	23	21	24	22	*	18	35	*	*
% consumers	10	10	11	17	16	18	20	26	16
Flavoured milk drinks**:									
average (g)	194	211	179	179	*	172	191	157	221
% consumers	27	26	27	20	16	23	34	37	31

Key: M = male; F = female; n = number; g = gram; % = percentage of consumers

Note: * = unavailable (where the number of consumers in any group is less than 30, the mean and percentage consumers are not presented); **flavoured milk includes: ready-to-drink and made-up flavoured milk drinks (e.g. milkshakes, hot chocolate, malted drinks, flavoured breakfast milk drinks such as Weetabix on-the-go drink), excluding powders and dry mixes; coffee beverages made with all dairy milk (with and without added sugar) bought at a cafe or shop (not sachets or capsules made up at home)

Source: OHID, (2025b)¹⁸

UK dairy purchasing trends: Insights from national household data

Defra Family Food Survey Data

In contrast to the data derived from NDNS, while not providing consumption data per se, the Family Food Survey (FFS), carried out by the Department of Food and Agriculture (Defra), offers insights into purchased quantities, expenditures and nutrient intake within households, as well as food and beverage consumption outside the home.

The FFS²¹ provides insights into expenditures and purchased quantities of food and drink for consumption within the home over the last 40 years. Total liquid cow's milk consumption has declined, with the average person consuming 22% less in 2023 compared with 2013.

Figure 3 compares the average weekly household purchase of milk varieties from 1980 to 2023. Historically, liquid whole milk was the dominant choice, though volumes declined from the 1980s onwards as dietary preferences shifted towards lower-fat options. This led to the growth of semi-skimmed milk, which became the preferred choice for many households since the 1990s. Purchases of skimmed, infant and instant dried milks remained comparatively stable throughout the period, while other milks and dairy desserts, which includes plant-based alternatives, have emerged as a growing segment, particularly from 2021 onwards, reflecting increased interest in dairy-free options.

Figure 3. Average weekly household purchases (millilitre per person) of whole milk, skimmed milk, semi-skimmed milk, infant milks, instant dried milk and other milks and dairy desserts

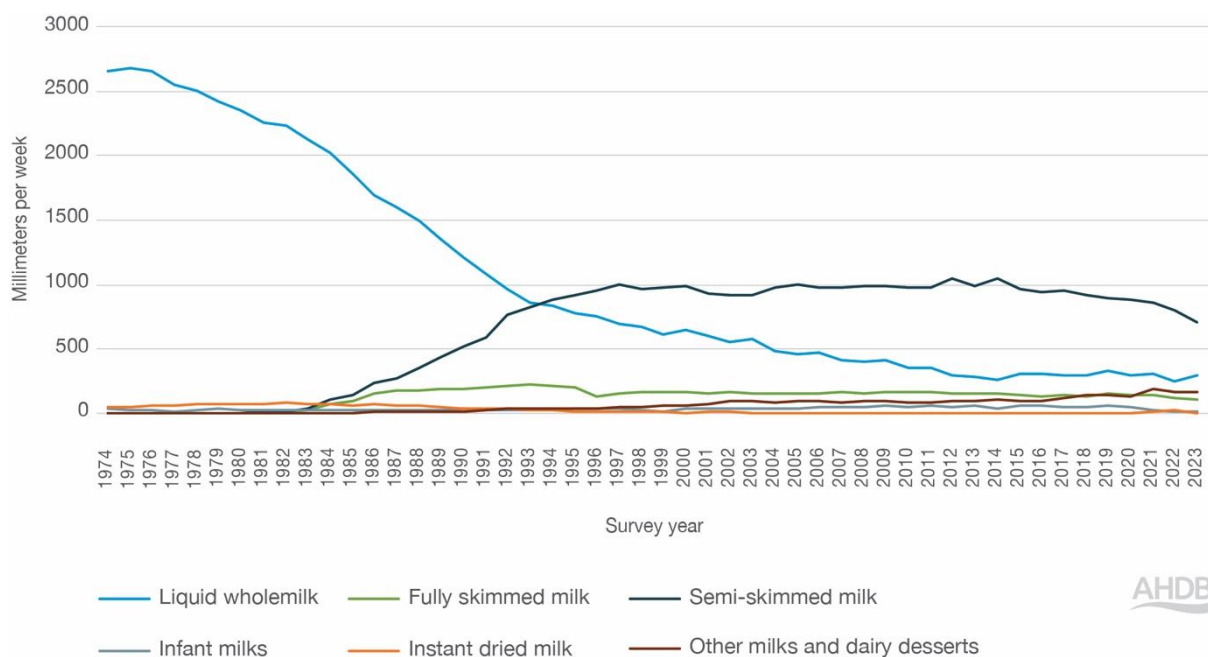
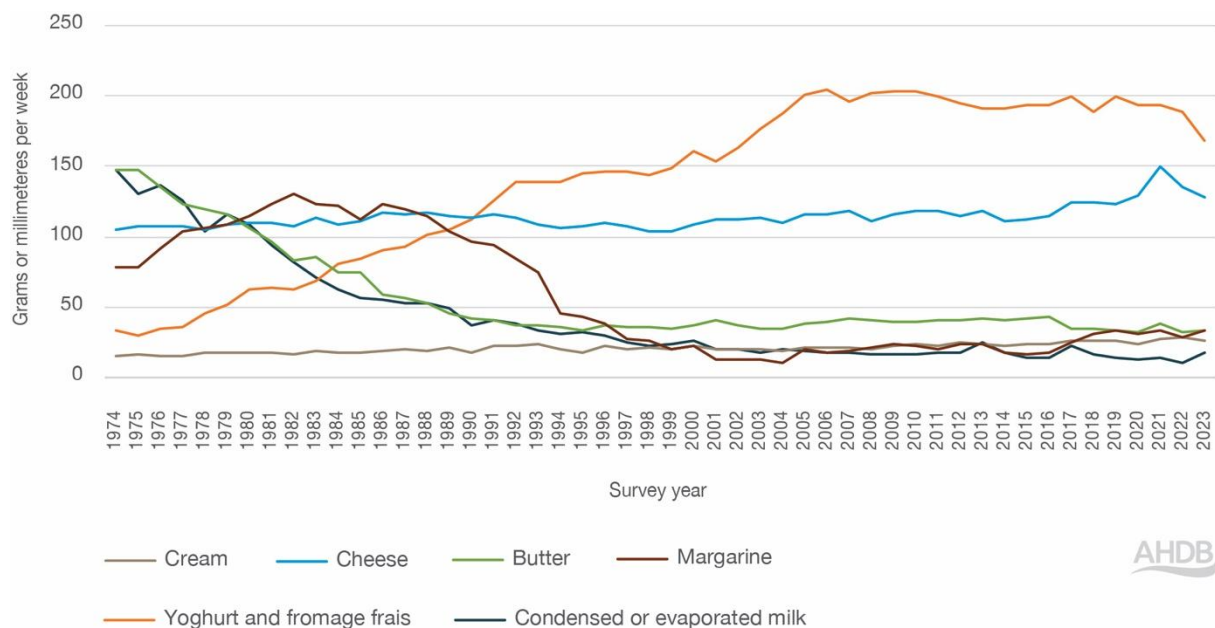


Figure 4. Average weekly household purchases (grams/millilitre per person) of condensed or evaporated milk, yogurt and fromage frais, cream, butter, margarine and cheese



Source: Defra (2023)²¹

Changing consumer views on dairy and purchasing behaviour

More recent shifts in consumer priorities in health help explain the latest changes across dairy categories. Consumers are showing greater interest in the naturalness and simplicity of products, which has supported renewed demand for whole milk and block butter while contributing to the long-term decline in margarine. In the most recent year, both whole milk and block butter were the only products in their respective categories to record year-on-year volume growth.²³ Ultra-processed foods are the number one nutritional concern for UK shoppers,²⁴ and 72% of consumers agree that too many foods have added ingredients, making them unhealthy.²⁵

Health motivations also continue to shape choices, with consumers purchasing dairy products more frequently due to their functional benefits, such as gut health support, high protein content, weight management and bone health benefits,²⁶ supporting the continued growth of yogurt and fromage frais. However, while health remains a key factor when purchasing dairy, consumers also factor in environmental and sustainability concerns of dairy farming and animal welfare which has impacted milk choices and supported the growth of plant-based drinks in recent years.²⁷

The contribution of dairy to nutritional intakes in the UK

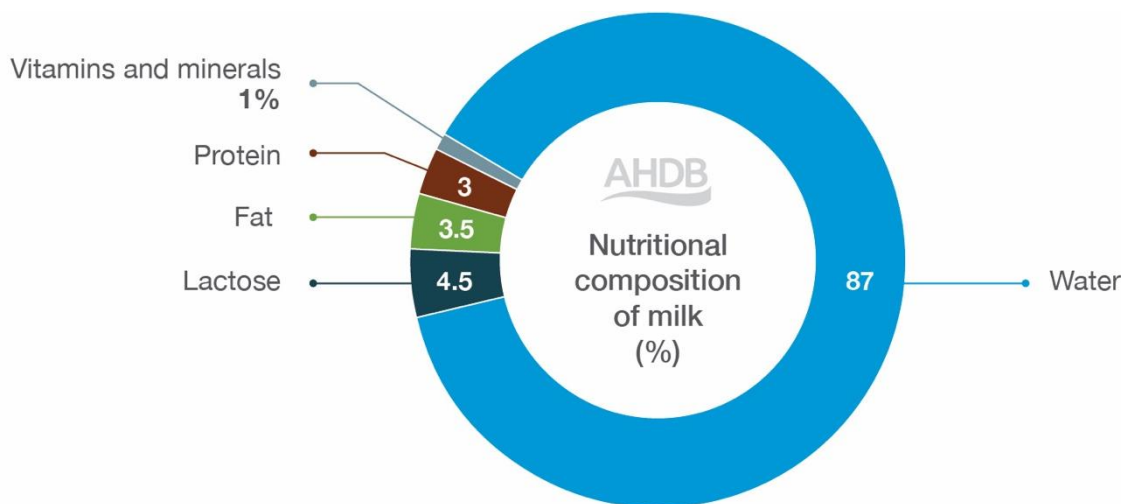
Summary points

- Milk and dairy products are nutritionally dense, providing a concentrated source of essential nutrients, including high-quality protein, calcium, iodine, potassium, vitamin B2 and B12, contributing significantly to UK dietary intakes across all age groups
- There is a growing understanding that certain foods may offer distinct nutrition and health benefits. These effects are influenced not just by individual nutrients, but by the combined action of nutrients and non-nutrient components, within the food matrix. Milk and dairy foods have a unique food matrix, where the unique structure and interaction of nutrients in dairy enhances nutrient absorption and may offer health benefits beyond individual nutrients
- Dairy proteins are high quality, easily digestible and rich in branched-chain amino acids, supporting muscle growth, maintenance and recovery, especially important for children and older adults. Milk is a key contributor to protein intake, especially in young children (up to 24%) and older adults
- Although milk and dairy contribute saturated fat, especially in young children, they also provide beneficial monounsaturated and polyunsaturated fats. Government advice is to choose lower-fat and lower-sugar dairy products where possible
- Accepted and familiar, milk and milk products offer a simple and affordable solution to addressing micronutrient shortfalls. In the UK, 17% of adolescent children (11–18 years old) fall below the lower reference nutrient intake (LRNI) for calcium and 21% fall below the LRNI for iodine, highlighting a critical need to address this age group. Additionally, vitamin B2 deficiency is also prominent among adolescents and adults, with 23% of those aged 11–18 and 15% of those aged 19–64 also falling below the LRNI
- Dairy contributes significantly to daily intakes of key nutrients: calcium: 33–50% depending on age group; iodine: 34–54%, with milk being the primary source in the UK; vitamin B2 and B12, 26–43% across age groups
- Switching from dairy to plant-based alternatives may reduce intakes of calcium, iodine, vitamin B2 and B12, especially if alternatives are unfortified or consumed in low quantities. Shortfalls in these key micronutrients particularly affect adolescents, women of childbearing age and vegans without fortified foods or supplements

Nutritional composition of milk and dairy

Milk is primarily water (87%), with lactose (4–5%), protein (3%), fat (3–4%), minerals (0.7%) and vitamins (0.1%) (see Figure 5).²⁸ It also contains trace amounts of enzymes, bioactive peptides, cytokines, hormones and lipids, such as conjugated linoleic acid, contributing to its functional properties.²⁹

Figure 5. Composition of milk



Dairy proteins include caseins (80%) and whey (20%), both high-quality complete proteins providing all essential amino acids and easy to digest. Whey is especially rich in branched-chain amino acids (leucine, isoleucine, and valine) and lysine, while casein provides histidine, methionine and phenylalanine. The main type of fat in milk is saturated fat, with some monounsaturated fats and a small amount of polyunsaturated fats. The natural sugar in milk is lactose, a disaccharide which is broken down into glucose and galactose in the digestive system, with galactose converted into glucose in the liver before absorption. Milk also provides calcium, vitamin B12, vitamin B5, vitamin B2, phosphorus and potassium, along with smaller amounts of vitamin A, vitamin B3, folate, vitamin B6, vitamin D, magnesium, selenium and zinc. The nutrients in milk can be impacted by a number of factors, including the cow breed, feeding regimes and season.

The dairy matrix

There is a growing understanding that certain foods may offer distinct nutrition and health benefits. These effects are influenced not just by individual nutrients but by the combined action of nutrients and non-nutrient components, such as phytochemicals and microorganisms, within the food matrix.

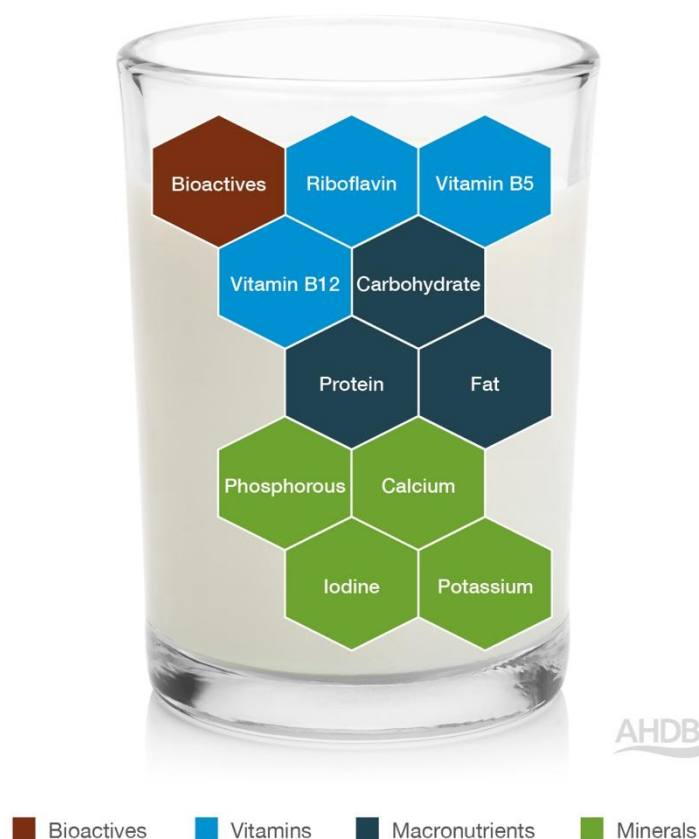
Milk and dairy foods have a unique food matrix that distinguishes them from other food groups. The dairy matrix describes the unique structure of a dairy food, its components (e.g. nutrients and non-nutrients), and how they interact. The 'dairy matrix health effects' refers to the impact of a dairy food on health that extends beyond its individual components (e.g. nutrients and non-nutrients).³²

The dairy matrix includes a diverse combination of nutrients, bioactive compounds and complex microstructures, like milk fat globule membranes.³⁰ These structural features can impact nutrient absorption, digestion and therefore how our body responds after eating, in terms of gastric emptying, appetite and food consumed.

Dairy is a diverse food group and different dairy products have distinct food matrices that may affect their functional and health properties. Fermented dairy, for example, contains increased concentrations of beneficial compounds such as organic acids, enzymes and bioactive peptides.³⁰

While the individual nutrients in dairy are important, it is also vital to consider the interactions and structures within dairy products, as well as the nutrients they provide (see Figure 6), as evidence demonstrates some health effects of the dairy matrix are greater than the sum of its individual parts.³¹

Figure 6. Illustrating how the structure and nutrient interactions within the matrix of dairy products contribute to health effects beyond individual nutrients.



Macronutrients in milk

The composition of milk continuously undergoes changes depending on factors such as breeding, feeding strategies, management of the cow, lactation stage and season.³³ Milk is rich in protein, with whole milk, semi-skimmed, 1% and skimmed milk providing similar amounts (3.4–3.5 g per 100 ml). Whole milk provides 63 kcal per 100 ml, with a total fat content of 3.6 g per 100 ml, falling above the 3 g threshold for a ‘low in fat’ claim. Semi-skimmed, 1% and skimmed milk are all low in fat and saturated fat. Milk is also naturally low in salt.

Table 3. Macronutrients and salt in milk (whole, semi-skimmed, 1% and skimmed) per 100 ml, along with the recommended intakes and the GB nutrition claims criteria

Nutrition per 100 ml	Whole milk	Semi-skimmed milk	1% milk	Skimmed milk	Recommendation ^a
Energy kcal <i>Low Energy ≤40 kcal/100^b</i>	63 No	46 No	41 No	34 Yes	2,000 kcal/day
Protein g (% protein) <i>Rich in protein (>20% of energy)^b</i>	3.4 (21.6%) Yes	3.5 (30.4%) Yes	3.5 (34.1%) Yes	3.5 (41.2%) Yes	45 g/day
Fat g <i>Low in fat ≤3 g/100 g^b</i>	3.6 No	1.7 Yes	1.0 Yes	0.3 Yes	70 g/day
Saturated fat g (% of total fat) <i>Low in saturated fat (≤ 1.5 g/100 g)^b</i>	2.29 (63.6%) No	1.07 (62.9%) Yes	0.60 (60.0%) Yes	0.13 (43.3%) Yes	20 g/day (<11 of EI)
Salt g <i>Low in salt (≤0.3 g/100 g)^b</i>	0.105 Yes	0.108 Yes	0.11 Yes	0.11 Yes	6 g/day

^aDietary Recommendations,³⁵ ^bNutrition & Health Claims³⁶

Note: EI = energy intake. All figures provided are pasteurised, averages. Sources: Food Composition³⁴
<https://quadram.ac.uk/UKfoodcomposition/> ([Whole milk](#), [Semi-skimmed milk](#), [1% milk](#), [Skimmed milk](#))

Table 4. Percentage contribution of ‘milk and milk products and alternatives’ to average daily energy, protein, fat and carbohydrate intake, by age

% contribution to average daily intake	1.5–3y	4–10y	11–18y	19–64y	65–74y	75+y
Energy	18	12	9	9	12	14
Protein	24	18	13	13	17	19
Total fat	26	17	12	12	15	18
Saturated fat	38	27	20	20	25	28
Monounsaturated fat	19	11	8	8	10	13
Omega-3 polyunsaturated fat	9	5	4	3	4	5
Omega-6 polyunsaturated fat	8	4	3	3	4	5
Trans fatty acids	41	33	25	27	32	34
Carbohydrate	11	9	6	6	8	10
Free sugars	17	13	10	8	9	12

Note: Milk and milk products and alternatives include whole milk (3.8% fat); semi-skimmed milk (1.8% fat); skimmed milk (0.5% fat); flavoured milk drinks; plant-based milk alternatives; cheese (including plant-based alternatives); yogurt, fromage frais and dairy desserts (including plant-based alternatives)

Source: OHID¹⁹

Protein

Proteins are made up of chains of amino acids with nine of the 20 different amino acids classified as essential or indispensable, meaning they must be obtained through the diet as the body cannot produce them. Branch-chain amino acids (BCAA) are particularly vital for inducing protein synthesis, essentially combining the components to form a protein (Table 5). Protein, crucial for muscle growth, relies on the three BCAAs. Leucine, which is high in dairy, is not only a building block for protein synthesis, it also initiates the process.^{37–38}

Table 5. Essential and non-essential amino acids

Essential amino acids	Non-essential amino acids
Isoleucine*	Alanine
Leucine*	Arginine
Lysine	Asparagine
Methionine	Aspartic Acid
Phenylalanine	Cysteine
Threonine	Glutamic Acid
Tryptophan	Glutamine
Valine*	Glycine
Histidine	Proline
	Serine
	Tyrosine

Key: * = branch-chained amino acids

Source: Lopez & Mohiuddin (2024)³⁹

Protein quality

Protein quality reflects how well a dietary protein supplies essential amino acids, considering both amino acid content and digestibility. The protein digestibility-corrected amino acid score (PDCAAS) is a well-established standard measure of protein quality, with most plant proteins scoring below 100%, indicating lower quality than animal proteins, except for a few, such as some soy isolates.

The newer digestible indispensable amino acid score (DIAAS) provides a more accurate measure of protein quality by assessing the bioavailability of essential amino acids and the amount of the first limiting amino acid absorbed.⁴⁰ A DIAAS of 100% indicates the protein fully meets the body's protein needs at the adult EAR of 0.66 g/kg body weight/day. A DIAAS below 100% indicates the limiting amino acid is insufficient, reducing the protein's overall effectiveness. Scores above 100% mean the first limiting amino acid exceeds requirements and can help complement limiting amino acids in other lower-quality proteins (Table 6).⁴¹

Plant and animal proteins differ in amino acid profiles and digestibility. Animal proteins, especially milk, closely match the human body's amino acid needs and have high biological value.^{28,42} Dairy proteins are rich in essential amino acids, particularly BCCA such as isoleucine, leucine, valine and lysine.²⁹ Leucine is especially important as it plays a key role in muscle growth, regeneration and maintenance, making milk and dairy valuable for supporting growth in children⁴³ and maintaining muscle mass and strength in older adults.⁴⁴

Table 6. Protein quality of common foods based on PDCAAS and DIAAS scores

Protein source	PDCAAS %	DIAAS %
Casein	100	137*
Whey	100	106*
Cow's milk	100	114
Egg	100	113
Red meat	92	126*
Soy protein isolate	100	98
Chickpeas	74	83
Cooked black beans	65	59
Green lentils	63	65
White rice	56	57
Wheat	51	45
Roasted peanuts	51	43

Key: PDCAAS = protein digestibility-corrected amino acid score; DIAAS = digestible indispensable amino acid score

Source: Berrazaga et al., (2019)⁴²; * = DIAAS values for casein, whey and pork from Herreman et al. (2020)⁴⁵

Protein requirements and intakes

Protein requirements vary by age, life stage and gender (see Table 7). Young children require more protein per kilogram of body weight to support their growth and development, while pregnant and breastfeeding women require extra protein to support both their own and their baby's nutritional needs. On average, men need more protein than women. The general guideline is 0.75 g of protein per kilogram of body weight. For example, a 60 kg person needs approximately 45 g of protein per day ($60 \text{ kg} \times 0.75 \text{ g} = 45 \text{ g/day}$). These recommendations are based on 1991 reference average body weights.^{35,36}

Table 7. UK dietary reference values (DRVs) for protein intake by age and gender

Age and gender	Weight (kg)	Adequate intake	
		Estimated average requirement (EAR) (g/day)	Reference nutrient intake (RNI) (g/day)
Infants:			
0–3 months	5.9	-	12.5
4–6 months	7.7	10.6	23.7
7–9 months	8.8	11.0	13.7
10–12 months	9.7	11.2	14.9
Children:			
1–3 years	12.5	11.7	14.5
4–6 years	17.8	14.8	19.7
7–10 years	28.3	22.8	28.3
Males:			
11–14 years	43.0	33.8	42.1
15–18 years	64.5	46.1	55.2
19–64 years	74.0	44.4	55.5
64–75+ years	71.0	42.6	53.3
Females:			
11–14 years	43.8	33.1	41.2
15–18 years	55.5	37.1	45.4
19–64 years	60.0	36.0	45.0
64–75+ years	62.0	37.2	46.5
Pregnancy			+6
Breastfeeding:			
0–6 months			+11
6+ months			+8

Key: RNI = reference nutrient requirements: the amount needed to meet the needs of most people, therefore intakes are unlikely to be deficient. Protein requirements (RNI) = 0.75 g of protein per kg of body weight, e.g. $60 \text{ kg} \times 0.75 \text{ g} = 45 \text{ g/day}$. Protein requirements during pregnancy and breastfeeding must be added to female adult requirements, i.e. the pregnancy calculation is $45.0 + 6 = 51 \text{ g/day}$. The EAR is estimated using $0.6 \text{ g/kg/body weight/day}$.

Source: Adapted from DH (1991)³⁵ and PHE (2016)⁴⁶

In developed countries such as the UK, protein intake typically exceeds the RNI across all age groups. For instance, children aged 1.5–3 years have an RNI of 14.5 g per day (Table 7) but consume an average of 47.3 g (Table 8). Adults have RNIs of 55 g (men) and 45 g (women) per day respectively, while average intakes are 80.6 g and 60.2 g respectively.

Table 8. Average daily protein intake (g/day), by age and gender

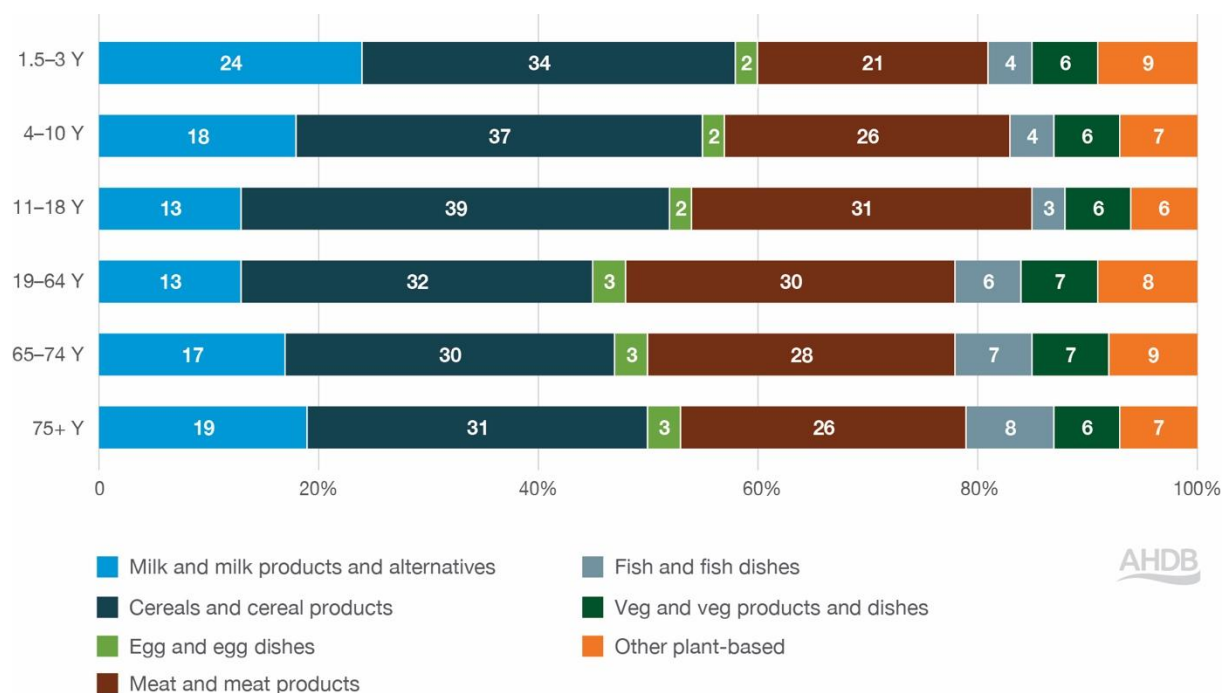
Average daily protein intake (g)	1.5–3y	4–10y	11–18y	19–64y	65–74y	75+y
All	47.3	57.1	66.5	70.2	66.7	63.3
Males	ND	59.6	74.3	80.6	72.1	68.1
Females	ND	54.5	58.3	60.2	61.7	59.6

Key: ND = no data available.

Source: OHID, 2025b¹⁸

In UK adults (19–64 years), the main protein sources are cereals (32%), meat (30%) and milk and dairy products (13%) (Figure 7). For children aged 1.5–3 years, milk and dairy products contribute 24% of total protein intake, with whole milk providing 10% and semi-skimmed milk 4%.¹⁸

Figure 7. Top dietary protein sources by age



Milk and milk products and alternatives include whole milk (3.8% fat); semi-skimmed milk (1.8% fat); skimmed milk (0.5% fat); flavoured milk drinks; plant-based milk alternatives; cheese (including plant-based alternatives); yogurt, fromage frais and dairy desserts (including plant-based alternatives).

Cereals and cereal products include pizza; pasta and pasta-based dishes; rice and rice-based dishes; other savoury cereal products and dishes; wheat bread (white, wholemeal and mixed grain); sandwiches; breakfast cereals; sweet biscuits; buns, cakes, pastries and fruit pies; puddings.

Eggs and egg dishes include all types of egg (duck, hen, goose and quail) boiled, fried, scrambled, poached and dried, including plain omelette; home-made, takeaway and restaurant dishes and manufactured ready meal, including egg dishes where primary component is egg, such as omelettes with additions, egg curry.

Meat and meat products include beef, lamb and pork products and dishes; bacon, ham and other processed red meat; poultry, poultry products and dishes; coated poultry; offal; burgers, kebabs, sausages and sausage products and dishes; meat pies and pastries.

Fish and fish dishes include white and oily fish; breaded and battered fish; fish products and dishes.

Veg and veg products and dishes include vegetables, vegetable products and dishes; pulses and legumes (and products and dishes); baked beans; potatoes (baked, roast or boiled); chips and fried potatoes; plant-based meat alternative.

Other plant-based foods providing protein include savoury snacks; nuts and seeds; fruits; sugar preserves and confectionery; fruit and vegetable juice, tea, coffee and water and miscellaneous (e.g. soup, savoury sauces, sports foods and drinks).

Source: calculated using NDNS data¹⁸

The protein transition: shifting from animal to plant proteins

The protein transition, shifting from animal-based to more plant-based protein sources, is gaining attention from governments, researchers and the media.

Public health dietary guidance is encouraging an increase in plant-rich foods for both health and environmental benefits (see page 102 for the environmental section). Countries including the UK are promoting plant-based eating, with some setting specific animal-to-plant protein ratios, such as a 40:60⁴⁷ or 30:70 split.¹⁴ Currently, high-income countries such as the UK average a 60:40 ratio.⁴⁸

While the goal of the protein transition is to improve health and sustainability, it often overlooks key nutritional factors, such as essential amino acid intake, micronutrient bioavailability and overall dietary adequacy. Significant reductions in animal-source foods may worsen existing protein and micronutrient deficiencies,⁴⁹ particularly among vulnerable groups such as young children, adolescents, pregnant and breastfeeding women and older adults.⁵⁰

Simply replacing dairy with plant proteins can lower both protein quality and intake of key micronutrients found in the dairy matrix.⁵¹ Animal proteins generally offer higher protein quality and essential amino acid density, while plant-based diets often require greater total protein and energy intake to compensate for lower protein quality and often need to be eaten in greater volume than animal-sourced foods to be comparable.⁵² Even in high-income countries with adequate protein intake, protein quality remains important.⁵³ In the UK, plant foods provide around 40–46% of total protein intake (Table 9), mainly from cereals and cereal products (30–39%), while pulses and legumes contribute just 1%.¹⁸

Low-quality proteins can be partially compensated for by eating more of them, but effective complementation requires different limiting essential amino acids. Adding high-quality protein is more effective than increasing complementary low-quality protein sources alone.⁵⁴

Table 9. Percentage protein contributions from milk, plant-based alternatives and other non-animal sources by age group

Age	Total milk ¹	Plant-based milk alternatives	Cheese, yogurt, fromage frais and dairy desserts ²	Milk and milk products ³	Other non-animal-protein-containing foods ⁴
1.5–3y	15	1	7	22	44
4–10y	11	0	5	16	46
11–18y	8	0	4	12	46
19–64y	8	0	5	13	41
65–74y	11	0	5	16	40
75+y	14	0	5	19	40

¹ Includes whole milk (3.8% fat), semi-skimmed milk (1.8% fat), skimmed milk, flavoured milk drinks

² Includes plant-based alternatives

³ Includes total milk and cheese, yogurt, fromage frais and dairy desserts figures

⁴ Estimated plant-based proteins included: cereals and cereal products; vegetables and potatoes; and other plant-based protein sources. Although some of these foods are not proteins per se, they were included because of their contribution to protein within the diet.

Source: NDNS OHID (2025b)¹⁸

Most plant-based milk alternatives, except soy milk, are lower in protein than cow's milk, and contribute little to overall protein intake. Australian data suggests replacing cow's milk with these low-protein milk alternatives has minimal impact for most people but may significantly reduce protein intakes in older adults, aged 71+ years.⁵⁵

From a musculoskeletal health perspective, dairy proteins rich in essential amino acids, such as leucine, support muscle growth and maintenance. A Canadian study of 5,034 healthy children found those consuming more plant-based milk alternatives were, on average, shorter than those drinking cow's milk, with a 1.5 cm height difference at three cups per day.⁵⁶

Focusing solely on protein content overlooks the broader nutritional value of protein-rich foods, which also provide essential vitamins, minerals and non-nutrient compounds, such as inhibitory phytates and lectins, and bioactive peptides that benefit muscle protein synthesis. The structure and interactions of these nutrients within the food matrix are also important considerations beyond protein quality.⁵¹ A key concern with more environmentally sustainable diets is the risk of inadequate micronutrient intake. A recent Australian study found that diets with 60–80% total protein from animal sources reduced this risk while remaining sustainable.⁵⁷ Similarly, a Canadian analysis of children aged 9–18 years old showed that a 3:1 ratio of animal to plant protein supported optimal macronutrient balance and adequate intake of most essential nutrients.⁵⁸ However, the authors emphasised the need for a balanced approach when increasing plant-based proteins, especially for children and other vulnerable groups.

Sustainable diets must balance health, environmental and social factors to avoid unintended consequences. In line with the United Nations Sustainable Development Goal 2, the FAO recommends dietary diversity across 10 key food groups, including dairy, to ensure adequate nutrient intake and to combat hunger.¹¹

Cow's milk protein allergy

Cow's milk protein allergy (CMPA) is an immune-mediated allergic reaction to milk proteins, mainly affecting infants and young children. Although true incidence is around 1% in under-2s, it may be over diagnosed, with perceived rates as high as 10%.^{59–60} Most children outgrow their milk allergy by age five.

Reintroduction of cow's milk protein at the right time and in the correct form is important. The milk ladder has been shown to be an effective tool for the management of some CMPA, with the goal to achieve tolerance.^{61–62} It works by exposing the body to a certain amount of milk protein that has been cooked (low down the ladder) and eventually uncooked or raw protein (at the top of the ladder).

As cow's milk is a key source of energy, protein, vitamins and minerals for growing children, suitable alternatives are essential. Nutritionally appropriate milk substitutes are available on prescription for young children and over the counter for older children.⁶³

Fat

Fat plays an important role in the diet, providing energy, essential fatty acids and helping the body absorb fat-soluble vitamins. A third of our daily energy should come from fat, mainly unsaturated, equating to approximately 70 g fat per day for women and 90 g for men.⁶⁴

Milk fats are mainly present in globules as an oil-in-water emulsion. The majority (98%) of milk fat is in the form of triglycerides (a molecule of glycerol bound to three fatty acids). These triglycerides are made from more than 400 different fatty acids, making milk fat the most complex of natural fats.³³ Only 15 of these fatty acids are at a level of more than 1%, with the rest present only in trace amounts. The other milk fats (about 2%) include diacylglycerols, cholesterol, phospholipids and free fatty acids.³³

The saturated fatty acids account for about 70% of total fatty acid content in milk, with the most abundant being palmitic acid (C16:0), stearic acid (C18:0) and myristic acid (C14:0) (Table 10). Some short-chain fatty acids, such as butyric acid (C4:0), or odd-chain fatty acids, such as pentadecanoic (C15:0) and heptadecanoic (C17:0), are present only in the fat of ruminants.²⁹

Monounsaturated fatty acids (mainly oleic acid (C18:1)), make up around 27% of milk fat and polyunsaturated fatty acids 4%, particularly linoleic acid (18:2) and α -linolenic acid (18:3), as well as EPA and DHA.²⁹ Milk also has small amounts of natural trans fatty acids, produced by bacteria in the cow's stomach. These include trans-vaccenic acid and conjugated linoleic acid (CLA).

Several factors impact the fatty acid composition of milk (e.g. breed, parity, stage of lactation, feeding and milk yield).⁶⁵

Table 10. The main fatty acids in milk

	Fatty acid	Common name	% of fatty acid in milk
Saturated fatty acids	4:0	Butyric acid	3.30
	6:0	Caproic acid	1.90
	8:0	Caprylic acid	1.20
	10:0	Capric acid	2.60
	12:0	Lauric acid	3.50
	14:0	Myristic acid	11.50
	16:0	Palmitic acid	25.80
	18:0	Stearic acid	11.00
Monounsaturated fatty acids	16:1	Palmitoleic acid	2.90
	18:1 (cis)	Oleic acid	28.00
Polyunsaturated	18:2 (cis)	Linoleic acid (omega-6)	2.40
	18:3 (cis)	Alpha-linolenic acid (omega-3)	0.50
Trans fatty acids	18:1 (trans)	Vaccenic	2.1
Conjugated linoleic acid (CLA)	18:2 (cis-9, trans-11)	Rumenic acid	0.4*

Source: Adapted from Sanjulian et al., (2025)²⁹; *figure from Lindmark Mansson (2008)³³

Saturated fats

Saturated fats should form no more than 10% of total daily energy intake (20 g for an adult woman and 30 g for a man)^{64,66} – intakes that the UK diet currently exceeds (Table 11).

Table 11. Dietary fat recommendations, including current UK intake levels

Type of fat	Recommendations ^a	Current intakes adults 19–64y ^b		
		All	Males	Females
Total fat	≤35% of energy intake	34.5%	34.3%	34.7%
Saturated fat	≤10% of energy intake	12.4%	12.3%	12.5%

^aDH (1991)³⁵ (Recommended figures based on % energy, excluding alcohol) and SACN (2019)⁶⁶; ^bOHID (2025b)¹⁸

Cereals make the largest contribution to saturated fat intakes for adults (28–31%) and children aged 4–18 years (36–37%), mainly due to the contribution from sandwiches (which also includes spreads and fillings), pizza, sweet biscuits and cakes. Milk and dairy contribute the most (38%) among children aged 1.5–3 years (Table 12).

Table 12. Percentage contribution of different food groups, including milk and milk products, to saturated fat intakes, by age

Food group	1.5–3y %	4–10y %	11–18y %	19–64y %	65–74y %	75+y %
Milk and milk products	38	27	20	20	25	28
- Milk	23	16	10	8	11	16
- Milk products	15	11	9	11	13	12
Cereals and cereal products (incl. processed)	30 (10)	36 (15)	37 (12)	31 (9)	28 (9)	29 (14)
Meat and meat products	12	15	19	18	17	15
Fat spreads	6	6	5	8	11	12
Sugar, preserves and confectionery	3	5	7	6	4	4
Vegetables and potatoes	4	4	4	5	5	4
Eggs and egg dishes	2	2	2	3	3	3
Fish and fish dishes	1	1	1	2	3	3
Savoury snacks	1	2	2	1	1	1
Nuts and seeds	1	1	1	2	1	1
Fruit	1	1	1	1	1	1
Miscellaneous	2	1	1	2	2	2
Average daily saturated fatty acids intake (g)	17.8	20.5	23.1	22.6	21.6	23.0

Milk includes whole milk (3.8% fat), semi-skimmed (1.8% fat), skimmed milk (0.5% fat), other milk and cream, flavoured milk drinks.

Milk products include whole-milk cheese (including plant-based alternatives); yogurt, fromage frais and dairy desserts (including plant-based alternatives), ice-cream.

Cereals and cereal products include pizza; pasta and pasta-based dishes; rice and rice-based dishes; other savoury cereal products and dishes; wheat bread (white, wholemeal and mixed grain); sandwiches; breakfast cereals; sweet biscuits; buns, cakes, pastries and fruit pies; puddings. Processed versions include sweet or savoury biscuits; cereal bars; buns, cakes, pastries, and fruit pies; and puddings.

Meat and meat products include beef, lamb and pork products and dishes; bacon, ham and other processed red meat; poultry, poultry products and dishes; coated poultry; offal; burgers, kebabs, sausages and sausage products and dishes; meat pies and pastries.

Fat spreads include butter, ghee, dairy spreads.

Sugar, preserves and confectionery include sugars, preserves and sweet spreads, sugar and chocolate confectionary.

Vegetables and potatoes include vegetables, vegetable products and dishes; potatoes (baked, roast or boiled), chips and fried potatoes.

Fish and fish dishes include oily fish, fish products and dishes.

Miscellaneous includes soup, savoury sauces, condiments and cooking ingredients.

Source: NDNS, OHID (2025b)¹⁸ Note: total figure discrepancies are due to decimal place rounding off.

Unsaturated fats

Replacing saturated fats with unsaturated fats helps improve blood lipid profiles, such as lower LDL cholesterol, and reduces the risk of cardiovascular disease. Monounsaturated fats benefit heart health by maintaining levels of 'good' HDL cholesterol while reducing levels of 'bad' LDL cholesterol. Polyunsaturates also help lower the level of 'bad' cholesterol in the blood and provide essential fatty acids (omega-3 and -6) that are vital for a healthy brain and nervous system.⁶⁴

Milk and dairy contain very low levels of polyunsaturated fats and contribute only 3% to adult intakes of both omega-3 and omega-6 polyunsaturated fatty acids.¹⁸ Monounsaturated fats are found in greater levels, and so 8–13% of adult intakes are from milk and dairy¹⁸ (See Table 4).

Trans fatty acids

Trans fatty acids can be industrially produced. These used to be found in processed and hardened vegetable oils, but they have been reduced to very low levels in the UK since the 1980s due to changes in food manufacturing.⁶⁷

The majority of trans fat in the UK diet comes from natural sources in meat and milk, although levels are very low. In UK adults, average intakes of trans fatty acids are 0.9 g a day.¹⁸ Trans fatty acids contribute to 0.5% of total energy intakes, which is well below the maximum 2% level recommended.⁶⁸ Natural trans fatty acids are considered less of a concern at the levels typically found in the diet.⁶⁹

Evidence suggests natural trans fatty acids from milk and dairy, in particular CLA and trans vaccenic acid, may be linked to several health benefits, such as improved blood lipid profiles and decreased cholesterol absorption.⁷⁰

Milk sugars (lactose)

Lactose is the natural sugar found in milk and dairy. It is present within the structure of milk, and when consumed, it is digested by the enzyme lactase, which breaks it down into glucose and galactose, which are absorbed within the small intestine.

As it is naturally present in milk, lactose is excluded from the definition of free sugars. However, some milk and dairy products (e.g. flavoured milk drinks, yogurts and ice cream) contain added sugars and therefore contribute to intakes of free sugars. The largest contributor to free sugars is cereals (29–40% depending on age group), with flavoured milk and dairy products contributing between 8% and 17% of free sugars intakes (Table 13).

Having a diet high in free sugars can be harmful to health as it is associated with dental decay and may lead to excess consumption of energy, which over time can cause obesity. UK recommendations state that free sugars should account for no more than 5% of daily energy intakes. For adults, this is a maximum of 30 g, for children aged 7–10, it is 24 g a day and for 4–6-year-olds, it is 19 g a day.⁷¹ Overall, less than one in 10 children (9%) and less than one in five adults (19%) meet this recommendation. Average intakes were 10.5% of energy for children and 10% for adults, with girls aged 11–18 years having the highest intake (12% of energy).¹⁸

Table 13. Percentage contribution of different food groups, including milk and milk products, to free sugars intakes, by age

Food group	1.5-3y %	4-10y %	11-18y %	19-64y %	65-74y %	75+y %
Milk and milk products	17	13	10	8	9	12
- Milk	0	0	0	0	0	0
- Flavoured milk drinks	3	3	4	2	1	5
- Plant-based milk alternatives	2	0	1	1	0	1
- Yogurt, fromage frais and dairy desserts	9	5	2	2	3	3
- Ice cream	4	4	2	2	3	3
Cereals and cereal products	36	36	33	29	38	40
Sugar, preserves and confectionery	14	18	22	26	26	24
Non-alcoholic beverages	19	22	27	19	10	12
Average daily free sugars intake (g)	26.6	40.2	51.0	46.3	34.9	37.9

Milk includes whole milk (3.8% fat), semi-skimmed (1.8% fat), skimmed milk (0.5% fat), other milk and cream.

Flavoured milk drinks includes ready-to-drink and made-up flavoured milk drinks (e.g. milkshakes, hot chocolate, malted drinks, flavoured breakfast milk drinks, such as Weetabix on-the-go drink), excluding powders and dry mixes; coffee beverages made with all dairy milk (with and without added sugar) bought at a cafe or shop (not sachets or capsules made up at home).

Plant-based milk alternatives include soya, rice, oat, almond, coconut, pea and hemp drinks and coffee beverages made with all plant-based drinks (with and without added sugar) bought at a cafe or shop (not sachets or capsules made up at home).

Yogurt, fromage frais and dairy desserts and ice cream includes plant-based alternatives.

Cereals and cereal products include pizza; pasta and pasta-based dishes; rice and rice-based dishes; other savoury cereal products and dishes; wheat bread (white, wholemeal and mixed grain); sandwiches; breakfast cereals; sweet biscuits; buns, cakes, pastries and fruit pies; puddings.

Sugar, preserves and confectionary includes sugars, preserves and sweet spreads, sugar and chocolate confectionary.

Non-alcoholic beverages are reported as consumed with diluent water.

Source: NDNS OHID, (2025b)¹⁸

All sugars in drinks (other than dairy milk), including plant-based drinks, are classified as free sugars.⁷² These sugars may be added as an ingredient or are present due to the manufacturing process.¹⁷ For example, in oat drinks, free sugars can be released through the enzymatic breakdown of starch within the oats during processing. As a result, plant-based drinks labelled 'unsweetened' or containing 'no added sugars' may still contain free sugars as a result of processing.

Dental health

Irrespective of the free sugars content, plant-based drinks may not have the same protective effects against dental caries offered by casein, calcium and phosphate that are present in cow's milk.⁷³

Among common carbohydrate sources, lactose is the least likely to cause tooth decay.⁷⁴ It stimulates saliva production, which helps neutralise acidity in the mouth, and is poorly fermented by the oral microbiota, making it less harmful to teeth than other carbohydrates.^{73–74} A recent review found milk and dairy products are generally non-cariogenic (non cavity-causing) in children and adolescents, with probiotic-supplemented products offering additional dental benefits.⁷³

Glycaemic response

Like all digestible carbohydrates, the consumption of lactose results in a glycaemic response. The glycaemic index (GI) indicates how quickly a food raises blood glucose levels. Lactose is classified as a low-GI carbohydrate with a GI of 46, notably lower than other disaccharides, such as sucrose (GI of 65) and maltose (GI of 105). Interestingly, the GI of milk is even lower, in the range of 25–48.⁷⁴

The dairy matrix plays an important role in slowing gastric emptying and therefore the absorption of lactose. For example, casein protein and fat are known to empty notably slower due to gastric coagulation,⁷⁵ and whey proteins have a strong effect on glycaemic control by stimulating glucagon-like peptide (GLP-1) secretion, which slows gastric emptying.⁷⁴ Also, when consuming milk, it temporarily reduces the acidity (raises the pH) in the stomach, triggering increased gastric fluid to restore acidity. This dilutes the lactose concentration in the stomach, slowing stomach emptying and the absorption of lactose sugars.⁷⁴

Research has shown that choosing low-GI foods (55 or below) can help control blood glucose levels in people with type 2 diabetes and may help control appetite and therefore weight management⁷⁶ (See Type 2 diabetes section).

Lactose intolerance

Lactose malabsorption refers to the reduced ability to digest lactose due to diminished lactase enzyme activity, although it doesn't always result in symptoms (lactose intolerance). Lactose intolerance is when the inability to digest lactose results in noticeable gastrointestinal symptoms, such as abdominal pain, bloating or diarrhoea.

The most common cause of lactose malabsorption in adolescents and adults is a progressive decrease in lactase activity or 'lactase non-persistence'. The activity of lactase in the digestive system is at a maximum in babies at birth as breast milk has high concentrations of lactose. Lactase activity reduces in most populations during childhood, although some populations have a greater decline (e.g. people of Asian, African, South American, Southern European and Australian Aboriginal descent) than others (e.g. people in Northern Europe).⁷⁷ An estimated 8% of the UK population have lactose intolerance.⁷⁸

Cow's milk contains approximately 5 g lactose per 100 ml and most people with lactose maldigestion tolerate up to 12 g of lactose in a single dose (e.g. one large glass of milk) with no, or only minor, symptoms. Lactose digestion has been shown to improve by combining small amounts with other foods throughout the day.⁷⁹

Bacteria in the colon can adapt their activity to improve lactose tolerance.²⁸ Evidence suggests lactose consumption may impact the composition of the gut microbiome, stimulating growth of beneficial bacteria and increasing the production of their metabolites.^{79–82} In addition, recent lab-based research suggests that lactose consumption in healthy adults can benefit the gut microbiome.⁸³ (See Gut health and dairy section).

Key micronutrients

Dairy products such as milk, yogurt and cheese provide a wide range of nutrients. Milk is high in calcium, iodine and vitamin B12 and a source of vitamins B2, B5, phosphorus and potassium. Yogurt is high in calcium, iodine and phosphorus and a source of potassium and vitamin B2. While Greek yogurt is high in iodine and a source of calcium, vitamin A and phosphorus. A portion of cheese is also a source of calcium, iodine, vitamins B2, B5, B12, folate, phosphorus and selenium, depending on the type of cheese (see Table 14).

Table 14. Vitamins and minerals that milk, yogurt and cheese are a 'source of' or 'high in'

	RI	'Source of' and 'high in' eligibility claims	Whole milk	Semi-skimmed milk	Skimmed milk	'Source of' and 'high in' eligibility claims	Plain yogurt	Plain Greek yogurt	Hard cheese	Cottage cheese
			per 100 ml				Per 150 ml portion		Per 30 g portion	Per 100 g portion
Vitamin A^a (ug)	800	≥56 ≥120	38	20	1	≥120 ≥240	48	172.5 ✓	109.8	67
Vitamin B2 (mg)	1.4	≥0.09 ≥0.21	0.19 ^b ✓	0.18 ^b ✓	0.15 ^b ✓	≥0.21 ≥0.42	0.41 ✓	0.195	0.129	0.24 ✓
Vitamin B5 (mg)	6	≥0.42 ≥0.9	0.58 ✓	0.68 ✓	0.50 ✓	≥0.9 ≥1.8	0.75	0.84	0.12 ✓	0.3
Folate (μg)	200	≥14 ≥30	8	9	9	≥30 ≥60	27	27	9 ✓	22
Vitamin B12 (μg)	2.5	≥0.175 ≥0.375	0.4 ^b ✓✓	0.4 ^b ✓✓	0.3 ^b ✓	≥0.375 ≥0.75	0.3	0.3	0.48 ✓	0.6 ✓
Calcium (mg)	800	≥56 ≥120	120 ✓✓	120 ✓✓	125 ✓✓	≥120 ≥240	300 ✓✓	189 ✓	212.1 ✓	127 ✓
Iodine (μg)	150	≥10.5 ≥22.5	23 ^b ✓✓	26 ^b ✓✓	31 ^b ✓✓	≥22.5 ≥45	94.5 ✓✓	58.5 ✓✓	12.3 ✓	24 ✓
Phosphorus (mg)	700	≥49 ≥105	96 ✓	94 ✓	96 ✓	≥105 ≥210	255 ✓✓	207 ✓	146.1 ✓	171 ✓
Potassium (mg)	2000	≥140 ≥300	157 ✓	156 ✓	162 ✓	≥300 ≥600	420 ✓	276	23.1	161
Selenium (μg)	55	≥3.85 ≥8.25	1	1	1	≥8.25 ≥16.5	2	3	10 ✓	4

Key: Figures are from UK food composition tables in McCance and Widdowson's The Composition of Foods.

^aRetinol equivalents

^bFigures from nutrient analysis survey of cow's milk in the UK, OHID, (2025c)⁸⁴,

To claim that a food is a 'source of' a particular vitamin or mineral, it needs to contain more than 15% of the reference intake, and more than 30% for a 'high in' claim. For beverages, 7.5% of the reference intake of a particular nutrient is considered a 'source of' ([Dept Health & Social Care, 2021⁸⁵](#); [DH, 2017⁸⁶](#))

✓ 'Source of' ✓✓ 'High in' according to [EU Nutrition Claims](#).

RI = EU reference intake, from [Regulation \(EU\) No 1169/2011](#).

Source: <https://quadram.ac.uk/UKfoodcomposition/> ([Whole milk](#), [Semi-skimmed milk](#), [Skimmed milk](#), [Plain, whole milk yogurt](#), [Plain, Greek style yogurt](#), [Hard cheese \(Cheddar, Red Leicester, Double Gloucester\) average](#), [Spreadable, full-fat, soft cheese](#), [Plain cottage cheese](#); portion sizes from [BNF, 2021⁸⁷](#))

Low micronutrient intakes are common in the UK population, particularly in young people (11–18) and adults. Deficiencies (intakes below the LRNI) for calcium, iodine, vitamin B2, vitamin A, potassium, selenium and zinc occur frequently (see Table 15). Milk and dairy products are key providers of many of these micronutrients, especially vitamin B2 and B12 and iodine intakes across all age groups and making the largest contribution to calcium intakes among children and older adults (see Table 16).

Notably, 17% of adolescent children (11–18) fall below the LRNI for calcium and 21% fall below the LRNI for iodine, highlighting a critical need to address this age group. Additionally, vitamin B2 deficiency is also prominent among adolescents and adults, with 23% of those aged 11–18 and 15% of those aged 19–64 also falling below the LRNI. This section will examine the key micronutrients found in milk and dairy, particularly calcium, iodine and vitamins B2 and B12.

Table 15. Percentage of different age groups in the UK with intakes of key micronutrients below the lower reference nutrient intake (LRNI)

Percentage below the LRNI	1.5–3y	4–10y	11–18y	19–64y	65–74y	75+y
Calcium	0	2	17	9	7	6
Iodine	2	6	21	13	4	5
Vitamin B12	0	0	2	3	0	2
Vitamin B2	0	1	23	15	8	8
Folate	0	1	8	8	3	4
Vitamin D	17	19	18	22	25	23
Vitamin A	4	8	16	10	4	6
Potassium	0	1	32	28	14	23
Selenium	0	1	36	45	45	52
Zinc	3	7	18	10	6	10
Iron	6	2	29	19	4	7

Key: LRNI = lower reference nutrient intake is the amount of a nutrient that is enough for only a small number of people in a group who have low requirements (2.5%) i.e. the majority need more.

Source: NDNS OHID, 2025b¹⁸

Table 16. Percentage contribution of milk and dairy products and alternatives to key micronutrient intakes, by age

	1.5–3y	4–10y	11–18y	19–64y	65–74y	75+y
Calcium	50	41	33	34	42	45
Iodine	54	48	38	34	42	44
Vitamin B12	43	35	26	27	30	32
Vitamin B2	42	35	26	27	32	34
Folate	16	11	9	9	11	12
Vitamin A	28	22	18	16	18	18
Retinol	48	39	32	30	32	32
Potassium	23	18	14	12	15	17
Selenium	16	11	8	7	10	11
Zinc	27	20	14	15	18	21

Milk and milk products and alternatives include whole milk (3.8% fat); semi-skimmed milk (1.8% fat); skimmed milk (0.5% fat); flavoured milk drinks; plant-based milk alternatives; cheese (including plant-based alternatives); yogurt, fromage frais and dairy desserts (including plant-based alternatives).

Source: NDNS, OHID 2025b¹⁸

Calcium

Calcium is essential for maintaining healthy, strong bones and teeth, with 99% stored in the skeleton. Calcium also supports muscle and nerve function, blood clotting, energy metabolism, digestive enzymes, as well as having a role in cell division and specialisation. Adequate intake is particularly important during adolescence when bone growth is rapid – 40% of bone mass is built during this time and 90% of bone mass is reached by age 18. Reflecting this, daily calcium requirements are higher for adolescents (1,000 mg for boys, 800 mg for girls) than for adults aged 19 and over (see Table 17).⁸⁸

Calcium is particularly important for postmenopausal women as it helps reduce bone mineral loss, which accelerates substantially during late perimenopause and the early postmenopausal years. Women typically lose 7–10% of bone mass during this period.⁸⁹ The British Menopause Society recommends a daily intake of 1,000 mg calcium for postmenopausal women (see Table 17).

Average daily calcium intakes among 11–18-year-olds are currently below recommended levels at 842 mg for boys and 677 mg for girls, with 15% of boys and 18% of girls falling below the LRNI.¹⁸ Women aged 65–74 average 779 mg a day – also below the 1,000 mg recommended for postmenopausal women.⁹⁰ Vitamin D is essential for calcium absorption and bone development, especially in childhood and young adulthood. Currently, 10% of children (4–10) and 23% of adolescents (11–18) are deficient in vitamin D (levels <25 nmol/L 25(OH)D). Dietary sources of vitamin D are limited, and unlike the USA and some European countries, dairy in the UK is generally not fortified with vitamin D. However, an appropriately designed and well-implemented vitamin D food fortification policy could help improve vitamin D status in the UK population.⁹¹

Milk and dairy product intake provides around one-third of daily calcium for adolescents and adults and half for young children (1.5–3 years). Milk alone contributes between 22% to 32% of calcium intake depending on age (see Table 18). While calcium intake is similar between omnivores and vegetarians, vegans consume substantially lower calcium. In the EPIC-Oxford study, vegans averaged

582 mg/day in women and 610 mg/day in men – below the 700 mg/day recommend for adults. After 14 years follow-up, intake rose to 848 mg/day, possibly due to increased awareness and greater availability of more calcium-fortified plant-based dairy alternatives.⁹²

A carefully planned vegan diet with calcium-fortified products and plant sources can meet calcium requirements^{93–94}. However, research studies show many vegans still have low or inadequate intakes of calcium and other micronutrients.^{5, 95} With the shift towards plant-based diets and increasing consumption of plant-based dairy alternatives, it is vital to ensure nutritional adequacy (see section: Considerations when shifting to more plant-based dairy alternatives).

Table 17. Reference nutrient intakes for calcium

Age	Calcium mg/day
0–12 months	525
1–3 years	350
4–6 years	450
7–10 years	550
11–18 years	
Boys	1000
Girls	800
Adults 19+ years	700
Those who are breastfeeding	1250
Postmenopause ^a	1000
If taking an osteoporosis medication ^b	1000

Source: DH, 1991³⁵; ^aBritish Menopause Society (Stevenson, 2022)⁹⁰; ^bRoyal Osteoporosis Society⁹⁶

Table 18. The percentage contribution to calcium intake of milk and dairy products, by age

Percentage contribution to daily calcium intake	1.5–3y	4–10y	11–18y	19–64y	65–74y	75+y
Milk and milk products and alternative	50	41	33	34	42	45
of which:						
Whole milk (3.8% fat)	20	10	6	3	3	4
Semi-skimmed milk (1.8% fat)	9	14	11	10	17	17
1% fat milk	0	0	0	1	1	0
Skimmed milk (0.5% fat)	1	1	1	2	5	4
Flavoured milk drinks	2	3	5	6	4	6
Cheese ¹	8	6	6	6	7	6
Yogurt, fromage frais and dairy desserts ¹	7	5	3	4	4	4

¹Includes plant-based alternatives

Source: OHID, 2025b¹⁸

Iodine

Iodine is essential for production of thyroid hormones that support growth, metabolism and neurodevelopment. Long-term iodine deficiency can cause goitre (an enlarged neck) and other disorders, including intellectual disability and hyperthyroidism. While severe deficiency is rare in high-income countries such as the UK, mild-to-moderate iodine deficiencies, particularly during pregnancy, may impair cognitive development.

Recommended iodine intakes

In the UK, the adult LRNI for iodine is 70 µg/day (the minimum intake required to prevent goitre), while the RNI is set at 140 µg/day, to allow for a safety margin.³⁵ Unlike most nutrients, the RNI for iodine doesn't follow the usual definition of meeting the needs of 97.5% of the population, so the iodine recommendation in the UK is not a true RNI by the usual definition.⁹⁷

Globally, iodine recommendations, especially for pregnancy and lactation, are higher. For example, the World Health Organization and the Institute of Medicine (IOM) suggest nearly double the UK intake (see Table 19). UK guidelines assume sufficient thyroid iodine stores during pregnancy and lactation; however, many women of childbearing age may lack adequate stores due to long-term low intake.⁹⁷

Table 19. Iodine requirements set by the UK and international bodies

Life stage	Daily iodine requirements µg/day		
	UK ^a RNI	USA ^b RDA	Worldwide ^c RNI
15–18 years	140	150	150
19–50 years	140	150	150
Pregnancy	-	220	250
Lactation	-	290	250

Key: RNI = reference nutrient intake; RDA = recommended dietary allowance.

Source: ^aDepartment of Health³⁵; ^bInstitute of Medicine⁹⁸; ^cWorld Health Organization⁹⁹

Iodine intakes and status in the UK

Iodine intake is significantly lower in females, with 29% of girls (11–18) and 18% of women (19–64) falling below the LRNI (see Table 20).

Table 20. Mean iodine intakes and percentages below the LRNI, by age and gender

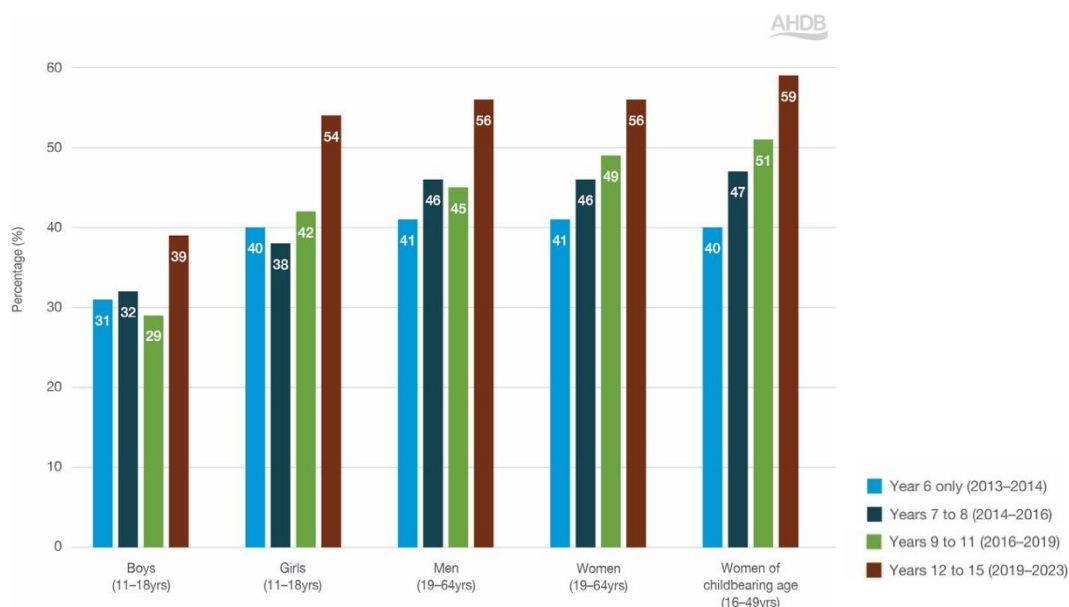
	11–18 years			19–64 years		
	All	Boys	Girls	All	Male	Female
Mean iodine intake	115	130	100	143	163	124
% below LRNI	21	14	29	13	9	18

Source: OHID, 2025b¹⁸

Urinary iodine concentration is a key indicator of population iodine status. Between 2013 and 2023, urinary iodine concentrations declined significantly in the UK, by 3.4% on average per year in girls (11–18) and 2.9% per year for both men and women (19–64), representing total drops of 29% and 25% respectively.¹⁸ Since 2013, iodine insufficiency has risen, with over half of girls 11–18y (54%), adults (56%) and women of childbearing age (59%) falling below the WHO sufficiency threshold (≥ 100 $\mu\text{g/L}$) (see Figure 8).¹⁸

The latest NDNS data confirms increased iodine deficiency across all age groups,¹⁸ with adolescent girls (11–18) and adults (19–64) showing mild deficiency (see Figure 8).^{18,100}

Figure 8. Percentage of adolescents and adults with insufficient iodine status (2013–2023)



Note: The figures show the percentage with median urinary iodine concentrations below 100 $\mu\text{g/L}$, which indicates inadequate iodine status. Years 9 to 11 is based on three survey years, whereas Years 7 to 8 is based on two survey years and Year 6 is based on a single survey year. Years 12 to 15 is based on four survey years. No spot urine samples were collected between April 2020 and November 2021 due to COVID restrictions.

Source: NDNS, OHID 2025b¹⁸

Dietary sources of iodine

Milk and dairy products are the main iodine sources in the UK, providing 54% of intake in children (1.5–3 years) and 38% in adolescents (11–18) (see Table 21). Though naturally low in iodine, milk becomes iodine rich due to fortified cattle feed and iodine-based disinfectants used during milking. Iodine levels are higher in winter milk, due to less pasture grazing.^{101,102} These practices, along with increased milk consumption, tripled UK iodine intake between 1950 and the 1980s, helping to eliminate iodine deficiency and goitre, which had been common in the UK in the 1800s and early 1900s.¹⁰⁰ Fish is also iodine-rich but contributes only 6–10% of intake due to low consumption, especially in young women.^{18,103}

Table 21. Percentage contribution of milk, cheese and yogurt to iodine intake, by age

	1.5–3y	4–10y	11–18y	19–64y	65–74y	75+y
Milk and milk products and alternatives	54	48	38	34	42	44
Whole milk (3.8% fat)	23	12	7	4	3	5
Semi-skimmed milk (1.8% fat)	12	19	15	12	19	18
1% fat milk	0	0	1	1	1	0
Skimmed milk (0.5% fat)	1	1	1	3	6	5
Flavoured milk drinks	3	4	6	7	4	7
Cheese ¹	3	2	2	2	2	2
Yogurt, fromage frais and dairy desserts ¹	10	7	4	5	6	5
Cereals and cereal products	17	19	24	16	13	14
Fish and fish dishes	10	10	6	8	8	10

Key: ¹Includes plant-based alternatives

Source: OHID 2025b¹⁸

Groups at risk of iodine deficiency

Pregnancy

Iodine is essential during pregnancy and early life, as thyroid hormones, dependent on iodine, are critical for brain development. Deficiency during pregnancy can impact the developing child's cognitive outcomes. The Avon Longitudinal Study of Parents and Children¹⁰⁴ found that children of mothers with mild-to-moderate iodine deficiency in the first trimester had lower verbal IQ and reading scores at ages eight and nine. Observational studies have linked such deficiency to increased neurological and psychological problems, including hyperactivity, and reduced language and spelling, and language skills.^{105,106} Raising awareness among women of reproductive age and health professionals is key to reducing these risks.¹⁰⁶

Adolescents and women of childbearing age

Adequate iodine intake in adolescent girls and women of childbearing age is crucial to build sufficient thyroid hormone stores for pregnancy requirements.¹⁰⁷ These population groups are at higher risk of

iodine deficiency due to lower milk and dairy consumption. A recent Irish study found 32% of girls aged 11–18 and 25% of those aged 5–10 had intakes below the LRNI.¹⁰⁸ UK dietary data also shows iodine intakes among girls and women of childbearing age are worryingly low.¹⁸ These groups are most likely to avoid food rich in iodine (dairy and fish) and to adopt a plant-based diet,¹⁰⁹ with women aged 25–40 being the main consumers of plant-based milks.^{103, 110, 111}

Vegan and predominantly plant-based diets

The Scientific Advisory Committee on Nutrition in 2014 highlighted the higher risk of iodine deficiency in vegans and vegetarians.¹¹² A recent meta-analysis confirmed low iodine intake and status in vegans,¹¹³ with UK vegans having the lowest reported intakes of 17.3 µg/d¹¹⁴ and 24.4 µg/day¹¹⁵.

The risk of iodine deficiency is greater in countries such as the UK without universal salt iodisation, unlike nations such as the Netherlands and New Zealand, where iodised salt in bread reduces reliance on animal products.⁹⁷ Vegetarian and vegan diets often provide less iron and selenium compared with omnivorous diets. Iron and selenium are key nutrients for thyroid function alongside iodine. Deficiency, in all three – more common with plant-based diets – may increase the risk of thyroid dysfunction more than any single deficiency alone.⁹⁷

Switching from dairy to plant-based alternatives

Iodine concentration in cow's milk varies seasonally from 22 µg/100 ml (whole milk) in summer to 34 µg/100 ml winter (skimmed milk).⁸⁴ In contrast, unfortified plant-based milks contain only 2% of the level in cow's milk. A 2020 UK survey found just 28% of non-organic milk alternatives were iodine-fortified, typically at 22.5 µg/100 ml – the minimum required to be labelled a source of iodine.¹¹⁶

A modelling study showed that replacing cow's milk with current plant-based alternatives would reduce iodine intake across all age groups. Fortification at ≥22.5 and <45 µg iodine/100 ml may help offset this drop in iodine intake.¹¹¹ However, the impact of plant-based milk alternatives depends on the overall diet and whether cow's milk is fully or partially replaced.¹¹⁷ The lack of iodine fortification and the low iodine content of unfortified plant-based dairy alternatives mean consumers are at risk of low iodine intake if they switch from cow's milk products.¹⁰⁰

Vitamin B2

Vitamin B2 (riboflavin) helps release energy from food, reduce tiredness and support normal skin, vision and nervous system and red blood cell maintenance. It also aids iron metabolism and interacts with other B vitamins (B3, B6, B12, and folate). Since the body cannot store vitamin B2, a small daily intake (1.3 mg for men and 1.1 mg for women) is essential (see Table 22). Deficiency can impair the function of other micronutrients and may lead to anaemia and hypertension.¹¹⁸

Table 22. Reference nutrient intakes for vitamin B2

Age	Vitamin B2 mg/day
0–12 months	0.4
1–3 years	0.6
4–6 years	0.8
7–10 years	1.0
Males:	
11–14 years	1.2
15+ years	1.3
Females:	
11+ years	1.1
Pregnancy	+0.3
Lactation	+0.5

Source: DH, 1991³⁵

Vitamin B2 deficiency may be underestimated in the UK due to the assumption of adequate intake.¹¹⁹ However, recent evidence from high-income countries shows low vitamin B2 status and deficiency is more common than previously thought, particularly among adolescent girls and young women.¹¹⁸ Those avoiding dairy, which is the main source of B2, such as individuals with lactose intolerance are at higher risk.^{118,120} In the UK, 32% of girls aged 11–18 and 19% of women aged 19–64 fall below the LRNI of 0.8 mg/day,⁸⁴ with signs of deficiency appearing after intakes below 0.5–0.6 mg/day.

The UK and Ireland uniquely assess vitamin B2 status¹¹⁸ through blood analysis in national surveys, revealing high vitamin B2 deficiency rates, affecting 47% of adults over 65 and up to 76% of 11–18-year-olds (see **Table 23**).¹⁸ Similar trends are seen in Ireland (61% of adults), though clinical biomarker thresholds may need review.^{121,122}

Table 23. Percentage of different age groups that exhibit low or deficient vitamin B2 status

Vitamin B2	4–10y %	11–18y %	19–64y %	65+y %
Percent with low/deficient status ¹	65	76	59	47

¹Erythrocyte glutathione reductase activation coefficient (EGRac) greater than 1.3.

Source: NDNS, OHID, 2025b¹⁸

Milk and dairy products are the main sources of vitamin B2 across most age groups, with milk and fortified breakfast cereals providing around half of children's intake (see Table 24). Although plant-based milk alternatives may seem to be nutritionally comparable to milk, a 2020 UK survey found only 29% were fortified with vitamin B2. Even when fortified, plant-based alternatives may not provide sufficient micronutrients if consumed in low quantities.¹¹⁹

Table 24. Percentage contribution of the main dietary sources to vitamin B2 (riboflavin) intake, by age

	1.5–3y	4–10y	11–18y	19–64y	65–74y	75+y
Milk and milk products and alternatives	42	35	26	27	32	34
Whole milk (3.8% fat)	19	9	5	3	3	4
Semi-skimmed milk (1.8% fat)	8	12	9	8	13	14
1% fat milk	0	0	0	0	1	0
Skimmed milk (0.5% fat)	1	1	1	1	3	3
Other milk and cream	0	0	0	0	1	1
Flavoured milk drinks	2	2	4	5	3	5
Plant-based milk alternatives	2	1	1	2	1	1
Cheese ^a	3	2	3	3	3	2
Yogurt, fromage frais and dairy desserts ^a	6	5	2	3	4	4
Cereals and cereal products	31	35	35	26	25	26
Breakfast cereals	18	18	13	10	13	14
Meat and meat products	8	11	16	14	13	12

Key: ^aIncludes plant-based alternatives

Source: NDNS, OHID, 2025b¹⁸

Vitamin B12

Vitamin B12 supports red blood cell production, nervous system function and helps reduces tiredness. Vitamin B12 deficiency develops gradually and may cause symptoms like fatigue, shortness of breath, headaches, indigestion, loss of appetite, palpitations, problems with vision, diarrhoea, a sore red tongue, memory problems and cognitive changes. If left untreated, deficiency can cause neurological symptoms, such as numbness, muscle weakness, balance and coordination issues, as well as psychological problems.¹²³

Vitamin B12 is only found naturally in animal foods (e.g. meat, fish, eggs and dairy). Vegans must rely on fortified foods and supplements. Most UK plant-based milk alternatives are now fortified, though typically at lower levels than cow's milk. One survey found fortified plant milk alternatives had the equivalent of 48% of the vitamin B12 found in cow's milk.¹¹⁶ Interestingly, fortification rates are improving as they have risen from 50% of plant milk alternatives in 2020¹²⁴ to 79% in 2024–25.¹²⁵

Overall, UK vitamin B12 intakes are generally adequate, averaging 3.1–4.3 µg/day across all age groups – well above the RNI (see Table 25).¹⁸ Vitamin B12 deficiency is rare (serum B12 <150 pmol/L) affecting no more than 4% of boys aged 4–10 and women aged 19–64 years, with few (≤4%) falling below the LRNI.¹⁸

Cow's milk makes a large contribution to vitamin B12 intakes (see Table 26) but replacing it with fortified plant milk drinks has little impact on overall intake. Even unfortified alternatives pose low risk for the general population, though vegans are more vulnerable to vitamin B12 deficiency.⁹

In 2018, the UK Food Standards Agency's Food and You survey identified 1% of UK adults as vegan.¹²⁶ Vegans were found to have lower vitamin B12 status compared with vegetarians and omnivores,¹²⁷ but this can be mitigated through supplements or regular consumption of fortified foods.

Current guidance recommends vegans eat vitamin B12-fortified foods at least twice a day or take a supplement.^{93,128}

Table 25. Reference nutrient intakes for vitamin B12

Age	Vitamin B12 µg/day
0–6 months	0.3
7–12 months	0.4
1–3 years	0.5
4–6 years	0.8
7–10 years	1.0
11–14 years	1.2
15+ years	1.5
Pregnancy	No increase
Lactation	+0.5

Key: RNI = reference nutrient intake

Source: Department of Health³⁵

Table 26. Percentage contribution of milk, cheese and yogurt to vitamin B12 intake, by age

	1.5–3y	4–10y	11–18y	19–64y	65–74y	75+y
Milk and milk products and alternatives	43	35	26	27	30	32
Whole milk (3.8% fat)	18	9	5	3	2	4
Semi-skimmed milk (1.8% fat)	8	12	9	8	12	12
1% fat milk	0	0	0	1	0	0
Skimmed milk (0.5% fat)	1	1	1	1	3	2
Flavoured milk drink	2	2	3	5	3	5
Plant-based milk alternatives	2	1	1	2	1	1
Cheese ^a	7	5	5	5	5	4
Yogurt, fromage frais and dairy desserts ^a	6	4	2	2	2	2
Ice cream ^a	1	1	1	0	1	1
Meat and meat products	15	20	26	24	24	24
Cereals and cereal products	23	28	30	19	18	18
Breakfast cereals	10	10	7	5	7	8

Key: ^aIncludes plant-based alternatives

Source: NDNS, OHID, 2025b¹⁸

Other important micronutrients

Milk and dairy provide a variety of other key nutrients and make important contributions towards intakes. Vitamin A, vitamin B5, phosphorus, folate, potassium, selenium, zinc and choline are discussed below.

Intake of vitamin A, which supports normal vision, skin and immune system function, is low in both adolescents and adults, with 10% of adults and 16% of adolescents with intakes below the LRNI. Low levels are most common in adolescent girls (11–18), with 18% having intakes below the LRNI. Milk and dairy provide almost a fifth (18%) of vitamin A in this age group and in young children (1.5–3-year-olds), it makes the largest contribution (28%) to vitamin A intakes.

Vitamin B5 (pantothenic acid) helps release energy from food, support mental performance and reduce tiredness and fatigue. Data on vitamin B5 intake or status in the UK is not routinely collected as its found in many foods, including milk and dairy products, such as cheese, which are useful sources. Similarly, data on phosphorus intakes is not routinely collected in the UK as its available in many foods, including milk and dairy products, some of which are rich in this nutrient.

Folate helps make red blood cells, reduce tiredness and support a healthy immune system. It is also vital for the normal development of the nervous system in unborn babies. Folate recommendations are 200 µg a day for adults and 300 µg a day during pregnancy and 260 µg when breastfeeding. Additionally, a supplement of 400 µg a day is recommended for women planning a pregnancy and during the first 12 weeks of pregnancy. However, one in 10 women of childbearing age have folate intakes below the LRNI, with average intakes of 189 µg (from food sources) and 219 µg (from food and supplements). Vegetables (23%) and cereals (35%) contribute the most to adult folate intakes, but milk and dairy contribute to intakes (9%), with some dairy, such as cheese, being a source of folate.

Potassium helps nerves and muscles (including the heart) function normally, as well as controlling the fluid balance in the body and maintaining normal blood pressure. Intakes among adults, particularly females, are low (see Table 27). Potassium is found in many foods, including milk and dairy, which contribute between 12% and 17% of intakes in adults (see Table 16).

Selenium helps protect body cells against damage and supports the immune system, skin and nails. It is also important for male fertility. Between 36% and 52% of all adolescents and adults have low intakes of selenium, with more women in all age groups with intakes below the LRNI (see Table 15). Cereals and meat contribute the most to selenium intakes, with milk and dairy providing between 7% and 11% of intakes.

Table 27. Percentage with intakes of potassium and selenium below the LRNI

Age group	Potassium % below LRNI		Selenium % below LRNI	
	Males	Females	Males	Females
11–18 years	27	37	28	45
19–64 years	21	35	32	57
65–74 years	9	19	35	54
75+ years	13	31	42	59

Source: NDNS, OHID, 2025b¹⁸

Zinc supports normal mental function, fertility and immunity, as well as helping wounds heal and maintaining normal hair, skin and nails. While milk is not considered a source of zinc, it provides between 14% and 27% of intakes across age groups. Low intakes are most common among adolescent girls ages 11–18, affecting 23% of this group.

Choline is an essential nutrient to be obtained from the diet as the amount produced by the body may not be adequate for the body's needs. Choline is needed for normal liver function, fat metabolism and homocysteine regulation (important for heart health), as well as a healthy brain and nervous system, particularly during pregnancy and while breastfeeding.¹²⁹ The UK has not set recommendations for choline; however, the European Food Safety Authority set adequate intakes at 400 mg a day for adults, 480 mg day during pregnancy and 520 mg a day when breastfeeding.¹³⁰

Choline intake data is lacking in the UK, but average intakes for adults in different European countries are around 310 mg a day and 293 mg a day in non-European countries.¹³¹ Meat, milk, grains, eggs and their derived products were reported to be the main dietary sources in European countries.¹³²

Plant-based diets tend to provide less choline than an animal-based diet.¹³¹ The global trend to reduce animal-source foods in order to attain sustainability goals implies that it may be difficult to achieve adequate choline, especially in vulnerable population groups, such as young women and infants.¹³³

Considerations when shifting to more plant-based dairy alternatives

Summary points

- Plant-based diets are rising in the UK, but replacing dairy with plant-based dairy alternatives raises concerns about iodine, calcium, vitamin B2 and B12, which are already low in parts of the population
- Cow's milk provides substantial nutrients (200 ml serving delivers 43% iodine, 33% calcium, 40% vitamin B2, 10% B12 recommendations for an adult woman), whereas plant-based drinks are inconsistently fortified (78% overall; 31% iodine) and often have lower bioavailability
- Plant-based milk alternatives (PBMA), if not fortified, may pose risks for vulnerable groups, including children and older adults. Limited research exists on health outcomes of PBMA consumption, but current evidence suggests lower growth and micronutrient intake in children consuming PBMA compared with cow's milk
- PBMA are significantly more expensive than dairy, often costing nearly three times more due to processing and fortification. Most are classified as ultra-processed foods (UPFs), raising concerns about their health impact, though evidence is still emerging
- Reducing dairy may not improve environmental impact if nutrient adequacy relies on other foods; diet-based strategies are needed to balance health, sustainability and affordability

An increasing number of adults in the UK are transitioning to a plant-based diet, with up to 13% self-reporting as flexitarians, or 16% if specifically considering adult women (as of July 2025).¹³⁴

Many plant-based drinks contain free sugars and vary in micronutrient fortification, making nutrient adequacy an important consideration during this transition, especially for micronutrients already at low levels in the population. A key concern is that consumers may assume that these products are nutritionally similar to milk and dairy, when in fact they are currently a poor replacement for iodine and vitamin B2.¹¹⁹ For example, a portion of milk (200 ml) would provide 43% of iodine, 33% of calcium, 40% of vitamin B2 and 107% of vitamin B12 recommendations for a female adult. In contrast, consuming one portion each of milk, yogurt and cheese (i.e. three portions of dairy products per day) would provide 161% of vitamin B12, 87% of calcium, 86% of iodine and 79% of vitamin B2 recommendations for a female adult.¹¹⁹

Fortification of plant-based alternatives

The UK's Eatwell Guide advises when buying dairy alternatives to choose unsweetened, calcium-fortified versions.¹ However, a recent government report recommended that plant-based drinks should be fortified not only with calcium, but also with vitamin A, vitamin B2, vitamin B12 and iodine at levels comparable with those found in semi-skimmed cow's milk, and with vitamin D.⁹

The nutrient composition of PBMA is evolving quickly. Between 2020 and 2023, 78% were fortified, compared with 57% in 2020. In 2023, 31% of PBMA were fortified with iodine, compared with only 4% in 2020. Although fortified PBMA still contained less iodine (26.2 µg/100 ml; range: 22.0–29.9 µg/100ml) than cow's milk (31.4 µg/100ml) and no PBMA marketed for the general public were fortified with vitamin A.^{9,135} Of the fortified PBMA, increases in calcium and vitamin B12 meant that levels in 2023 were similar to that of cow's milk. However, there remains wide nutritional variation in PBMA, with 22% still unfortified.¹³⁵

Nutrient bioavailability

Bioavailability may differ between micronutrients found naturally within the food matrix and those that are added as fortificants.¹³⁶

Many dietary recommendations, including in the UK, are based on the total calcium density of foods, with only limited consideration of bioavailability as a critical factor in determining a good source. Current recommendations do not acknowledge the huge disparities of calcium bioavailability in plant-based foods and are based on assumptions that have not been widely validated.¹³⁷ Muleya et al. (2024)¹³⁷ reported the bio-accessible calcium from plant-based drinks was surprisingly low (<5%, compared with 30% for milk), despite their high calcium content, which raises doubts about the calcium-related health claims often associated with such drinks. This was due to the low solubility of the calcium used for fortification and the potential presence of phytates.

The nutrient content of plant-based drinks at the time of consumption is often dependent on whether the product has been shaken, since the added nutrients are not part of the food matrix¹³⁸ and fortified nutrients can form a sediment.¹³⁷ However, some manufacturers now add stabilisers to prevent added calcium sedimenting.¹³⁹ Interesting effects on the bioavailability of nutrients have also been found when combining foods in a meal. For example, consuming dairy foods along with high-phytate foods (e.g. rice, tortillas or bread) improved absorption of zinc.¹⁴⁰

Unintended consequences of less/no dairy

There is concern that the variation in the nutritional profile of PBMA may impact the most vulnerable in society, including infants and children and the elderly, who rely on nutrients in dairy products, such as calcium, iodine and vitamin B12.¹²⁴ A recent report for the UK government concluded that replacing cow's milk with typical nutrient-profile plant-based drinks may have potential nutritional risks, contributing to higher intakes of free sugars and insufficient intakes of key micronutrients, such as vitamin A and iodine, especially in young children (aged 1–5 years) for whom the relative contribution

of cow's milk to nutrient intake is largest.⁹ Research on the impact of PBMA drinks on health outcomes for children and adults is limited, with a 2024 review identifying just six studies evaluating the nutritional and growth effects of PBMA drinks. It concluded that height, body mass index and micronutrient intake were lower in children who consumed plant-based drinks than those who consumed cows' milk.¹⁴¹

Most plant-based drinks are considered an ultra-processed food (UPF) as their production requires extensive processing of the base ingredient and addition of nutrients and other ingredients, such as emulsifiers, stabilisers and flavourings.¹⁴² The associations between UPFs and health are concerning, but current evidence is unclear as to whether these foods are inherently unhealthy due to processing or their nutritional content.¹⁴³

Plant-based milk and dairy alternatives cost considerably more than their dairy equivalents, with production and fortification expenses making them almost three times as expensive.¹²⁴ A recent analysis of nutrient-adequate sustainable diets found that reducing or eliminating dairy had little effect on the environmental impact but increased the cost of the diet notably. Because diets are required to be nutrient-adequate, the removal of products with a perceived high environmental impact does not necessarily reduce the impact of the whole diet as replacements to retain nutrient adequacy will also have an impact. Hence, diet-based approaches are critical.¹⁴⁴

How dairy consumption impacts health: the latest evidence

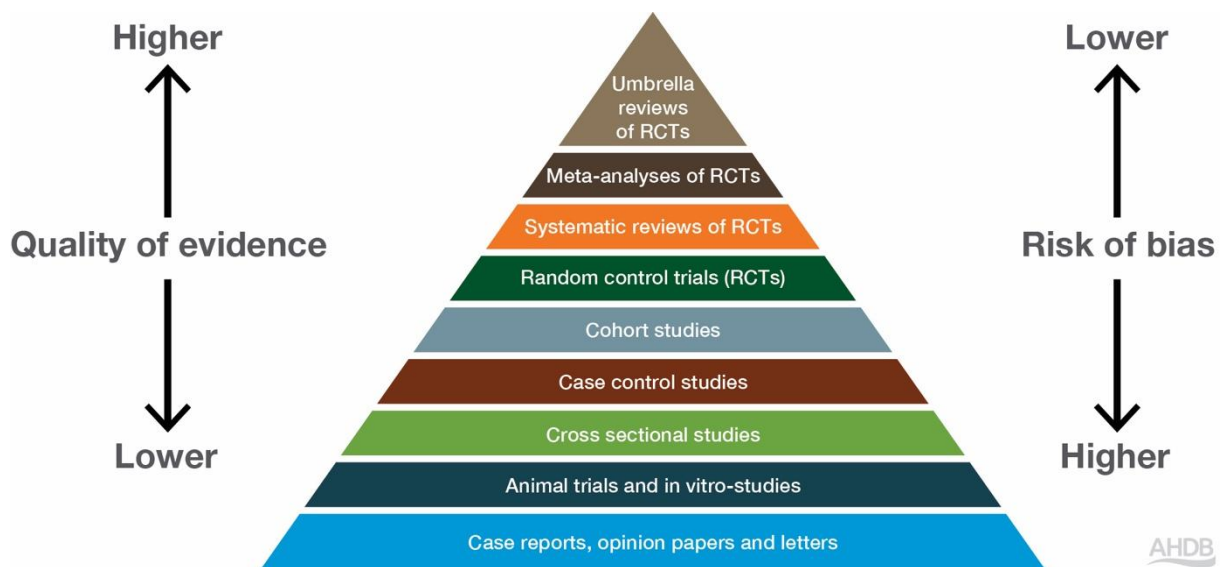
Summary points

- Dairy provides key nutrients (calcium, protein, phosphorus, vitamin K2) that support bone strength. Strong evidence shows dairy, particularly milk and yogurt, improves bone mineral density and reduces fracture risk, especially in older adults. Fermented dairy may enhance calcium absorption and support gut health, further benefiting bone health
- Overall, dairy, especially fermented products like yogurt and cheese, is neutral or beneficial for CVD risk. Evidence links total and low-fat dairy to reduced risk of hypertension, stroke and CVD mortality, with potential added benefits from vitamin K2 and probiotics
- Strong evidence supports dairy's protective role against colorectal cancer, mainly due to calcium. There is limited evidence of reduced breast cancer risk (notably in pre-menopausal women) and possible increased prostate cancer risk with very high dairy/calcium intake, suggesting moderation for men at higher risk
- Dairy is not linked to increased obesity risk and may support healthier body composition. Whole milk may lower childhood obesity risk, while fermented dairy, particularly yogurt, reduces abdominal fat and helps preserve lean mass – important for people on GLP-1 medications for weight loss
- Moderate intake of low-fat dairy, especially yogurt, consistently lowers risk of type 2 diabetes (T2D). Fermented dairy improves insulin sensitivity and reduces metabolic syndrome risk. Evidence also supports benefits for body composition and glucose control in early stages of T2D
- Fermented dairy (yogurt, kefir) is a key source of probiotics that support gut microbiome diversity, digestion and lactose tolerance. Lactose itself may act as a prebiotic, further supporting gut health. Fermented dairy improves lactose digestion and tolerance, supported by approved health claims in the UK and EU

The risk of developing non-communicable diseases (NCDs) is multifactorial. Factors include physical activity, genetics and socioeconomic status. Dietary choices also significantly influence the likelihood of developing diet-related NCDs while promoting health and longevity through good nutrition. This section aims to provide a brief summary of the current evidence base in relation to key areas of public health that dairy has been linked to. These include: bone health, CVD, raised blood pressure, cancer, weight control, type 2 diabetes and gut health.

When considering the relationship between dairy and health, it helps to understand the different types of research and how strongly they can support conclusions, i.e. the hierarchy of evidence (Figure 9).

Figure 9. Hierarchy of scientific evidence pyramid



At the top of this hierarchy are umbrella reviews, which summarise findings from multiple systematic reviews and meta-analyses. When conducted and interpreted well, they provide some of the most reliable insights available. Systematic reviews and meta-analyses combine and analyse multiple studies (e.g. cohort or randomised controlled trials – RCTs) to assess the strength and quality of evidence. Systematic reviews and meta-analyses of RCTs typically provide stronger evidence than observational studies.

Well-designed RCTs are considered the gold standard for establishing cause and effect. In nutrition research, they can show whether specific dietary interventions affect markers linked to future disease (such as cholesterol and cardiovascular disease).

When RCTs are not feasible, observational studies, such as prospective cohort studies that follow a large, diverse study population over an adequate time period, can provide useful assessment on how particular foods or diets impact health outcomes.

This report focuses on the highest level of evidence available, before considering evidence lower down the hierarchy. It also considers the most recent research available in each health area considered.

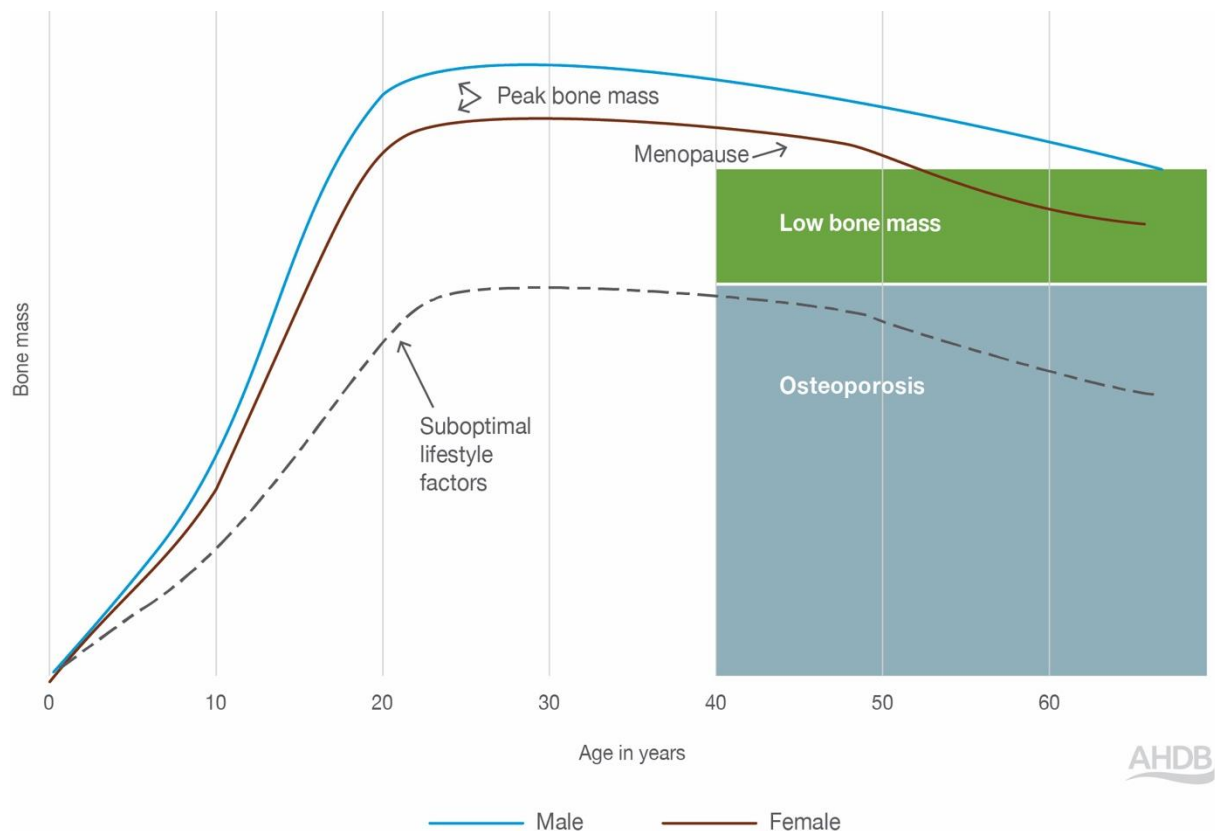
Bone health and osteoporosis

Osteoporosis is a condition where bones lose density, becoming fragile and prone to fractures. It develops gradually over several years and is often only diagnosed after a minor fall causes a bone to break. In the UK, one in two women and one in five men aged over 50 will experience a fragility fracture (breaks from low-impact events like a fall from standing height).¹⁴⁵

Global population growth and ageing have led to a rising number of fractures each year.¹⁴⁶ In the UK, around 549,000 new fragility fractures occur annually, with women accounting for 67%.¹⁴⁷ Such fractures cause severe pain, disability and reduced quality of life. In 2019, they cost the UK £5.4 billion, accounting for 2.4% of total healthcare spending.^{147,148}

The risk of osteoporosis increases with age, female gender, post-menopause, Caucasian ethnicity, prior fractures and family history. In older adults, the osteoporosis risk is dependent on peak bone mass and the rate of bone loss overtime. The effect of different lifestyle choices on bone mass across the lifespan is presented in Figure 10.

Figure 10. Bone mass across the lifespan with optimal and suboptimal lifestyle choices



Note: A healthy diet and lifestyle in early life helps individuals achieve their highest possible peak bone mass. This helps reduce risk of osteoporosis in later life. After peak bone mass is reached in the late 20s, bone mass gradually declines, with women having a period (around 5–10 years) of rapid bone loss with the onset of menopause, when the protective effect of oestrogen is lost.

Source: Adapted from (Weaver et al, 2016)¹⁴⁹

Peak bone mass

Bone mass builds slowly in childhood, then rapidly during puberty peaking in the late 20s, shortly after peak height gain. In European populations, peak bone mineral accretion occurs around 12.5 ± 0.90 years in girls and 14.1 ± 0.95 years in boys. About 39% of total body bone mineral mass is gained during the four years around this peak, and 95% of adult bone mass is reached within four years after. This period of rapid accretion is critical for maximising peak bone mass, which is 60–80% genetically

determined and 20–40% influenced by lifestyle, especially diet (that is adequate in protein, calcium and vitamin D) and regular weight-bearing exercise.¹⁴⁹ A 10% increase in peak bone mass may delay the onset of osteoporosis by 13 years.¹⁵⁰

Lifestyle factors to minimise bone loss

A healthy, balanced diet, limited alcohol consumption and avoidance of smoking help reduce osteoporosis risk. Adequate calcium and vitamin D intake, through diet or supplements, along with regular weight-bearing and muscle-strengthening exercises are recommended.¹⁴⁷

Dairy is a key source of calcium and also provides other bone-supporting nutrients, such as protein, phosphorus, potassium, magnesium, vitamin K2 and zinc.

Evidence on dairy products and bone health

This section begins with an overview of recent evidence, including umbrella reviews^{151–152} and a scoping review for the Nordic Nutrition Recommendations 2023.¹⁵ It also covers prospective cohort studies from the past five years. While cohort studies show associations, they don't prove causation. RCTs provide stronger evidence, and most recent RCTs on dairy consumption focus on bone mineral density or bone turnover markers rather than fracture risk.

Umbrella reviews of observational studies

The evidence indicates dairy to be beneficial for bone health and osteoporosis prevention. However, some findings are less clear, due to the variability in study quality, outcome measures and the types of dairy product consumed.

The Webster et al. (2021)¹⁵¹ umbrella review of meta-analyses found no clear link between total dairy consumption and hip fracture risk. Specifically, no significant associations were observed for total dairy¹⁵³ milk, or cheese consumption¹⁵⁴ or dietary calcium intake with the risk of suffering from hip fractures.¹⁵⁵ However, higher yogurt consumption was associated with a reduced risk in the incidence of hip fractures.¹⁵⁴ It is important to note, though, that the methodological quality of most included systematic reviews and meta-analyses was rated as critically low, making the overall evidence uncertain.

When looking at osteoporosis, the evidence is more consistent.¹⁵² The Feng et al. (2023)¹⁵² umbrella review showed that dairy intake supports bone mineral density and fracture prevention. Of the 13 studies on milk and dairy products, 10 were rated moderate to high quality, using the GRADE classification system.¹⁵⁶ The review also highlighted the benefits of dairy, vegetables, fruits and micronutrients, and the importance of limiting alcohol and coffee to reduce osteoporosis risk.

A review for the Nordic Nutrition Recommendations by Bjørklund Holven and Sonestedt (2024)¹⁵ also found inconclusive evidence linking dairy intake to fracture risk. While milk consumption supports bone health during the faster linear growth phases of childhood and adolescence, benefits in adults were less consistent. The authors noted that the different dairy products may have distinct health effects beyond their nutrient content. More clarity on dairy's protective effect against fractures in adults is provided by recent cohort studies discussed below.

Recent research from prospective cohort studies

Recent cohort studies suggest that milk intake is beneficial for reducing fracture risk in women.^{157–159} However, findings for yogurt and cheese are somewhat mixed (see Table 28). For example, in the US Nurses' Health Study, women with higher daily cheese intake were associated with lower fracture risk, but no link was found for yogurt.¹⁵⁷ Similarly, studies where average yogurt and cheese consumption were low, in Japan (at 19 g/day and 3 g/day respectively)¹⁵⁸ and the USA (both around 20 g/day),^{160,161} found no association. In contrast, a Swedish cohort with much higher intakes (200 g/day yogurt, 20–39 g/day cheese) showed significant protection by decreasing fracture risk.¹⁶²

Table 28. Summary of recent cohort studies

Study reference	Cohort study details	Consumption levels considered	Key findings
Alagheband et al. (2025) ¹⁵⁹	14,220 Finnish women average age at baseline 52.3 years 25-year follow-up	Milk and yogurt: No intake: 0 ml/day Moderate intake: ≤400 ml/day High intake: >400 ml /day Cheese: No intake: 0 slice/day Moderate intake: ≤3 slices/day High intake: >3 slices/day	Milk and yogurt: higher intake associated with lower risk of any fracture and osteoporotic fracture. Total dairy: highest vs. lowest intake linked to reduced fracture risk (HR: 0.74; 95% CI: 0.61–0.89). Milk: higher intake associated with lower fracture risk (HR: 0.85; 95% CI: 0.77–0.94). Cheese: higher intake associated with lower risk of hip fracture only.
Kojima et al. (2023) ¹⁵⁸	1,429 Japanese women aged ≥45 years at baseline 15-year follow-up	Milk: Low intake: <1 cup/day Medium intake: 1 cup/day High intake: ≥2 cups/day Yogurt and cheese: Low intake: <1 time/week High: ≥1 time/week	Milk: higher intake associated with lower risk of osteoporotic fracture. Yogurt and cheese: no association with osteoporotic fracture risk. Higher consumption of milk (but not yogurt or cheese) was associated with lower risk of osteoporotic fracture.
Yuan et al. (2023) ¹⁵⁷	103,003 US women average age 48 years at baseline 24 year follow-up	Milk and total dairy: Lower intake: <1 servings/day Higher intake: ≥1 servings/day Yogurt: Lower intake: <1 servings/week Higher intake: ≥1 servings/week Cheese: Lower intake: <5 servings/week Higher intake: ≥5 servings/week	Milk and total dairy: higher intake associated with lower fracture risk. Cheese: >1 serving/day linked to slightly lower fracture risk vs. <1 serving/week (HR: 0.89; 95% CI: 0.79–0.99). Yogurt: no association with fracture risk.
Webster et al. (2022) ¹⁶³	26,318 UK women aged 35–69 years at baseline 22-year follow-up	Linear associations between increments in dietary protein (25 g/day), calcium (300 g/day), total dairy (105 g/day, milk (240 ml)	Overall: no clear association between hip fracture risk and intake of calcium, vitamin D or animal products (including dairy). Underweight women: higher intakes of protein, calcium, total dairy and milk linked to lower hip fracture risk. Healthy/overweight women: no association observed.

Alagheband et al (2025)¹⁵⁹ found that higher milk and yogurt intake was linked with lower overall fracture risk, but only cheese was associated with reduced hip fracture. The authors suggested dairy affects different bone types differently. Its protective effect may be stronger in trabecular bone (e.g. spine), which loses bone density faster from calcium deficiency, than cortical bone (e.g. hip). Interestingly, higher cheese consumption was linked to lower hip fracture risk, unlike milk and yogurt. This may be due to nutritional differences of cheese and the type of cheese consumed (e.g. a higher protein-to-calcium ratio and salt content), which could influence bone health.

People with low body weight often have a lower bone mineral density and may benefit from bone-supporting nutrients, such as protein, calcium and vitamin D found in dairy products. In the UK Women's Cohort Study,¹⁶³ no overall associations were found between these nutrients and hip fracture risk. However, among underweight women, higher intakes of protein (increments of 25 g/day), calcium (increments of 300 mg/day), dairy (105 g/day) and milk (240 ml/day) were associated with reduced risks of hip fracture. Due to limited data on bone mineral density and body composition, further research is needed to confirm these findings.

Systematic reviews/meta-analyses of randomised controlled trials

Like the scoping review by Bjørklund Holven & Sonestedt (2024)¹⁵ (above), the National Osteoporosis Foundation¹⁴⁹ found strong evidence that dairy and vitamin D support reaching peak bone mass in children and adolescents. Grade A evidence supported calcium intake and physical activity, especially during late childhood, while grade B evidence supported the role of dairy and vitamin D on bone development. A more recent meta-analysis of 21 RCTs¹⁶⁴ reinforces these findings. Evidence suggests dairy consumption also supports bone health in adults. A meta-analysis by Hidayat et al. (2022)¹⁶⁵ found that milk intake slightly but significantly increased bone mineral density at the hip and spine in adults and reduced bone turnover markers. Wallace et al.¹⁶⁶ reviewed 17 RCTs on the effect of dairy products on bone mineral content and density in adults aged <50 years old (n=3) or >50 years old (n=14). Most of the included RCTs found positive effects, especially in those aged >50 years old. However, limited data in younger adults (<50 years) prevents firm conclusions from that age group.

Nutrition may have a greater impact on bone health during key life stages, such as the menopause transition and older age, which are more prone to bone mineral loss.¹⁶⁶ A two-year RCT including 7,195 older adults (average age 86 years) found that increasing dairy intake (additional milk, yogurt and cheese) to achieve 3.5 servings a day led to a 33% reduction in all fractures, 46% in hip fractures and 11% in falls, compared with those consuming two servings a day.¹⁶⁷ Notably, these benefits appeared within three to five months.

Table 29. Summary of systematic review and meta-analyses of RCTs

Study reference	Details of evidence	Dairy products compared	Key findings
Weaver et al. (2016) ¹⁴⁹	Dairy consumption in children and adolescents	Calcium studies used: supplementation with pills/chews (n=9), fortified foods (n=4), dairy foods (n=2) and combination of dairy and pills (n=1) Dairy studies included supplementing diet with milk and/or cheese and other dairy foods Vitamin D : supplementation range from 200 IU/day to 300,000 IU/a quarter	Calcium : grade A evidence for bone health (based on 21 RCTs). Dairy : grade B evidence for bone health (based on 3 RCTs). Vitamin D : grade B evidence (based on eight RCTs, one prospective study, three cross-sectional studies)
Hidayat. et al (2023) ¹⁶⁴	Dairy consumption in children and adolescents	Participants supplemented with milk (n=15 RCTs), dairy products (n=4 RCTs), cheese (1 RCT), yogurt (n=1). Most RCTs asked control group to continue with habitual diet, some used unfortified juice or placebo as a control.	Dairy supplementation (ages 3–18) : small but significant increase in bone mineral mass (based on 21 RCTs; majority rated moderate/high quality).
Wallace et al. (2021) ¹⁶⁶	Dairy consumption in adults	Participants supplemented with high calcium milk powder, milk, calcium and vitamin D fortified/unfortified dairy products . Control groups had either low or no milk/dairy consumers or asked to continue with habitual diet.	Adults <50 years : insufficient evidence (grade D) for dairy's effect on bone mineral density/content (based on 3 RCTs). Adults >50 years : moderate evidence (grade B) showing dairy benefits bone mineral density/content (based on 14 RCTs).
Hidayat et al. (2022) ¹⁶⁵	Milk consumption in adults	Participants supplemented with either milk powder (40–110 g/day) or milk (237–1,000 ml/day). 13 RCTs used vitamin D fortified milk . Most RCTs asked control group to continue with habitual diet, some used juice or placebo drink/tablets as a control.	Milk supplementation : small but significant increase in bone mineral density at the hip and spine (based on 20 RCTs, moderate quality).

Key: grade A = strong evidence: clear findings from at least one large, well-conducted, generalisable RCT with minimal bias. Grade B = moderate evidence: consistent results from multiple well-designed prospective cohort studies with relevant measures across different populations. Grade C = limited evidence: findings from several cohort studies, with some limitations, such as bias, measurement issues or inconsistent results. Grade D = inadequate evidence: studies with major flaws or multiple minor issues, leading to low confidence in the findings (Guyatt et al., 2008).¹⁶⁸

Summary of research findings for dairy and bone health

Evidence from observational studies on the impact of dairy on fracture risk is mixed. There is good evidence showing dairy's protective effect on fractures,¹⁵² but other evidence is less consistent.^{15,151} However, this is likely due to varying study quality and baseline calcium intakes, as calcium's effect plateaus beyond certain intake levels. Other possible confounding factors include the type of dairy consumed, fortification, population vitamin D status and lifestyle habits, such as regular weight-bearing exercise.

Recent prospective cohort studies, particularly in women, increasingly link milk and dairy intake to reduced fracture risk.^{157–159,163} Stronger evidence from RCTs shows that dairy improves bone mineral density.¹⁵⁴ In children and adolescents, dairy supports bone growth and achieving peak bone mass,^{149,164} while in adults, it helps slow bone loss,^{165–166} and in older adults it reduces falls and fractures.¹⁶⁷

Dairy offers key bone-supporting nutrients, especially bioavailable calcium – the mineral most important for bone health. There is some evidence suggesting that fermented dairy products may further enhance calcium bioavailability and absorption, as well as gut health, further supporting bone health.¹⁶⁹ When combined with a healthy, balanced diet and regular weight-bearing exercise, dairy plays a supportive role to lifelong bone health.

Cardiovascular disease (CVD)

Cardiovascular disease affects over 7.6 million people in the UK, and more than half of us will develop a heart or circulatory condition in our lifetime.¹⁷⁰ Poor diet, physical inactivity, excess weight and obesity are key contributors to this growing health issue.

Coronary heart disease (CHD), caused by reduced blood flow to the heart, is one of the UK's leading causes of death, responsible for around 66,000 deaths annually. One in eight men and one in fourteen women die from CHD. Stroke, where blood supply to the brain is interrupted, affects over 100,000 people each year.¹⁷⁰ High blood pressure is the leading modifiable risk factor for CVD, contributing to around half of heart attacks and strokes. High cholesterol is another major risk factor, with 50% of UK adults affected and 30% are living with high blood pressure.¹⁷⁰

Most global and UK dietary guidelines recommend limiting saturated fat intake to below 10% of total energy to reduce CVD risk.⁶⁶ However, these guidelines often overlook the food sources of saturated fats. Current UK intake exceeds this target – children consume 12.5% and adults 12.6% of energy from saturated fats.¹⁸ In children aged 1.5–3 years, milk and dairy alternatives are the main contributors (38%). In older children and adults cereals and cereal products, such as sandwiches, pizza, biscuits and cakes, are the largest sources (28–37%).¹⁸ Emerging evidence challenges the recommendation to reduce saturated fat without considering its source.¹⁷¹

CVD and dairy

Dairy foods are often linked to CVD due to their relatively high saturated fat content, contributing 20–38% of UK intake¹⁸ (see Table 12, page 33). However, the dairy matrix contains nutrients and bioactive components beneficial to cardiovascular health. Recent research shows that overall dietary patterns have a greater relevance to cardiovascular health than saturated fat alone.¹⁷²

The following sections examine the link between dairy and cardiovascular disease, using umbrella reviews, systematic review of cohort studies and recent findings from large-scale cohort studies. Given the diverse nutrient profiles and matrices of different dairy products, their effects on cardiovascular risk factors may differ. To explore potential mechanisms, evidence from recent RCTs, including systematic reviews, meta-analyses and individual RCTs published is examined.

Umbrella reviews of observational studies

The Nordic Nutrition Recommendations review found no link between dairy intake and increased CVD risk, with most meta-analyses showing neutral or favourable associations, especially for fermented products such as yogurt and cheese.¹⁵ Godos et al. (2020)¹⁷³ reported convincing evidence that total dairy intake lowers hypertension risk and likely reduces CVD, high blood pressure and fatal stroke. Fontecha et al. (2019)¹⁷⁴ found regular and low-fat dairy were either neutral or protective against CVD mortality, CHD and ischaemic and haemorrhagic stroke. Similarly, Jabbarie et al. (2023)¹⁷⁵ reported a probable link between higher intake of total and low-fat dairy and reduced hypertension risk.

Focusing specifically on milk consumption and health outcomes, Zhang et al. (2021)¹⁷⁶ found that an additional 200 ml of milk (about 1 cup) per day was associated with a 7% lower risk of stroke, 6% lower risk of CVD and a 4% lower risk of hypertension. However, higher-fat milk slightly increased stroke risk by 4%,¹⁷⁶ while low-fat milk showed no association.¹⁷⁴ Regarding cardiometabolic biomarkers of risk, 12 meta-analyses of RCTs indicate that dairy intake does not adversely affect blood lipids (i.e. total and LDL cholesterol) or blood pressure, and fermented milk products, such as yogurt, kefir and cheese, may improve these markers.¹⁷⁴

Fermented dairy products generally show favourable effects on CVD risk. While some meta-analyses found no association, others reported significant reductions in stroke and CVD risk with increased intake of up to 200 g a day, along with lower stroke mortality.¹⁷⁴

Cheese also shows mixed associations with CVD risk. Of three meta-analyses reviewed by Fontecha et al. (2019)¹⁷⁴, one found a protective effect, while two found no association. For CHD risk, two meta-analyses reported reduced risk with increased intake (50–75 g/day) and two found no association.¹⁷⁴ Higher cheese intake was also linked to lower stroke risk in four meta-analyses, and another showed no effect.¹⁷⁴ Similarly, more recent evidence suggests cheese consumption may reduce the risk of CVD, CHD, stroke and CVD-related mortality, though not hypertension.¹⁷⁷ Cheese and other dairy products are predominant sources of vitamin K2, which may support cardiovascular health by helping prevent or reverse vascular calcification.¹⁷⁷ Interestingly, moderate butter and cream intake show no significant association with CVD, CHD or stroke risk, across multiple meta-analyses.¹⁷⁴

Closer alignment with heart-healthy diets like the Eatwell Guide and DASH (dietary approaches to stop hypertension) diet can help prevent CVD.^{178–179} The DASH diet, designed to lower blood pressure, is a plant-based diet that includes 2–3 servings of low-fat dairy daily and is linked to decreased CVD incidence and improved blood pressure and cholesterol levels. Notably, its benefits persist even when low-fat dairy is replaced with full-fat options.¹⁸⁰

Recent observational research from cohort studies

This section summarises recent systematic reviews and meta-analyses of cohort studies not covered in the earlier umbrella reviews (see Table 30). It includes findings from recent large cohort studies,

such as the UK Biobank and China Kadoorie Biobank cohorts of 0.9 million adults,¹⁸¹ the ATTICA cohort in Greece¹⁸² and the EPIC cohort in nine European countries¹⁸³ (see Table 31).

Cardiovascular disease (CVD)

Changes in dairy intake inevitably influence the overall impact of the diet on health.¹⁸⁴ A recent review of 15 cohort studies by Kiesswetter et al. (2024)¹⁸⁴ found little evidence that substituting dairy products with other plant- or animal-based foods significantly affects CVD risk. However, replacing dairy with red meat showed increased CVD risk, while replacing butter with olive oil reduced CVD mortality.

Evidence on total dairy intake and CVD mortality is mixed. Naghshi et al. (2022)¹⁸⁵ reported a significant inverse association, while Giosue et al. (2022)¹⁸⁶ found none, regardless of fat content.^{185–186} Low-fat milk showed no link, but high-fat milk was associated with increased risk. However, more recent large cohort studies suggest potential cardiovascular benefits from dairy consumption, e.g., the ATTICA study reported a 23% lower CVD risk with one additional dairy serving¹⁸² and the UK Biobank study found higher dairy intake linked to reduced CVD risk.¹⁸¹

Coronary heart disease and stroke

Dairy intake appears to modestly reduce CHD and stroke risk.¹⁸⁷ The UK Biobank study linked >1 serving/day to a 7% lower CHD risk, while a large Chinese cohort found a 9% higher risk of CHD with ≥4 days-a-week intake.¹⁸¹ Both cohorts reported lower stroke risk – 6% lower in the Chinese and 14% in the UK.¹⁸¹ These differences may reflect genetic factors, lactose intolerance and habitual dairy intake, with UK dairy consumption four times higher, suggesting cardiometabolic benefits may require higher intake levels.¹⁸¹

High blood pressure

Dairy intake, especially low-fat options and milk, is linked to a 4–5% reduced risk of hypertension,^{187–188} while high-fat dairy shows no such benefit.¹⁸⁸ Earlier reviews support this, noting protective effects from total dairy, low-fat milk and yogurt (but not high-fat, fermented dairy or cheese).¹⁸⁹ These associations varied by region and sex differences, reflecting variation in the types and amounts of dairy consumed, dietary patterns and possible hormone-related mechanisms.¹⁸⁹

Fermented dairy may protect against CVD by introducing probiotics and bioactive peptides that benefit the gut microbiome, helping to reduce inflammation and blood pressure.^{175,182} Recent large cohort studies support these findings. The ATTICA study linked one extra daily serving to a 20% lower CVD risk,¹⁸² while EPIC found a 7–8% reduction per additional serving of yogurt or cheese,¹⁸³ suggesting that fermented dairy is particularly protective against CVD.

Table 30. Summary of systematic reviews of prospective cohort studies published since 2022 on dairy intake and cardiovascular disease risk

Study reference	Details of evidence	Consumption levels considered	Key findings
Kiesswetter et al. (2024) ¹⁸⁴	25 publications included in the meta-analyses	Whole-fat dairy (200 g) Low-fat dairy (200 g) Red meat (125–142 g) Cheese (20 g) Butter (5 g) per day	<u>Stroke:</u> Substituting both whole- and low-fat dairy products with red meat was associated with higher risk of stroke (SRR (95%CI): 1.10 (1.04, 1.17); 1.11 (1.04, 1.17) [Certainty of evidence rated: moderate–low]. Substituting different types of dairy (whole-fat milk, low-fat milk, cheese, buttermilk and butter) against each other or butter (5 g) with equal amounts of olive oil or avocado was not associated with risk of stroke. [Certainty of evidence rated: moderate].
Chen et al.(2022) ¹⁸⁷	24 studies on CHD risk, 20 studies on stroke risk, 18 studies on hypertension risk and dairy	Increments of total, high-fat and low-fat dairy (200 g), milk (242 g), yogurt (184 g), cheese (28 g) per day	<u>CHD risk:</u> The pooled RR for a 1 serving/day increase in total dairy was 0.98 (95% CI: 0.95, 1.00) [Moderate quality of evidence]. Also, no differences in CHD risk with increments of high-fat dairy, low-fat dairy, milk or yogurt. [Low quality of evidence]. <u>Stroke:</u> A 1 serving/day increase in total dairy was associated with a 4% lower risk of stroke (pooled RR: 0.96; 95% CI: 0.93, 0.99) [Low quality of evidence]. A 1-serving/day increase of milk was associated with 6% lower risk of stroke (pooled RR: 0.94; 95% CI: 0.89, 0.99) [Low quality of evidence]. <u>Hypertension:</u> Each additional daily serving of total dairy was associated with a 4% lower risk of hypertension (pooled RR: 0.96; 95% CI: 0.94, 0.97) [Moderate quality of evidence]. Each additional serving of low-fat dairy , but not milk or yogurt, was associated with a 5% lower risk of hypertension (pooled RR: 0.95; 95% CI: 0.92, 0.98) [Low quality of evidence].
Feng et al. (2022) ¹⁸⁸	17 studies on dairy and hypertension	Increments of total, high-fat and low-fat dairy (200 g/day)	<u>Hypertension:</u> Each additional daily serving of total dairy was associated with a 5% reduced risk (pooled RR: 0.95; 95% CI: 0.93, 0.97). Each additional daily serving of low-fat dairy was associated with a 6% lower risk of hypertension (pooled RR: 0.94; 95% CI: 0.90, 0.98). Intake of high-fat dairy was not associated with hypertension. Each additional serving of milk was associated with a 6% lower risk of hypertension (pooled RR: 0.94; 95% CI: 0.92, 0.97) [Moderate risk of bias in included studies].
Naghshi et al. (2022) ¹⁸⁵	16 studies on CVD and total dairy, 15 studies on milk	Increments of total dairy (200 g) or milk (200 g) per day	<u>Risk of CVD mortality:</u> Each additional daily serving of total dairy was marginally associated with a 2% lower CVD mortality (pooled ES: 0.98; 95% CI: 0.96-1.00, p=0.10) [significant heterogeneity among studies]. No association between high-fat or low-fat dairy and risk of CVD mortality. Increased intake of one serving a day of high-fat milk or low-fat milk was not associated with risk of CVD mortality, but high high-fat milk intake was associated with increased CVD mortality risk (pooled ES: 1.09; 95% CI: 1.02-1.16) [No significant heterogeneity among studies]. No association with low-fat milk intake and CVD mortality risk [Moderate heterogeneity among studies].

Giosue et al. (2022) ¹⁸⁶	17 studies on dairy products and CVD/CHD incidence/mortality	Increments of total dairy or milk, yogurt (200 g) per day; and cheese (10–50 g) per day	<u>CVD or CHD incidence and mortality:</u> Consumption of total dairy foods, either full-fat or low-fat dairy, up to 200 g per day, was not associated with CVD/CHD incidence and mortality. No association with milk consumption (up to 200 g/day) and cardiovascular endpoints (e.g. fatal and non-fatal CHD events). Fermented dairy intake is associated with lower CVD risk (yogurt), and lower CHD risk (cheese).
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Key: CI = confidence interval; SRR = summary of relative risks; ES = effect size

Table 31. Recent large cohort studies exploring association between dairy and CVD risk

Study reference	Cohort study details	Intake/frequency of consumption	Key findings
Zhuang et al. (2025) ¹⁸¹	CKB (n=487,212) Participants recruited from 2004–2008 UKB (n=418,895) for cheese analysis (n=183,446) for individual dairy products Participants recruited from 2007–2010	CKB cohort Never/rarely; monthly; 1–3 d/wk; regularly (≥4 d/wk) UKB cohort 0 servings/d; ≤0.5 serving/d; 0.5–1.0 serving/d; >1 serving/d Milk: 0 servings/d; ≤0.5 serving d; >0.5 serving/d Cheese: <2/wk; 2–4/wk; 5–6/wk; ≥7/wk Cheese type: 0 servings/d; ≤0.5 serving d; >0.5 serving/d	Regular dairy consumption was associated with: A 9% higher risk of CHD (HR: 1.09, 95% CI 1.05–1.13) (p-trend<0.001) a 6% lower risk of stroke (HR: 0.94, 95% CI 0.91–0.97) (p-trend<0.005) No significant association with CVD (HR 1.00, 95% CI 0.97–1.03) (Never/rarely vs. regular consumers) Higer dairy intake was associated with: Lower CVD risk (HR:0.93, 95% CI 0.88–0.98) (p-trend=0.004) Lower CHD risk (HR: 0.93, 95% CI: 0.88–0.99) (p-trend=0.014) Lower ischaemic stroke risk (HR: 0.86, 95% CI: 0.75–0.99) (p-trend=0.036) Milk intake (>0–0.5 serving/d) was associated with: Lower risk of haemorrhagic stroke (HR: 0.43, 95% I:0.21–0.87) Higher cheese intake (≥7/wk vs <2/wk) was associated with: Lower CVD risk (HR 0.88; 95% CI: 0.83–0.94) (p<0.001) Lower CHD risk (HR 0.88; 95% CI: 0.82–0.94) (p<0.001) High-fat cheese intake (>0.5 serving/d) was associated with: Lower CVD risk (HR: 0.92, 95% CI: 0.88–0.96) (p<0.001) Lower CHD risk (HR: 0.91, 95% CI: 0.87–0.96) (p<0.001) Low-fat cheese intake (>0.5 serving/day) was associated with: Lower ischaemic stroke risk (HR:0.72, 95% CI: 0.54–0.95) (p=0.008) Hard cheese intake (>0.5 serving/day) was associated with: Lower CVD risk (HR:0.90, 95% CI: 0.86–0.95) (p<0.001) Lower CHD risk (HR: 0.89, 95% CI:0.84–0.94) (p<0.001) Fresh cheese intake (>0.5 serving/day) was associated with: Lower CVD risk (HR:0.89, 95% CI: 0.80–0.99) (p=0.007) Lower CHD risk (HR: 0.89, 95% CI:0.84–0.94) (p=0.011)

		Yogurt: 0 servings/d; ≤0.5 serving d; >0.5 serving/d	Yogurt intake (>0.5 serving/d) was associated with: Lower ischaemic stroke risk (HR: 0.86, 95% CI: 0.77-0.98) (p=0.005)
Kouvari et al. (2025) ¹⁸²	ATTICA cohort study n=3,042 men (49.8%) and women (50.2%) from Greece 20-year follow-up	Food frequency questionnaire with photographs to assist with defining portion size	In crude analysis, an increase of one daily serving of dairy products (any kind) was linked to a 23% reduced risk of developing CVD during the 20-year follow-up period. Consuming one additional serving per day of fermented dairy products was linked to a 20% reduction in CVD risk. Moreover, individuals who consumed fermented dairy products at a rate equivalent to or exceeding 76% of their total daily dairy intake experienced a 32% lower incidence of CVD. Additionally, when the ratio of fermented to non-fermented dairy product consumption exceeded 2.5, there was a 20% lower risk of developing CVD. Using low-fat milk to substitute whole-fat yogurt was a protective dietary modification against CVD risk. Substitution of low-fat with whole-fat yogurt increased CVD risk (1.35, (1.02, 1.58)).
Key et al. (2019) ¹⁸³	EPIC cohort dairy and IHD n=409,885 men and women in 9 European countries Mean follow-up of 12.6 years	Food frequency questionnaire	Risk was inversely associated with intakes of yogurt (HR, 0.93 [95% CI, 0.89–0.98] per 100 g/d increment), cheese (HR, 0.92 [95% CI, 0.86–0.98] per 30 g/d increment). Risk for IHD was inversely associated with consumption of yogurt, cheese . Comparing participants in the highest fifth of intake of cheese with those in the lowest fifth of such intake showed that non-HDL cholesterol was lower by 0.10 mmol/L, whereas the intake of cheese was unrelated to systolic blood pressure.

Randomised controlled trials: Recent systematic reviews and meta-analyses

Cholesterol and blood lipids

Kiesswetter et al (2023)¹⁹⁰ summarised evidence from 19 RCTs on dairy intake and blood lipids in healthy adults (see Table 32). High dairy intake (≥3 servings a day), irrespective of fat content, had no detrimental effects on total, LDL, HDL cholesterol or triglycerides, compared with a diet low in dairy. Full-fat dairy products may raise HDL cholesterol, and yogurt (versus milk) was reported to improve both triglycerides and HDL cholesterol.

The HDL cholesterol-raising effect of full-fat dairy may stem from its saturated fatty acids, particularly, myristic and palmitic acids.¹⁹¹ Yogurt's benefits, compared with milk, could be due to fermentation, which enhances nutritional properties, such as increased conjugated linoleic acid (CLA), B-vitamin production and bioactive peptides with anti-hypertensive and anti-oxidative protective effects. Fermented dairy also contains lactic acid bacteria that may support cardiovascular health.¹⁹⁰ Similarly,

Giosue et al. (2022)¹⁸⁶ reported that total dairy intake, regardless of fat, had a neutral effect on blood lipids, while probiotic-enriched dairy products lowered total and LDL cholesterol.

RCTs support cheese's cholesterol-lowering effects, relative to butter,¹⁹² likely due to its unique dairy matrix¹⁹³ and higher calcium content.¹⁹⁴

Given the established sex differences in CVD risk, understanding responses to dairy fats is key for tailored dietary advice. Rooney et al. (2025)¹⁹⁵ found women responded more favourably to cheese than its isolated components, suggesting a stronger dairy matrix effect. In contrast, Ziaei et al. (2021)¹⁹⁶ reported probiotic fermented milk reduced total and LDL cholesterol levels more effectively in men than women, especially when consumed for more than eight weeks, or with multiple probiotic strains.

Blood pressure

Dairy intake, irrespective of fat content, showed no adverse effect on blood pressure.^{186,190} Both low-fat and full-fat dairy improved systolic blood pressure,¹⁹⁰ and fermented milk and yogurt intake was reported to reduced blood pressure.¹⁸⁶

Dairy provides nutrients linked to lower blood pressure, including calcium, magnesium, potassium and, uniquely, phosphorus, which shows benefits only when sourced from dairy,¹⁹⁷ highlighting the potential importance of the dairy matrix. Bioactive peptides released from milk and dairy during digestion, or fermentation, may also contribute to its blood pressure-lowering effects.¹⁸⁹

Table 32. Summary of systematic reviews and meta-analyses of RCTs from 2022

Study reference	Details of evidence	Dairy products compared	Key findings
Pradeilles et al. (2023) ¹⁹²	Intake of cheese on blood lipids and lipoprotein concentrations in adults	Hard or semi-hard cheese intakes vs. energy-matched quantity of an alternative dairy food (e.g. butter)	Relative to butter, intake of hard or semi-hard cheese for 14 days lowered fasting circulating total cholesterol and LDL cholesterol and, to a lesser extent, HDL cholesterol (based on seven RCTs; all rated as 'some concerns' in relation to risk of bias).
Kiesswetter et al. (2023) ¹⁹⁰	Effects of dairy intake on markers of cardiometabolic health in adults	High dairy intake, mostly defined as ≥ 3 servings/day, compared with low dairy or control intervention	High-dairy intake (irrespective of fat content) showed no detrimental effects on blood lipids and blood pressure. Both low-fat and full-fat dairy improved systolic blood pressure. Full-fat dairy may increase HDL cholesterol compared with a control diet. Yogurt improved triglycerides and HDL cholesterol compared with milk. (Based on 19 RCTs. In relation to risk of bias: 88% rated as 'some concerns' the rest rated as 'high'.)

Giosue et al. (2022) ¹⁸⁶	Effects of dairy products (i.e. low/full-fat dairy, milk, butter, cheese, yogurt) on major CVD risk factors	Effect on blood pressure with total dairy intake (one meta-analysis of RCTs), or yogurt/dairy foods enriched with probiotics (three meta-analyses of RCTs) Effect on blood lipids with yogurt and other dairy enriched with probiotics (seven meta-analyses of RCTs)	No evidence for a detrimental effect of dairy consumption on blood pressure; if anything, a slight improvement with increasing consumption of yogurt enriched with probiotics and fermented milk has been described. Yogurt and other dairy products enriched with probiotics (80–600 ml/day) consistently show a reduction in total and LDL cholesterol. (Study quality not assessed.)
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Summary of research findings for dairy and CVD

Evidence from both observational studies and RCTs shows dairy is either neutral or beneficial for CVD risk, with fermented products such as yogurt and cheese showing particularly favourable effects. Some studies report benefits irrespective of fat content, while others suggest low-fat dairy is more cardioprotective.

Dairy foods vary widely in their nutrient content, structure and food matrix, influencing their metabolic effects. Regional dietary patterns and sex-specific cardiometabolic risk further complicate their impact on CVD. This diversity makes broad conclusions difficult. Future research should focus on specific dairy products and population sub-groups (e.g. pre- and postmenopausal women). Notably, diets including low-fat dairy are well-established as heart-healthy diets.^{198–199}

When considering the evidence in the area as a whole, Kiesswetter et al. (2023)¹⁹⁰ noted that many studies were partially funded by dairy-related organisations or industry. However, a systematic review by Chartres et al. (2020)²⁰⁰ found no clear evidence that industry funding biased results or conclusions.

Cancer

In the UK (2022), colorectal cancer was the second most common cancer in men (11% – 26,593 cases) and the third in women (10.7% – 22,836 cases).²⁰¹ Breast cancer was the most common cancer among women, (27.6% – 58,756 cases), while prostate cancer led in men (22.9% – 55,485 cases). This section focuses specifically on these three cancers due to their links with dairy consumption.

Dairy in relation to cancer

Since 1997, the World Cancer Research Fund (WCRF) and the American Institute for Cancer Research (AICR) have published evidence reviews every 10 years on how diet and nutrition affect cancer risk. The latest, the Third Expert Report (2018),²⁰² presents global cancer prevention recommendations from the Continuous Update Project (CUP), focusing on diet, nutrition and physical activity for cancer prevention and survival.

The WCRF evidence on dairy states:

*“There is strong evidence that consumption of dairy products, and consumption of calcium supplements, both help protect against colorectal cancer.”*²⁰²

*“There is also limited but suggestive evidence that consumption of dairy products might increase the risk of prostate cancer. The evidence of potential for harm means no recommendation has been made for dairy products.”*²⁰²

The following sections summarise WCRF CUP findings, alongside recent umbrella reviews, systematic reviews and large cohort studies on CRC, breast and prostate cancer. It also includes key insights from the WCRF International report on ‘Dietary and lifestyle patterns for cancer prevention’ that focused on colorectal and breast cancer.²⁰³

Colorectal cancer (CRC)

WCRF/AICR Continuous Update (CUP)

The WCRF reported strong evidence that dairy consumption decreases the risk of bowel cancer, primarily due to its high calcium content.²⁰⁴ Other potentially protective components include lactic acid-producing bacteria, casein, lactose, lactoferrin, butyrate and vitamin D from fortified dairy products, though it is important to note further research is needed.

Of the 14 studies included in the systematic review, a dose-response meta-analysis of 10 studies showed a 13% lower risk of colorectal cancer per 400 g daily increase in dairy product consumption (see Table 33).²⁰⁴

Table 33. Summary of dose-response meta-analyses for dairy consumption and diets high in calcium on cancer risk

STRONG EVIDENCE					
Cancer type	Type of evidence	Total studies (studies in meta-analysis)	Increment	Relative risk estimates (95% CI)	Conclusion
Colorectum	Dairy products (includes total dairy, milk and cheese, and dietary calcium)	14 (10)	400 g/day	0.87 (0.83–0.90)	Probable: decreases risk
	Milk	13 (9)	200 g/day	0.94 (0.92–0.96)	
	Cheese	9 (7)	50 g/day	0.94 (0.87–1.02)	
	Dietary calcium	20 (13)	200 mg/day	0.94 (0.93–0.96)	
LIMITED EVIDENCE					
Cancer type	Type of evidence	Total studies (studies in meta-analysis)	Increment	Relative risk estimates (95% CI)	Conclusion
Breast cancer (pre-menopause)	Dairy products (includes total dairy and milk intakes)	13 (7)	200 g/day	0.95 (0.92–0.99)	Limited-suggestive: decreases risk
	Diets high in calcium ^a	6(5)	300 mg/day	0.87 (0.76–0.99)	Limited-suggestive: decreases risk
Breast cancer (post-menopause)	Diets high in calcium ^a	7(6)	300 mg/day	0.96 (0.94–0.99)	Limited-suggestive: decreases risk
Prostate cancer	Dairy products (includes total dairy, milk, cheese and yogurt intakes) ^b	21 (15)	400 g/day	1.07 (1.02–1.12)	Limited-suggestive: increases risk
	Diets high in calcium ^b	16(15)	400 mg/day	1.05 (1.02–1.09)	Limited-suggestive: increases risk

Note: Probable = evidence is strong enough to support a judgement of a probable causal (or protective) relationship, which generally justifies goals and recommendations designed to reduce the risk of cancer. Limited-suggestive = evidence is inadequate to permit a judgement of a probable or convincing causal (or protective) relationship but is suggestive of a direction of effect. The evidence may be limited in amount, or by methodological flaws, but shows a generally consistent direction of effect. This judgement generally does not justify making recommendations. Limited evidence = evidence is inadequate to support a probable or convincing causal (or protective) relationship. The evidence may be limited in amount or by methodological flaws, or there may be too much inconsistency in the direction of effect (or a combination), to justify making specific public health recommendations.

Source: Primarily from WCRF/AICR, (2018c),²⁰⁵ with other sources highlighted as ^aWCRF, (2018d),²⁰⁶ ^bWCRF, (2018e)²⁰⁷

Recent systematic reviews and meta-analyses

Meta-analyses by Barrubés et al. (2019)²⁰⁸ found that low-fat milk and cheese intake were linked with protection against CRC, particularly in the colon. No significant associations were found between CRC risk and intakes of whole milk, low-fat or fermented dairy products or cultured milk. However, other meta-analyses reported that higher yogurt and cheese intake may lower CRC or rectal cancer risk.^{209–210} While more research is needed to better understand the impact of different types of dairy on CRC risk, current evidence suggests that consumption of dairy foods, especially low-fat milk, cheese and yogurt, may be protective against CRC.^{208–209}

Recent large cohort studies

Recent analysis of the UK Million Women Study (n=542,778 women) by Papier et al., (2025)²¹¹ supports WCRF findings that dairy likely reduces CRC risk.²⁰² Most dairy foods and nutrients were inversely associated with CRC risk, except cheese and ice cream. A 200 g/day milk intake was linked to a 14% reduction in CRC risk – more than double the 6% risk reduction reported in the 2018 WCRF report²¹¹ and 5% from the EPIC cohort study²¹² for the same milk intake. In contrast, the UK Biobank study (n=475,581) found no significant associations with CRC risk, likely due to incomplete milk intake data affecting accuracy.²¹³

The China Kadoorie Biobank (n>500,000) also found no significant link between dairy intake and CRC or most other cancers. However, in this population with relatively low dairy intakes, each 50 g/day increase in dairy was linked with higher risk of overall cancer (7%), liver (12%) and female breast cancer (17%).²¹⁴ These findings suggest that dairy and cancer risks may differ in populations with widespread lactose intolerance.²¹¹

Dairy's protective effect against CRC is mainly thought to be attributed to calcium intake, as calcium binds to bile and free fatty acids in the colon, reducing their potentially carcinogenic effects.²¹¹ A 300 mg/day increase in calcium intake was linked to a 17% lower CRC risk in the UK Million Women Study²¹¹ and 15% in the US Nurses' Health Study.²¹⁵ The US Nurses' Health Study was a cohort of younger women, aged 25–42, and highlights the importance of adequate calcium intake for protecting against CRC, especially in young women.²¹⁵

Breast cancer

WCRF/AICR Continuous Update (CUP)

The WCRF²⁰⁶ reported 'limited-suggestive' evidence that women who consume dairy and high-calcium diets may reduce pre- and postmenopausal breast cancer risk. Each 200 g a day increase in dairy intake was found to reduce the risk of pre-menopausal breast cancer by 5% (see Table 33).²⁰⁶

Recent reviews and meta-analyses of observational studies

An umbrella review²¹⁶ had similar conclusions, finding that diets high in calcium may reduce breast cancer risk in both pre-menopausal and postmenopausal women, while dairy intake may only be protective in pre-menopausal women. A further meta-analysis also linked dairy consumption to lower overall breast cancer risk, particularly in women under 45.²¹⁷ Similarly, Arafat et al. (2023)²¹⁸ reported an inverse association between dairy intake and breast cancer risk, though the effects may vary by dairy product type.

Low-fat dairy has also been linked to a lower breast cancer risk. Meta-analyses by He et al. (2021)²¹⁹ and An et al. (2025)²¹⁷ found higher consumption of low-fat dairy intake was protective against breast cancer, particularly in pre-menopausal women, with a 14% decreased risk with skimmed milk (RR: 0.86, 95% CI: 0.76–0.97). In contrast, Chen et al. (2019)²²⁰ reported no association between milk intake (low-fat or whole) and breast cancer risk. He et al. (2021)²¹⁹ reported a possible but non-significant increased risk with high-fat dairy, whereas Kazemi et al. (2021)²²¹ found no significant risk with milk intake up to 450 g a day, but a 30% increase in risk with intakes up to 1,300 g/day.

Fermented dairy may also offer protective effects against breast cancer. Kazemi et al. (2021)²²¹ found a 7.5% risk reduction with yogurt intake up to 100 g a day, and with each additional 30 g a day intake of cheese. Protective effects of fermented dairy were also reported by An et al. (2025)²¹⁷ and He et al. (2021),²¹⁹ where breast cancer risk, particularly among postmenopausal women, was reduced by 9% (RR: 0.91, 95% CI: 0.87–0.96) and 4% respectively (RR: 0.96, 95% CI: 0.93–0.99). Some human studies suggest fermented dairy, such as yogurt, may lower breast cancer incidence.²²² Emerging evidence also points to a potential role for probiotics in prevention and treatment, though further clinical research is needed to establish their effectiveness and safety.^{222,223}

The impact of dairy may vary by breast cancer sub-type. An et al. (2025)²¹⁷ reported a 31% increased risk of oestrogen receptor-negative (ER-) breast cancer (RR: 1.31, 95% CI: 1.08–1.59). In contrast, He et al. (2021)²¹⁹ found no association with ER- breast cancer but observed reduced risks for oestrogen receptor-positive (ER+) (21%) and progesterone receptor-positive (PR+) (25%) breast cancers. As part of the Global Cancer Update Programme (CUP Global), Becerra et al. (2023)²²⁴ examined the influence of diet after breast cancer diagnosis. However, evidence on dietary factors, including dairy, was limited and inconsistent, so no firm conclusions could be made.

Prostate cancer

WCRF/AICR Continuous Update (CUP)

The WCRF/AICR found limited evidence that a higher dairy intake may increase prostate cancer risk.²⁰⁷ A dose response meta-analysis of 15 studies showed a 7% increased risk per 400 g of dairy per day²⁰⁷ (see Table 33). When considering specific types of dairy product, low-fat milk (200 g a day), and cheese (per 50 g a day) were linked to a 6% and 9% increased risk respectively. No significant associations were reported for total milk, whole milk or yogurt.²⁰⁷

The WCRF also reported a 5% increased prostate cancer risk per 400 mg/day of dietary calcium, mainly from dairy products²⁰⁷ (see Table 33). This may be due to reduced production of the active form of vitamin D, which may promote prostate cells to grow and multiply faster.²⁰⁵ However, epidemiological studies show no clear link between pre-diagnostic vitamin D levels and prostate cancer risk.²⁰⁵

Recent reviews and meta-analyses of observational studies

An overview of six meta-analyses of observational studies found some evidence linking higher dairy intake to increased prostate cancer risk, though overall findings were inconclusive.²²⁵ A more recent meta-analysis reported increased risk with high intakes of total dairy, milk, cheese and butter, while

whole milk was linked to lower risk. No associations were found for low-fat milk, yogurt, ice cream or cream.²²⁶

Higher milk intake has been linked to modest rises in blood insulin-like growth factor-I (IGF-I) levels, which may raise prostate cancer risk.²⁰⁵ Harrison et al. (2017)²²⁷ found some evidence that milk may stimulate the IGF pathway, with circulating IGF proteins potentially influencing prostate cancer development.

Higher dairy protein intake may increase prostate cancer risk by stimulating IGF-I production.²²⁸ While no significant association was found with total, animal or plant protein, men consuming over 30 g a day of dairy protein had an increased risk. A 20 g a day increase (equal to 2.5 cups of milk or yogurt) was associated with a 10% higher risk. Intakes below 30 g a day showed no significant association, possibly reflecting the beneficial effects of nutrients provided by dairy.²²⁸

Consistent with the WCRF 2018 report, a recent meta-analysis by Xiong et al. (2025)²²⁹ found a 6% increased prostate cancer risk with each additional 300 mg a day of dietary calcium, with a 5% increase specifically from dairy sources. In contrast, non-dairy calcium sources showed no association. While findings suggest caution for high-risk population groups, the evidence from this meta-analysis remains insufficiently robust and inconclusive.²²⁹

Dietary patterns and recommendations

World Cancer Research Fund International

The recent 'Dietary and lifestyle patterns for cancer prevention' report²⁰³ emphasises that overall dietary and lifestyle patterns, rather than individual foods or nutrients, better reflect 'real life' habits and offer clearer guidance for preventing breast and colorectal cancer.

Based on analysis of 86 studies, the WCRF International report (2025)²⁰³ recommends including calcium-rich foods, such as dairy products, for CRC prevention. Unlike the 2018 guidelines which excluded dairy and calcium, due to limited evidence and prostate cancer concerns, current evidence now supports its inclusion in dietary and lifestyle recommendations for CRC prevention.²⁰³

Most dietary patterns in the CUP Global reviews did not distinguish between high- and low-fat dairy, though both appear similarly protective against CRC, mainly due to its high calcium content. For those unable to digest dairy, calcium-rich alternatives that can be easily absorbed should be prioritised.²⁰³ The WCRF International advises against supplements for cancer prevention, recommending calcium from food and beverages instead.²⁰³

Recommendations for colorectal cancer prevention are a healthy diet and lifestyle pattern that includes:

- Maintaining a healthy weight and habitually taking part in physical activity
- Prioritising consumption of fruit and vegetables, as well as fibre-containing foods
- Including the consumption of coffee and calcium-containing foods, such as dairy products
- Limiting consumption of sugar-sweetened beverages and alcohol
- Avoiding processed meat
- Not smoking

Recommendations for breast cancer prevention are a healthy diet and lifestyle pattern that includes:

- Maintaining a healthy weight, habitually taking part in physical activity
- Prioritising fruit and vegetables and fibre-containing foods
- Lower consumption of red and processed meat and sugar-sweetened beverages
- Avoiding alcohol and smoking

Source: WCRF International (2025)²⁰³

While breast and CRC prevention share similar dietary recommendations, evidence for including calcium-rich foods such as dairy is weaker for breast cancer, and hence not recommended.²⁰³ The review, of 84 studies relating to breast cancer prevention, noted the need for more well-conducted research, considering menopausal status and cancer sub-type.²³⁰

Summary of research findings for dairy and cancer

Strong evidence suggests that dairy foods, especially low-fat milk, cheese and yogurt, may reduce bowel cancer risk, primarily due to their high calcium content. Large cohort studies support the protective role of dietary calcium against CRC and a healthy diet that includes calcium-containing dairy foods is recommended for prevention.

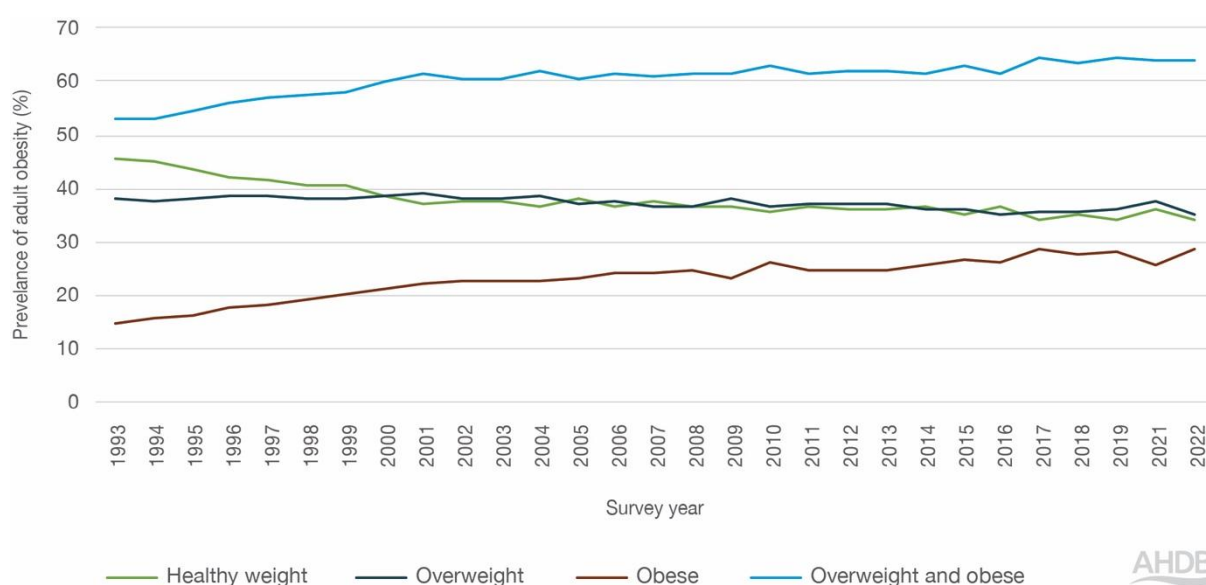
Dairy intake, especially milk, may be protective against breast cancer risk. Low-fat dairy appears protective for pre-menopausal women, while fermented dairy may benefit postmenopausal women. However, high milk intake should be avoided. Further research is still needed to clarify how different dairy products affect the risk of breast cancer sub-types across various age groups and menopausal stages.

Evidence indicates that milk and dairy consumption may be linked to increased prostate cancer risk. However, this evidence is limited. Men at high risk of prostate cancer are advised to moderate calcium intake from dairy sources.

Weight control

Global obesity rates have surged since 1990, with adult obesity more than doubling and adolescent obesity quadrupling.²³¹ In the UK, two-thirds of adults are above a healthy weight, and up to a third live with obesity²³² (see Figure 11). The National Child Measurement Programme in England shows that one in three children leaves primary school overweight or obese, with one in five living with obesity.²³³ Along with detrimental psychosocial impacts, excess weight in childhood and adolescence is linked to earlier onset of type 2 diabetes and CVD.²³¹ Obesity also contributes to reduced life expectancy and increases the risk for cancers, neurological disorders, chronic respiratory disease and digestive disorders.^{231, 233}

Figure 11. Trends in adult overweight and obesity in England



Source: NHS Digital, Health Survey for England 2022. Adult and children's overweight and obesity tables.

Dairy in relation to weight

Milk and dairy are often perceived to be high-calorie foods, leading to dietary recommendations for reduced- or low-fat dairy options to help support healthy weight control and lower adverse health risks such as CVD.^{1, 234–235} However, growing evidence suggests milk and dairy products may in fact have a beneficial role in weight management.

Evidence from recent umbrella reviews, observational studies and RCTs in relation to children, adolescents and adults is discussed below, including the potential of fermented dairy in reducing obesity risk.

Umbrella reviews

A review for the Nordic Nutrition Recommendations found limited and inconsistent evidence that dairy products may protect against obesity.¹⁵

Kristoffersen et al. (2025)²³⁶ reported no significant link between dairy and the risk of being overweight, while diets rich in whole grains, legumes, nuts and fruits were associated with lower risk of overweight and obesity risk and high intakes of sugar-sweetened drinks and red meat with higher risk. In contrast, an umbrella review by Zhang et al. (2021)¹⁷⁶ found milk helps protect against obesity, possibly due to its calcium, casein and whey protein, fatty acids and lipids that enhance satiety.¹⁷⁶ However, the authors stressed the need for well-designed, robust RCTs to confirm these findings.

Children and adolescents

Observational studies: systematic reviews and meta-analyses

Analysis by Lu et al. (2016)²³⁷ of 10 studies and a total of 46,011 children and adolescents with an average three-year follow-up, found those with the highest dairy intake group were 38% less likely to be overweight or obese (OR: 0.62; 95% CI: 0.49, 0.80), with each additional daily serving linked to a 0.65% reduction in body fat and a 13% lower overweight or obesity risk (OR: 0.87; 95% CI: 0.74, 0.98).

A meta-analysis of five cross-sectional studies by Babio et al. (2022)²³⁸ reported a 34% lower risk of obesity with higher dairy intake (OR: 0.66; 95% CI: 0.48, 0.91), though no significant association was found for overweight risk with total dairy intake. Several reviews found no significant associations between dairy intake and obesity in children and adolescents.

Babio et al. (2022)²³⁸ reported no association between milk consumption and obesity risk, while O'Sullivan et al. (2020)²³⁹ found no link between whole-fat dairy and increased body weight or adiposity. Similarly, Dougkas et al. (2019)²³⁴ concluded that milk and other dairy products, regardless of fat content, are consistently shown to have no link, or a protective link, with obesity in children.

A meta-analysis of observational studies by Vanderhout (2020a)²⁴⁰ found children who consume whole milk were around 40% less likely to be overweight or obese than those consuming reduced-fat milk, (OR: 0.61; 95% CI: 0.52, 0.72; $P < 0.0001$) though study heterogeneity was high.

Evidence on flavoured milk and overweight or obesity risk is limited and mixed. Patel et al. (2018)²⁴¹ reviewed three studies: one showed a non-significant increase in BMI; another linked BMI gains to increases in lean body mass; and the third found greater weight gain with flavoured milk intake. With the latest NDNS data showing almost one in five children (aged 4–10) and one in four adolescents (11–18) consuming flavoured milk (see Table 1 on page 17), more research is needed to understand its impact on nutrient intakes and obesity risk.²⁴¹

Recent randomised controlled trials

More high-quality cohort studies and RCTs are needed to clarify how different types of milk and dairy foods affect childhood obesity. In the Milky Way Study, 49 children regularly consuming whole-fat dairy were randomised to continue or switch to reduced-fat dairy for three months.²⁴² While reduced-fat dairy lowered dairy fat intake, it had no significant effect on body fat, composition or cardiometabolic disease risk, suggesting whole milk does not increase adiposity.²⁴² The ongoing CoMFORT trial aims to determine whether whole- or reduced-fat milk optimises nutrition and supports healthy growth and body composition in early childhood.²⁴³

Adults

Observational studies: systematic reviews and meta-analyses

Analysis of five cohort studies by Feng et al. (2022)¹⁸⁸ found that each additional 200 g/day intake of dairy was linked to a 25% lower risk of becoming overweight or obese, including 7% for high-fat dairy and 12% for milk. Similarly, analysis of US dietary survey data of 43,038 adults found whole milk intake was associated with lower body weight, BMI, waist circumference and obesity prevalence.²⁴⁴

A meta-analysis of six different studies by Schlesinger et al. (2019)²⁴⁵ found no link between dairy intake and overweight, obesity or abdominal fat gain. In contrast, Wang et al. (2016)²⁴⁶ reported a 25% lower obesity risk among adults with high dairy intake, (pooled OR: 0.75; 95% CI: 0.69, 0.81) and 23% lower risk with high milk intake (pooled OR: 0.77; 95% CI: 0.68, 0.87), though their findings were based on cross-sectional studies prone to bias. Cohort data from Schwinschackl et al. (2016)²⁴⁷ showed a 13% lower risk of overweight (OR: 0.87; 95% CI: 0.76, 1.00) and a 15% lower risk of abdominal obesity (OR: 0.85; 95% CI: 0.76, 0.95) among adults with the highest dairy intake.

Evidence suggests dairy may promote a healthier body composition. Analysis of 37 short-term RCTs reported minimal impact on BMI, but higher dairy intake reduced body fat (-0.23 kg) and increased lean mass (0.37 kg), especially in energy-restricted diets.²⁴⁸ With the growing use of GLP-1 medications for weight loss, dairy foods such as milk, yogurt and cheese may help preserve lean body mass and provide a nutrient-dense, affordable option for those with suppressed appetite. Recent nutrition guidance supporting GLP-1 therapy for obesity highlights dairy as a dietary factor to help maintain nutritional health.²⁴⁹

High-quality protein intake, from both animal and plant sources, supports weight management by reducing fat mass and maintaining muscle mass.²⁵⁰ Plant proteins improve lipid profile, insulin sensitivity and gut health, while animal proteins offer bioavailable essential amino acids that preserve muscle mass, notably, leucine, abundant in dairy, which stimulates muscle growth and may help prevent obesity. Dairy proteins such as whey and casein also enhance satiety, aiding weight loss.²⁵¹ Although vegan diets show the greatest weight loss, semi-vegetarian diets also lead to significant and sustained reductions in body weight.²⁵⁰

Recent randomised controlled trials

Analysis of 13 articles by Hong et al. (2021)²⁵² found dairy intake reduced fat mass and BMI in overweight or obese adults, though no significant changes were seen with body weight or waist circumference, possibly due to calcium from dairy inhibiting fat absorption.²⁵² Onvani et al. (2021)²⁵³ reported that consuming over 500 ml a day of milk or yogurt increased satiety and decreased energy intake at the next meal, but a 12-week RCT found no long-term effect on appetite.²⁵⁴

Fermented dairy

The type of dairy product matters for weight management, with evidence suggesting yogurt, especially high-fat and fermented varieties, shows the most benefit.^{247, 255} A recent meta-analysis of five cohort studies found moderate to high consumption of high-fat fermented yogurt may reduce abdominal obesity risk in adults, with 16% lower risk at eight servings per week, and 63% lower risk at 21 servings a week, though no benefits were seen with intakes below eight servings a week.²⁵⁶ High-fat yogurt may promote greater satiety, helping control hunger and overeating. Fatty acids, such as

pentadecanoic acid in full-fat dairy, are linked to less abdominal fat and may influence metabolism. In contrast, low-fat fermented dairy often contains added sugars to improve taste, which can offset potential benefits.²⁵⁶

Multiple cohort studies show yogurt intake is linked to lower obesity risk. A meta-analysis of 42 cohort studies by Feng et al. (2022)¹⁸⁸ found a 13% reduction in overweight and obesity risk per 50 g increment in yogurt intake. Similarly, analysis of 22 cohort studies by Schwingshackl et al. (2016)²⁴⁷ reported lower body weight and waist circumference with higher yogurt consumption. Savaiano and Hutkins (2021)²⁵⁷ also concluded yogurt and fermented milk had neutral or favourable outcomes on weight and body composition. However, evidence in children is limited, with Babio et al. (2022)²³⁸ finding no association between yogurt intake and overweight or obesity risk among children and adolescents.

The protective effects of fermented dairy on obesity may stem from its higher nutrient bioavailability (e.g. calcium), compared with other dairy products,¹⁸⁸ as well as slower gastric emptying and appetite-suppressing properties. Short-chain fatty acids may increase satiety, while anti-inflammatory effects could help regulate body weight.²⁵⁶

Summary of research findings for dairy and weight

Overall, the research suggests dairy may help support a healthy weight, though findings are inconsistent. Observational studies generally report neutral or protective effects, with milk, irrespective of fat content, not linked to increased adiposity, and whole milk potentially reducing obesity risk in children. Fermented dairy, specifically high-fat yogurt, appears most effective in reducing the risk of overweight or obesity.

Dairy provides high-quality protein, fat and calcium, which may support healthier weight and body composition by reducing fat, preserving lean mass and enhancing satiety. Protein quality, not just quantity, is key in preventing overweight and obesity. Animal and plant-based proteins offer complementary benefits for healthy weight control. Overall, the evidence indicates that including dairy, particularly as part of an energy-restricted diet, can help maintain a healthier weight and body composition.

Type 2 diabetes (T2D)

Type 2 diabetes (T2D) is currently the eighth leading cause of global disease burden and is projected to become the second by 2050.²⁵⁸ It arises when insulin production is insufficient or when the body becomes resistant to insulin, resulting in elevated blood sugar levels. The condition often develops gradually, with subtle symptoms that delay diagnosis.²⁵⁸ In the UK, around 6.3 million people are at an increased risk of T2D, with 1.3 million living undiagnosed. This brings the total number of individuals affected by diabetes or prediabetes to an estimated 12.1 million.²⁵⁹ Concerningly, rates of T2D are rising among adults under 40 years old and increasingly among children and young adults largely, driven by obesity.²⁵⁸

Key risk factors for T2D include excess body weight, older age, physical inactivity, ethnicity and a family history.²⁵⁸ Metabolic syndrome, characterised by abdominal obesity, dyslipidaemia (abnormal blood lipid levels), elevated blood pressure and insulin resistance, raises the risk further.²⁶⁰

Lifestyle interventions, particularly dietary improvements and increased physical activity, are effective in preventing and managing T2D.^{258–259} If left unmanaged, the condition can lead to serious damage to the cardiovascular system, blood vessels and organs. In the UK, diabetes contributes weekly to over 190 amputations, 770 strokes, 590 heart attacks and more than 2,300 cases of heart failure.²⁶¹

Dairy in relation to T2D

Dairy may lower the risk of T2D by improving blood sugar control and reducing abdominal obesity and waist circumference. Beneficial components of dairy include dairy proteins (and specific amino acids), specific fats (medium-chain, odd-chain saturated, unsaturated, branched-chain and natural *trans* fats), calcium, vitamin K and probiotics. Processing methods such as homogenisation and fermentation may also contribute to dairy's protective effect. However, further research is needed to clarify these mechanisms.^{188, 262}

The following section reviews recent evidence from umbrella reviews, meta-analyses and RCTs.

Umbrella reviews of observational studies

Milk (up to 500 ml a day) and yogurt, particularly low-fat varieties, are associated with lower T2D risk, though overall dairy intake shows no consistent link. Diets rich in whole grains, fruits and vegetables appear protective, while high consumption of sugar-sweetened beverages and red or processed meats increases T2D risk.²⁶³

Well-established dietary patterns, such as the Mediterranean and DASH diets, reduce the risk of T2D. The Mediterranean diet includes low to moderate dairy intake (mainly cheese and yogurt),^{263–264} while the DASH diet emphasises 2–3 daily servings of low-fat dairy, alongside fruits, vegetables, whole grains, nuts and legumes.²⁶⁵

Evidence from the Nordic Nutrition Recommendations and other reviews suggests that low-fat dairy, yogurt and cheese are associated with lower risk of T2D and improved insulin sensitivity.^{15, 173}

Another umbrella review²⁶⁶ reported that moderate dairy intake, particularly low-fat milk (200 g a day) and low-fat yogurt (100 g a day), was associated with reduced T2D risk, while no benefit was observed for full-fat dairy or cheese. The authors suggest that nutrients in dairy, such as calcium, vitamin D, proteins and probiotics, may contribute to these beneficial effects by supporting glucose metabolism, regulating post-meal blood sugar levels and improving insulin sensitivity.²⁶⁶

High cheese intake has been associated with a 7% reduction in T2D risk (RR: 0.93; 95% CI: 0.88, 0.98), although no link was found with prediabetes or metabolic syndrome.¹⁷⁷ Higher intakes of low-fat dairy and yogurt are consistently linked to reduced T2D risk. Toi et al.²⁶⁷ Toi et al. (2020) found each additional 200 g/day of dairy and low-fat dairy lowered risk, with significant benefits from cheese and yogurt, but no association for high intakes of milk or high-fat dairy. Similarly, Alvarez-Bueno et al. (2019)²⁶⁸ reported protective effects for low-fat dairy and yogurt (80–125 g a day), with only a modest benefit from cheese and none from high-fat dairy.

Recent observational research (systematic reviews and meta-analyses of observational studies)

Changing intake of one food group is inevitably accompanied by changes in intake of others, which can influence disease risk. Substituting low-fat dairy with red meat (unprocessed or processed) was associated with a higher risk of T2D, while swaps with whole grains, nuts, or whole milk with low-fat milk show no impact.¹⁸⁴

Cohort analyses also suggest that dairy, regardless of fat content, does not elevate prediabetes risk. Moderate protective effects were seen for total dairy, cheese and high-fat cheese. However, no associations were found with milk or yogurt, regardless of their fat content, and prediabetes risk.²⁶⁹

A meta-analysis of 20 cohort studies by Feng et al. (2022)¹⁸⁸ found that each additional 200 g/day intake of total dairy was associated with a 3% lower risk for T2D (RR: 0.97; 95% CI: 0.95, 0.99), with a borderline protective effect with low-fat dairy (RR: 0.96; 95% CI: 0.92, 1.00), but no association with high-fat dairy. Higher yogurt intake (per 50 g a day) was associated with a 7% reduced risk (RR: 0.93; 95% CI: 0.89, 0.97), while milk and cheese showed no effect.

Observational studies also show that fermented dairy, particularly yogurt, is linked to a 14–17% lower risk of T2D respectively (RR: 0.86; 95% CI: 0.83–0.90)²⁷⁰ (OR: 0.83; 95% CI: 0.73, 0.94),²⁷¹ though this may partly reflect healthier behaviours among yogurt consumers.²⁷²

Interestingly, fermented milk and yogurt are consistently linked to reduced risk of T2D and metabolic syndrome.²⁵⁷ Similarly, analysis of prospective cohort studies reported yogurt intake was associated with a 27% lower T2D risk (RR: 0.72; 95% CI: 0.70, 0.76) and a 20% reduction in development of metabolic syndrome (RR: 0.80; 95% CI: 0.74, 0.87).²⁷³ In contrast, cheese intake was associated with a 24% higher risk of T2D (RR: 1.24; 95% CI: 1.03, 1.49).²⁷³

Analysis of observational studies by Lee et al. (2018)²⁶⁰ found that milk (200 g a day) was linked to a 12% lower risk of abdominal obesity and yogurt (100 g a day) to a 16% lower risk of hyperglycaemia (high blood sugar). Comparing the highest versus lowest intakes, total dairy intake was associated with a 25% reduced risk of metabolic syndrome, with milk reducing the risk by 22% and yogurt 23%.²⁶⁰ Supporting this, Godos et al. (2020)¹⁷³ identified milk as having the strongest evidence for reducing metabolic syndrome risk.

Sex-specific differences have also been found to influence the impact of dairy intake on T2D risk. One study found a 13% reduced risk in women, but no effect in men.²⁷⁴ Hormone changes in women were suggested to partly explain the protective effect, though no difference was observed between pre- and post-menopausal women.²⁷⁴ Differences in fat distribution, visceral fat in men, which increases metabolic risk, versus subcutaneous fat in women, which is more sensitive to insulin and protective against T2D, may play a role. There is evidence to suggest that dairy protein potentially supports healthier fat distribution and reduces risk of T2D in women.²⁷⁴

Building on these sex-specific findings, dietary protein source also appears to influence T2D risk. Fan et al. (2019)²⁷⁵ reported that milk intake of 200 g a day reduced risk by 9%, while yogurt showed consistent benefits at all intake levels, most notably a 17% reduction in T2D when consumed at 60 g a day. Cheese intake had a borderline effect but showed significant effects in women. It was concluded

that replacing red and processed meat with plant protein or yogurt was associated with a lower risk of T2D.²⁷⁵

Recent randomised controlled trials

Evidence from RCTs by Sochoł et al. (2019)²⁷⁶ supports observational findings that dairy may help prevent T2D, particularly in those at risk. A meta-analysis of 30 trials showed that low-fat dairy improved body weight, waist circumference and insulin sensitivity.

An eight-week RCT found that full-fat yogurt improved blood glucose in adults with prediabetes,²⁷⁷ while no effect was seen in participants with long-standing T2D regardless of fat content,²⁷⁸ suggesting benefits may be limited to earlier disease stages of T2D.²⁷⁹

In March 2024, the United States Food and Drug Administration approved a new qualified health claim stating that regular yogurt consumption, of at least two cups (three servings) per week, may reduce T2D risk, according to limited scientific evidence. The claim applies to all yogurt types, regardless of fat or sugar content, and was supported by 28 observational studies.^{280–281} Unlike an authorised health claim, which requires strong consensus and robust scientific evidence, a qualified health claim reflects credible, but not conclusive, evidence and must include disclaimers to communicate this uncertainty to consumers.

Summary of research findings for dairy and T2D

Overall, evidence suggests dairy, particularly moderate intakes of low-fat dairy and yogurt, may help reduce T2D risk. Total dairy, milk and yogurt show favourable effects on metabolic syndrome, while findings on cheese are mixed, but generally neutral or modestly protective against T2D risk.

Yogurt appears especially beneficial for lowering the risk of T2D, possibly due to probiotics and bioactive compounds in fermented dairy that support gut health and improve insulin sensitivity, though it is important to note that these favourable effects could also partly reflect healthier lifestyles of yogurt consumers.

Evidence from RCTs supports the observational studies that dairy, especially low-fat dairy and yogurt, protects against T2D, particularly in those at risk. Further research is needed to clarify the effects of different dairy types on T2D risk across the diverse population groups.

Gut health

Gut health and dairy

The bacteria in our gut (gut microbiome) play an important role in our overall health and are constantly evolving based on our diet, lifestyle, hormones and underlying disease.²⁸² When the natural balance of the gut is disturbed, a condition known as dysbiosis can cause digestive problems, inflammation, weakened immunity, mental health effects and chronic disease. Gut dysbiosis is characterised by a loss of beneficial and an increase in harmful microbes and a loss of diversity. Diet is the most influential factor in shaping the gut microbiome,²⁸³ yet the specific effects of dairy consumption remain unclear.²⁸⁴

This section reviews recent evidence from systematic reviews of observational studies and RCTs, as well as observational and randomised cross-over studies.

Milk and dairy in relation to gut health

A systematic review of seven RCTs by Aslam et al. (2020)²⁸⁴ reported that fermented dairy products including yogurt and kefir increased levels of beneficial probiotic bacteria such as *Lactobacillus* and *Bifidobacterium*. One RCT showed that yogurt reduced *Bacteroides fragilis*, a pathogenic bacterial strain. Only one of the included RCTs assessed milk intake, which increased abundance of beneficial *Lactobacillus* and *Bifidobacterium* but lowered overall bacterial diversity. The review also reported that whey and casein isolate, as well as the amount of dairy consumed, had no significant effect on gut microbiota composition.²⁸⁴

Newer studies suggest that lactose may act like a prebiotic, stimulating growth of beneficial bacteria, reducing harmful ones and increasing health-promoting short-chain fatty acids (SCFAs).^{83, 285} However, more clinical trials are needed to confirm these effects.⁸³

Fermented dairy and gut health

Fermented dairy foods such as yogurt and kefir are the most common dietary sources of probiotics, delivering beneficial bacteria that support gut health.²⁸⁶ These products are made by fermenting milk with specific bacteria that convert a component of lactose into lactic acid.²⁸³ Fermentation can enhance the nutritional quality of dairy by providing probiotics, prebiotics (substrates that feed beneficial gut microbes) and other bioactive compounds that support gut health and microbial diversity.²⁸⁷ The structure of fermented milk also helps protect probiotics as they go through the digestive system.^{283, 286}

A systematic review by Savaiano et al. (2021)²⁵⁷ found consistent benefits of fermented milk consumption for gastrointestinal health. More recent evidence supports this²⁸⁷ by showing that fermented dairy foods can help correct gut microbial dysbiosis and ease symptoms in individuals with gastrointestinal disease.

The strongest evidence for the health benefits of fermented dairy foods is their ability to improve lactose digestion and tolerance. Both the UK and EU have an approved health claim that 'live yogurt cultures can improve digestion of yogurt lactose in individuals with lactose maldigestion'.^{36, 288} To carry this health claim, yogurts must contain at least 10⁸ CFU (colony-forming units) of live *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* per gram. Given the growing evidence and international interest, recommendations to include fermented dairy in national dietary guidelines may be warranted.²⁵⁷

Recent observational and randomised cross-over studies

A recent cross-sectional study of 34 older adults²⁸⁹ found that higher milk and dairy consumption increases the levels of beneficial gut bacteria, including *Akkermansia* and *Faecalibacterium*. *Akkermansia* may help with weight regulation,²⁹⁰ while low levels of *Faecalibacterium* are associated with increased risk of inflammatory bowel disease.²⁸⁹ Both bacteria play key roles in immune-related disease.²⁹¹ The Chen et al. (2025)²⁸⁹ study also found that higher total dairy and cheese intake was associated with lower levels of *Bacteroides*, though evidence is conflicting as to whether this bacteria is beneficial or detrimental to health.

Similarly, a cross-sectional study of 130 healthy individuals found that natural yogurt intake was associated with higher faecal levels of *Akkermansia*, while sweetened yogurt intake was linked to lower levels of *Bacteroides*.²⁹⁰ Data from the UK Twins cohort showed that yogurt consumption was associated with a healthier diet and a temporary increase in yogurt-related bacteria, such as *Streptococcus thermophilus* and *Bifidobacterium animalis* subsp. *lactis*.²⁹²

A randomised cross-over study of 46 overweight middle-aged adults examined the impact of a high-dairy diet on gut bacteria.²⁹³ While overall microbial diversity didn't change, the high-dairy diet reduced specific butyrate-producing bacteria and increased *S. thermophilus*, likely due to higher yogurt intake. Butyrate is a beneficial SCFA that supports gut health. The high-dairy diet included six portions of dairy for men and five for women, with at least two portions of yogurt and one of cheese, compared with only one portion of dairy consumed on the low-dairy diet. Eight participants developed constipation while consuming the high-dairy diet, likely due to the lower fibre intake and reduced butyrate levels, which reduce motility in the colon.²⁹³

Summary of the evidence on dairy and gut health

Diet is the main factor influencing the gut microbiome, though specific effects of dairy remain unclear. Lactose may act as a prebiotic, promoting a healthy balance of gut microbes and the production of beneficial SCFAs. Fermented dairy is the most common dietary source of probiotics and has shown beneficial effects on gastrointestinal health, especially in those with gastrointestinal disease. The strongest evidence is for fermented dairy in improving lactose digestion and tolerance, which underpins an approved health claim in the EU and UK.

Glossary

Bone mineral content (BMC) Dual-energy X-ray absorptiometry (DXA) measures the BMC of the spine, hip, wrist, femur or any other selected part of the skeleton. It does this by focusing an X-ray on a body site and measuring the proportion of light rays that pass through the tissue as opposed to being blocked by minerals in the bone. Using computer software, it then divides that number by the surface area of the bone being measured to create BMD.

Bone mineral density (BMD) refers to the amount of mineral matter per square centimetre of bone. BMD is used as a predictor of osteoporosis and fracture risk.

Confounding factor is a variable that influences both the exposure (risk factor) and the outcome in a study, making it hard to determine whether the observed relationship is real or due to this third factor.

Disaccharides are two monosaccharides bonded chemically, like lactose (in dairy), sucrose (in sugar beet and cane sugar) or maltose (in molasses and beer). (See also monosaccharides.)

Estrogen-receptor positive or negative refers to the type of hormone receptors (proteins) found in or on breast or other cells that respond to circulating hormones and influence cell structure or function. A cancer is called estrogen-receptor positive (ER+) if it has receptors for oestrogen, and estrogen-receptor negative (ER-) if it doesn't.

Free sugars include all added sugars in any form; all sugars naturally present in fruit and vegetable juices, purées and pastes and similar products in which the structure has been broken down; all sugars in drinks (except for dairy-based drinks); and lactose and galactose added as ingredients. The sugars naturally present in milk and dairy products, fresh and most types of processed fruit and vegetables and in cereal grains, nuts and seeds are excluded from the definition.

Glycaemic Index (GI) is the measurement of how quickly a carbohydrate food will make your blood glucose levels rise after ingesting it. The higher the GI, the faster the impact.

Insulin-like growth factor (IGF) is a protein that interacts with cells, causing a cascade of chemical reactions in the cell that result in cell growth and multiplication. There are different types of IGF proteins that play different roles in this process.

Lactose intolerance is the occurrence of symptoms such as abdominal pain, bloating or diarrhoea in individuals with lactose malabsorption after ingestion of lactose.

Lactose malabsorption refers to any cause of failure to digest and/or absorb lactose in the small intestine.

Lower reference nutrient intake (LRNI) is the amount of a nutrient that is enough for only a small number of people in a group who have low requirements (2.5%), i.e. the majority need more.

Menopause is the time when periods stop as a result of the reduction and loss of ovarian reproductive function.

Metabolic syndrome is a group of conditions (e.g. high blood glucose, high blood pressure, high triglycerides, low HDL cholesterol and abdominal obesity) that raise the risk of heart disease, diabetes and stroke.

Milk fat globule membranes (MFGMs) are complex microstructures that enclose and protect milk fats in a layered membrane that controls the speed the fat is digested.

Monosaccharides are carbohydrates in their most basic form, i.e. glucose (e.g. in grains and pasta), fructose (e.g. in fruit, vegetables and honey) and galactose (in dairy).

Parathyroid hormone (PTH) maintains calcium balance in the circulation by promoting the resorption of minerals such as calcium from the bone in response to low blood concentrations of calcium.

Perimenopause is the time when a woman's hormones start to change in preparation for menopause and periods become irregular. It includes the time from the onset of the menopausal symptoms and the first year after menopause.

Post-menopause is the time after menopause when a woman hasn't had a period for over a year.

Prebiotic is a substrate that is selectively utilised by host micro-organisms conferring a health benefit.

Prediabetes is when higher than normal blood sugar levels can be detected via blood tests, which increases the risk of being diagnosed with type 2 diabetes.

Probiotics are live microorganisms which when administered in adequate amounts confer a health benefit on the host, and a general benefit could either be by supporting a healthy digestive tract or a healthy immune system.

Prostate is a walnut-sized gland in men that surrounds the top of the urethra just below the bladder outlet. The prostate makes the fluid that protects the urethra, and male hormones, such as testosterone, control its growth and function.

Reference nutrient intake (RNI) is the amount of a nutrient that is enough to ensure that the needs of nearly all a group (97.5%) are being met.

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Section 2: Environment

Farming practices and sustainable dairy production in the UK

Summary points

- Agriculture plays a dual role in climate change, being both a source of greenhouse gas (GHG) emissions and a provider of carbon sequestration and storage. Current reporting at a national level separates these elements, giving an incomplete picture. A whole-farm approach is needed so that net emissions and sequestration are consistently reflected in national inventories and product footprinting
- The UK dairy sector is often compared against global averages, but this is misleading. UK dairy systems are considerably more efficient than many international systems, and global averages overstate the UK footprint
- Agriculture contributed 12% of UK emissions in 2023 (UK GHG National Inventory), but this masks important nuances. Sequestration and renewable energy generated on farms are accounted for elsewhere in the inventory. In addition, the inventory equates all GHGs into carbon dioxide equivalents (CO₂e), whereas the majority of agriculture's emissions come from methane
- Milk production accounts for 2.8% of UK GHG emissions on a GWP100 basis, excluding any potential carbon sequestration.
- UK dairy farmers are already focused on producing nutritious food alongside adopting practices and technologies to reduce methane emissions, aligning with the Global Methane Pledge and the FAO's roadmap to zero hunger
- Methane is currently calculated using the GWP100 metric, which calculates methane's warming potential over a period of 100 years, whereas emerging science indicates that this is unsuitable. Methane is a short-lived gas, breaking down between 7 and 12 years, meaning that carbon emissions associated with agriculture are greatly reduced under the alternative metric, GWP*
- Emissions intensity of UK milk has fallen by 22% since 1990. Productivity has increased, with more milk now produced from fewer cows
- UK farms have some of the highest standards of animal health and welfare in the world, much of it being underpinned in legislation. There is a distinct correlation between maintaining high animal health and welfare and the reduction of carbon emissions due to the impact of productivity, with high animal health being a key driver in sustainable livestock systems. Advances in genetics are also enabling farmers to lower gross GHG emissions
- UK dairy cows are predominantly forage-fed, with purchased feeds forming only a supplementary part of their overall diet. The UK imports just 1% of global soya, with 62% already from low-deforestation sources in 2019 and a goal of reaching 100%

- 56% of UK farmland is permanent grassland, unsuitable for cropping but essential for grazing livestock and carbon sequestration. Converting existing grassland to arable land is not a straightforward solution, taking into account soil quality, topography, and unintended consequences, such as the release of carbon
- Farmers are adopting new land management practices, such as agroforestry, integrating trees and shrubs with grazing, using tree fodder where appropriate, and developing circular livestock systems that recycle nutrients, minimise waste and optimise outputs
- Farms play a central role in managing natural resources and ecosystem services. Most water used in UK dairy comes from rainfall (green) rather than mains supply (blue), and farmers are actively reducing pollutants to air and water, such as ammonia, nitrogen and phosphorus, while also supporting biodiversity
- The UK dairy sector has worked collaboratively across the supply chain to progress sustainability through the Dairy Roadmap since 2008. It remains committed to producing nutrient-dense food for a growing global population while maintaining and enhancing the natural environment

Introduction

Farmers provide one of life's most essential resources – food – but their contribution goes far beyond production. As custodians of 69% of the UK's land,¹ they play a vital role in delivering environmental services that are increasingly critical in both the mitigation of, and adaptation to, climate change.

These include:

- Managing water quality and flow
- Enhancing soil health and productivity
- Supporting biodiversity
- Sequestering and storing carbon in soils, trees, and other green infrastructure
- Adapting to a changing climate

In addition to their environmental role, livestock agriculture is a key economic contributor, with milk and milk products alone valued at £6.3 billion in 2024.¹

The UK's legally binding commitment to net zero by 2050² requires both significant reductions in greenhouse gas emissions alongside the removal of emissions. But sustainability is broader than emissions alone – it includes resource efficiency, waste reduction, nature recovery and carbon sequestration. Agriculture is uniquely positioned to influence all these areas.

This relationship with and influence on the natural world presents both a unique challenge and opportunity for agriculture, as while the UK legislation of reaching net zero by 2050 cements the need to dramatically reduce greenhouse gas emissions, it is also widely recognised that environmental sustainability is about more than reducing emissions alone. We must also make better use of natural resources, reduce waste, support nature recovery and, critically, remove more carbon from the

atmosphere and store in our soils, trees and other natural biomass. Agriculture is unique in that it has great influence on all these actions, especially the latter.

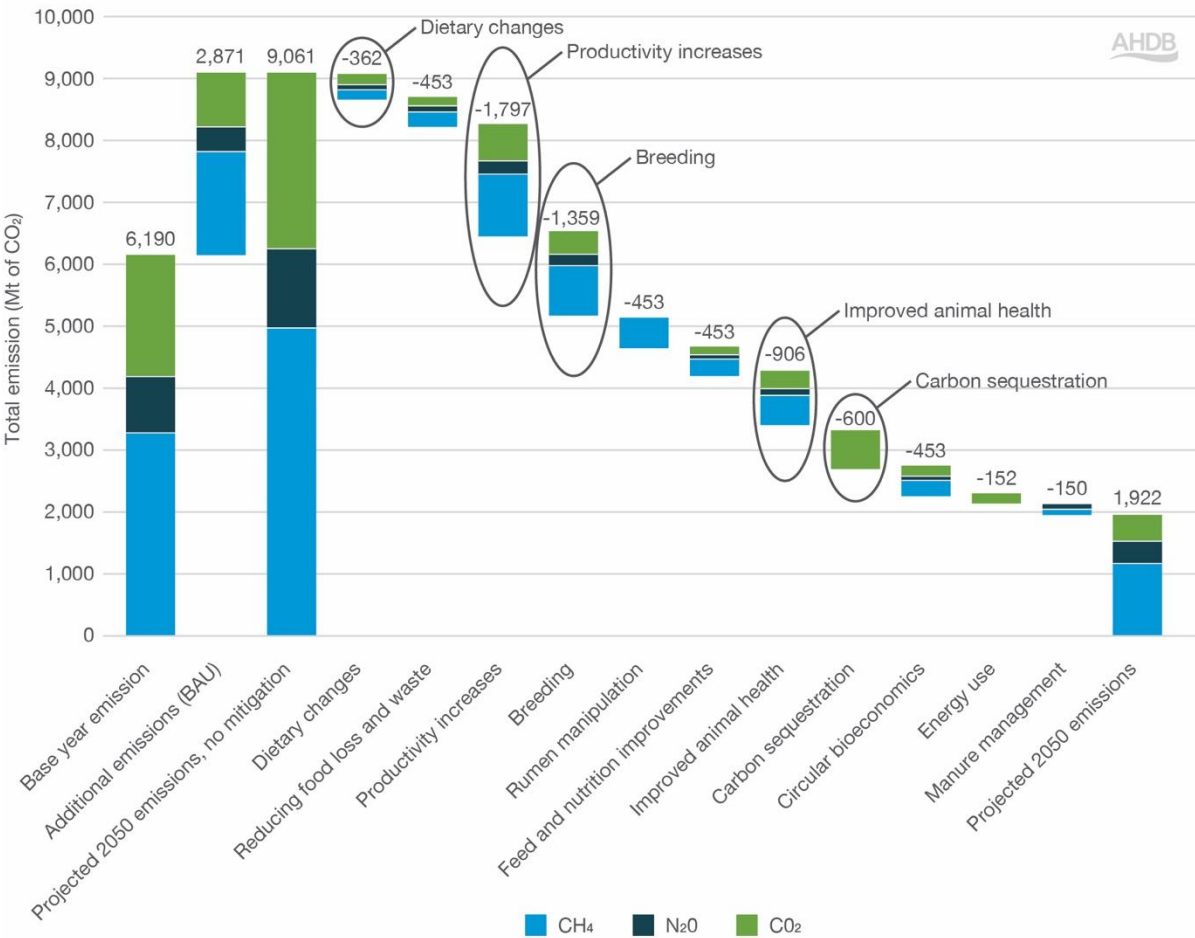
Government policy recognises this potential. The Net Zero Growth Plan² and Carbon Budget Delivery Plans³ outline measures such as agroforestry, cover crops and carbon audits to support farmers in reducing and sequestering emissions.

Contrary to popular belief, achieving a sustainable future does not necessarily require eating less meat and dairy. Livestock systems, when well-managed, can be circular and self-sustaining. In developed regions, improved efficiency can reduce animal numbers while maintaining output.

According to the FAO's Pathways towards lower emissions report, global livestock consumption is projected to increase by 20% by 2050, yet this can be achieved within the 1.5°C climate target through productivity gains, improved genetics and better animal health.⁴

With better data, informed consumer choices, and supportive policy, farming can continue to feed the population while restoring and protecting the natural environment.

Figure 1. Pathway to lower livestock emissions



Source: FAO 2023⁴

Consumers are increasingly considering the environmental footprint of their food choices. However, the data available to guide these decisions often lacks nuance and fails to reflect the complexity of agricultural systems. Common issues include:

- Use of global or regional averages to represent local products
- Comparisons across food categories with differing nutritional profiles
- Focus on single metrics such as a carbon footprint, ignoring biodiversity and water impacts
- Emphasis on gross emissions without accounting for carbon removals
- Aggregation of all greenhouse gases as CO₂e, disadvantaging methane-heavy sectors such as agriculture⁵
- Selective use of reports that omit counterevidence

British dairy farming has long been an essential part of the United Kingdom's agricultural landscape, producing milk, meat and other essential co-products alongside the delivery of ecosystem services. In recent decades, the sector has come under scrutiny for its environmental impact, but a closer examination reveals that British dairy farming demonstrates numerous aspects of sustainability. This analysis explores the multifaceted reasons why British dairy production can be considered environmentally sustainable, examining its unique climate and geography, farming practices, technological innovations and commitment to continuous improvement.

What are we already doing?

Summary points

- UK farmers are already focused on producing nutritious food alongside reducing environmental impact
- Agriculture was responsible for 12% of UK emissions in 2023,⁶ according to the UK GHG National Inventory. However, emissions for agriculture are more nuanced as sequestration and renewable energy generated from agriculture are accounted for in other parts of the inventory. The National Inventory equates all GHGs into carbon dioxide equivalents, whereas the majority of agriculture's emissions come from methane
- The production of milk is responsible for 2.8% of GHG emissions in the UK⁷ when calculated using GWP100 and excluding any potential carbon sequestration
- The agriculture sector is already embracing practices and technology to aid the reduction of methane emissions, with awareness of the Global Methane Pledge and the FAO's roadmap to zero hunger
- Methane is currently calculated using the GWP100 metric, which calculates methane's warming potential over a period of 100 years, whereas emerging science indicates that this is unsuitable, and that given it is a short-lived gas, it breaks down much quicker, between 7 and 12 years, meaning that carbon emissions associated with agriculture are greatly reduced under the alternative metric, GWP*

- Carbon emissions for dairy are often quoted using global averages, whereas the predominant systems adopted in the UK cannot be compared to other global systems, with global averages being higher than that of the UK.

The UK Dairy Roadmap is a long-standing, cross-industry initiative launched in 2008 to drive environmental sustainability across the entire dairy supply chain. Led by Dairy UK, the Agriculture and Horticulture Development Board (AHDB) and the National Farmers Union (NFU), the roadmap sets science-based targets in key areas such as water use, climate change, waste, biodiversity and air quality. It promotes collaboration between farmers, processors, retailers and foodservice providers to ensure shared responsibility for environmental progress. Notable achievements include a 20% improvement in water efficiency and a 22% reduction in emissions per litre of milk since 1990.⁸

In 2025, the roadmap entered a new phase with the formation of a unified governance structure and a new steering group comprising major industry players, including Arla, Müller, Tesco, and McDonald's, alongside the original custodians. This coalition aims to deliver a more resilient and sustainable dairy sector by aligning efforts across the value chain. A key output will be the Sustainable Dairy Pathways Report, due in 2026, which will identify the innovations and funding needed to meet net zero and other environmental goals.⁹

The roadmap also supports continuous improvement through benchmarking, data collection and the development of best-practice guidance. It has introduced new working groups focused on biodiversity and processor data and launched a dynamic online platform to share resources and track progress. With strong government backing and industry-wide commitment, the Dairy Roadmap is positioning the UK dairy sector as a global leader in sustainable food production.¹⁰

Progress in agriculture has been demonstrated via the 2023 Defra Farm Practices Survey, which showed that 62% of farms consider GHGs to be fairly/very important, - an increase from the 2019 figure of 55%. The main motivations were good business practice (83%) and concern for the environment (73%).¹¹

The Global Methane Pledge agreed at COP26 in 2021 entails a reduction target of at least 30% of global methane emissions from 2020 levels collectively across all sources, including agriculture (e.g. from enteric fermentation), by 2030.¹² The UK is one of 155 participating countries. Subsequently, at COP28, the FAO set milestones in its roadmap for zero hunger that included a target to reduce global methane emissions from the global livestock sector by 25% by 2030 compared with 2020 while increasing total factor productivity for livestock by 1.7% per year by 2050. This is in the context of a predicted increase in overall global meat consumption and greater production efficiencies.¹³

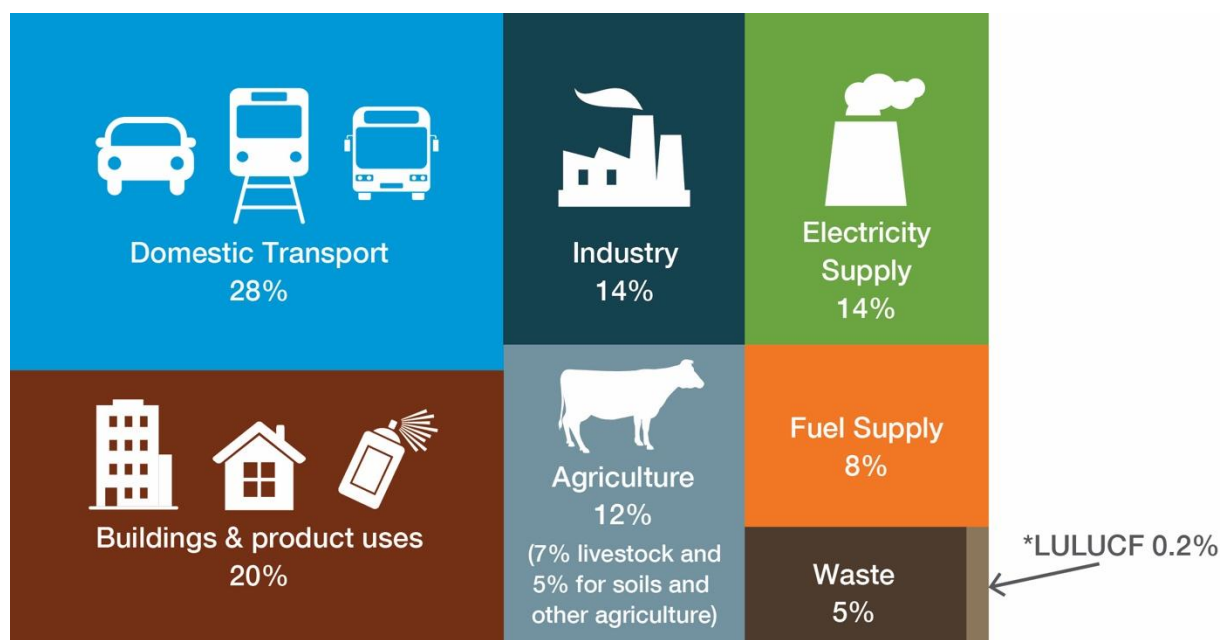
As part of the UK government's net-zero strategy, there is an ambition for 75% of farmers in England to be engaged in low-carbon practices by 2030, rising to 85% by 2035. Policy drivers here include the new sustainability and agri-environmental land management schemes in all nations of the UK.¹⁴

Accounting for GHGs of UK production

The UK's GHG National Inventory estimates that agriculture contributed 12% of national greenhouse gas emissions in 2022, with livestock responsible for about 7% of the total emissions (Figure 2).⁶ It is estimated that the production of milk accounts for 2.8% of total greenhouse gas emissions.⁷ Higher-emitting sectors include domestic transport (29%), buildings and product (20%), industry (14%) and electricity supply (11%).

However, the GHG National Inventory has limitations when assessing agriculture in its totality. Emissions are reported in sector silos and in CO₂e, but farms span multiple sectors and emit mainly non-CO₂ gases. The agriculture inventory only includes emissions from growing or rearing food and excludes land use changes or on-farm renewable energy generation - these are included in other inventories, meaning agriculture's gross emissions do not capture carbon sequestration or its contributions to renewable energy.

Figure 2. UK Greenhouse Gas Emissions (2023) by sector source⁶



LULUCF = Land Use, Land-Use Change, and Forestry

The main GHGs from agriculture are methane and nitrous oxide, and these comprise 58% and 27% of agricultural GHG emissions, respectively (based on GWP100 and CO₂e).⁶ The majority of agricultural methane in livestock agriculture arises from enteric fermentation, the by-product of a biological process of ruminants during digestion. Nitrous oxide predominantly comes from the application of manufactured fertilisers and manures to soils, either directly or indirectly.

All figures quoted in the GHG National Inventory use GWP100,¹⁵ - the most used global warming potential (GWP) value. It is used to compare different GHGs over 100 years and is expressed as carbon dioxide (CO₂) equivalents, or CO₂e.

GWP*¹¹ is a relatively new measure for calculating the impact of emissions of methane on the climate, taking account of the short-lived nature of methane and the rate of new emissions.¹⁶ The application of GWP*¹⁷ is currently nascent and evolving but better represents methane emissions from agriculture on global warming. Enteric fermentation-evolved methane is part of a biogenic carbon cycle, and when the methane is decomposed over a period of 7 to 12 years¹³ the resulting carbon dioxide is returned to the natural carbon cycle. This is different to other anthropogenic methane sources, such as mining and natural gas leaks which are not part of a natural carbon cycle – a point which has recently been recognised by the IPCC emission factors for biogenic and thermogenic methane.

In July 2023, 10 internationally recognised scientists, from eight of the UK's leading science institutes, published academic research in support of using GWP* as part of assessing climate impacts.¹⁸ The study highlights the necessity of reporting the climate impacts of food under multiple measures, over multiple time horizons and on individual GHGs, as well as collectively in CO₂ equivalents. This complexity is required to allow decision-makers to be fully informed, with more consideration to be given to broader sustainability issues, e.g. human health, agricultural resilience, nutritional complexities and global food security. The authors acknowledge that GWP* is a more accurate way of measuring the warming impact of methane and call for dual reporting, along with GWP100 at a national level, as a carbon auditing tool, on which debate continues.¹⁹

Global averages

When dairy carbon footprints are debated, it is often global footprints that are cited and the footprints for a single product are considered to be homogenous. It is important to acknowledge the variation between the systems in different countries, e.g. genetics and health, grazing and housing, as well as local factors, such as terrain, availability of resources (water, by-product feed) and climate. Thus, global averages are rarely representative of a UK product, and obtaining further life cycle assessments (LCA) based on primary local data to IPCC tier 3²⁰ standards in the future is imperative.

Table 1 shows the product carbon footprints for dairy (emissions intensity), encompassing global and UK footprints, as gross emissions only. Some comparisons are given in GWP* – these are expressed as CO₂we (carbon dioxide warming equivalents). The carbon footprint calculations do not include carbon sequestration or any other farm intervention to reduce emissions or capture carbon through net primary production or green energy (see Accounting for GHGs of UK production section).

Table 1. Dairy milk emissions per unit of output GWP 100 (kg CO₂e/kg FPC milk) and GWP* (kg CO₂we/kg FPC milk), excluding carbon sequestration.

Enterprise	Milk
UK: AgreCalc (2024) ^b kg CO ₂ e/kg FPC milk (GWP100, CO ₂ e)	1.33
UK: AgreCalc (2023) ^c kg CO ₂ e/kg FPC milk (GWP*, CO ₂ we)	0.59
UK: Poore and Nemecek (2018) ^a kg CO ₂ e/kg FPC milk (GWP100, CO ₂ e)	2.33
Global: Poore and Nemecek (2018) ^a kg CO ₂ e/kg FPC milk (GWP100, CO ₂ e)	2.69

^a From Poore and Nemecek data²¹; see also their study published in Science in 2018²² NB: there are limited number of data points in each respective data set and is more limited in the country data set. The system boundary of the P&N study is cradle-to-retail.

^c AgreCalc,²³ carbon and efficiency calculator; data from farms with applicable enterprises 2018–2022, AR4 GWP. Mean gross emissions only, emissions to farmgate as CO₂e/kg deadweight (dwt) and CO₂we/kg deadweight (dwt). The GWP* calculation is based on national emissions trends.

While the carbon footprint data provides an indicator for potential climate change impacts through global warming potential, it should not be viewed in isolation but considered alongside other environmental pressures and impacts to the ecosystem, such as effects on water quality and biodiversity.

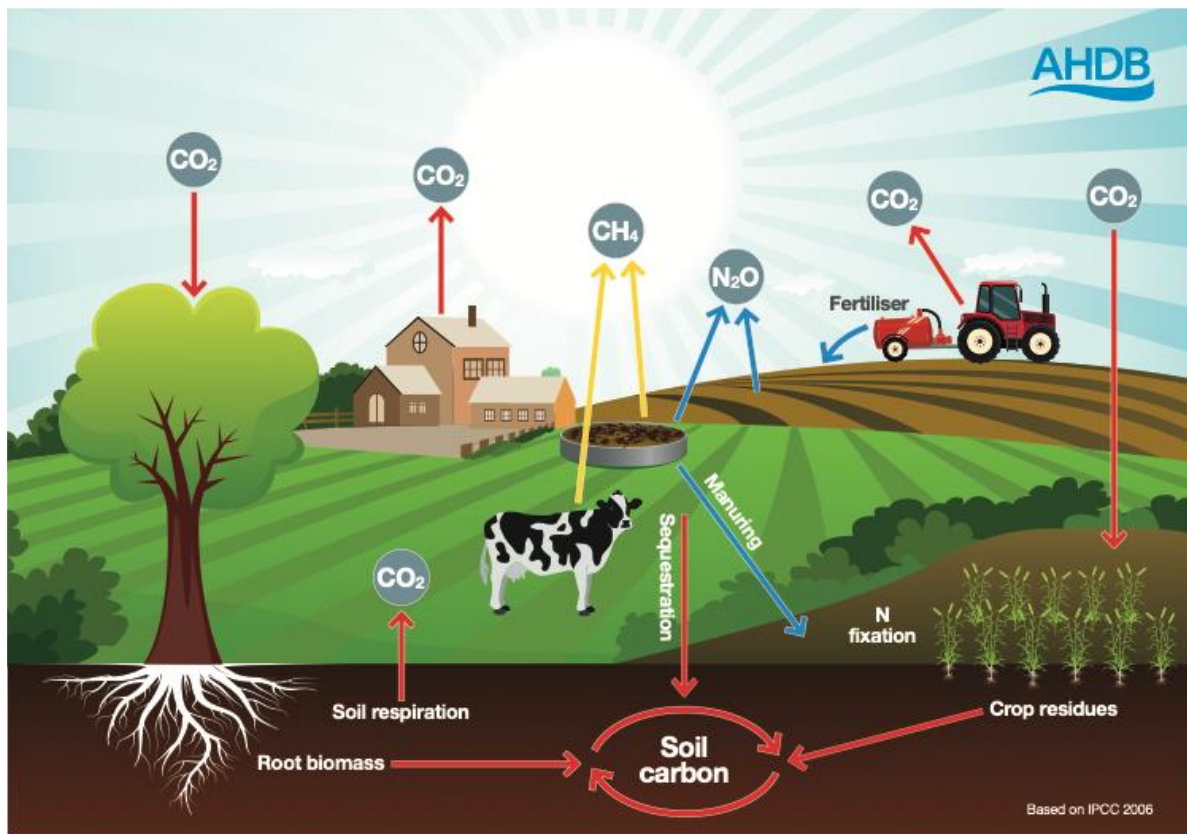
It is also worth noting that the UK dairy sector is advanced in its approach to calculating on-farm carbon emissions, with it being estimated that over 80% of dairy farmers have already calculated their carbon footprint and are working towards reducing their emissions.²⁴

Net zero, not gross zero

The journey to net zero began in Paris in 2015, where 196 parties of the UN Climate Change Convention agreed under section 1a to limit global warming to ideally 1.5°C (section 1b stating this needs to be done without reducing the planet's ability to produce food). To do this, emissions will need to reach net zero by 2050. A decade on and still the meaning of net zero is largely misunderstood. Net zero is defined in science and law and does not mean zero emissions – zero would mean no animals and no humans on earth. Net zero is defined as where any GHG emissions are reduced as much as

possible, with any remaining emissions balanced by activities that remove the same amount from the atmosphere²⁵ (Figure 3).

Figure 3. Determining carbon balance (net zero GHG emissions) by analysing how agriculture interacts with the whole environment, including carbon removal and nature recovery



Despite this, emissions from agriculture are reported in gross emissions. Globally in 2023, agriculture accounted for 12%²⁶ of direct emissions - the same figure of 12%²⁷ of UK emissions. Critically missing from these figures is the other side of the equation – the removal and storage of carbon from the atmosphere. Agriculture covers almost half of the Earth's habitable land,²⁸ a patchwork of habitats and landscapes that, through the process of photosynthesis, the absorption of carbon dioxide and releasing of oxygen by plants, removes carbon from the atmosphere – known as carbon flux - and when this carbon is removed for an indefinite period, this is defined as sequestration.²⁹

Additionally, most farms are a complex integrated system, producing a diverse range of foods and other products and services. Reporting an individual food's carbon footprint often fails to acknowledge the considerable benefits from an integrated system, taking the simplest route and declaring the emissions of that food product and not the wider carbon impact and benefits of the whole farm business, with allocation usually associated with economic value.

To address this simplistic approach, and for UK agriculture to help deliver net zero by 2050, measuring and reporting on the balance of both GHG emissions and carbon removals as a singular net-carbon position is critical. This insight and knowledge will empower farmers to make the right

decisions for their landscapes and farming systems, as well as receive due recognition and reward. However, this all starts with a baseline.

Within agriculture, delivering net zero aligns to agriculture's unique position and ability to be circular, relying on the balancing of the following:

- Understanding where GHG emissions come from **and** how to reduce them
- Understanding where carbon stocks are in the landscape **and** how to increase them
- Displacing fossil fuel emissions by generating renewable energy **and** minimising methane emissions by optimising waste management

To understand this position, a nationwide measurement, or baseline, must be obtained, offering both transparency and integrity to the entire journey. To demonstrate accurate change, whether positive or negative, the baseline measurement must be repeated at least every five years, as carbon stocks in the landscape are not permanent and can both be increased and lost. AHDB is currently undertaking a pilot scheme on 170 farms across Great Britain to take such baselining measurements.

Livestock

Summary points

- UK dairy cattle are on a predominantly forage-based diet
- Emissions intensity for milk has declined by 22% since 1990
- UK dairy herds have increased their productivity by producing more milk from fewer cows
- UK farms have some of the highest levels of animal health and welfare in the world, much of it being underpinned in legislation
- There is a distinct correlation between maintaining high animal health and welfare and the reduction of carbon emissions, due to the impact of productivity, with high animal health being a key driver in sustainable livestock systems
- Genetics plays an important part in underpinning the sustainable production of dairy; genetic developments have accelerated over recent years, enabling farmers to reduce their gross GHG emissions

Dairy cows are ruminants with the ability to convert plant material that is indigestible by humans to nutrient-dense food and readily available micronutrients and return carbon to the soil through their manures.

Dairy cow diets in the UK are primarily forage-based, with grass and grass silage forming the main components, supplemented by concentrates and by products like barley, wheat and sugar beet, depending on the season and the cow's needs. Diets are balanced for energy and protein, with the goal of achieving high milk yields and maintaining cow health and reproduction.

The GHG emissions per litre of milk production or emissions intensity has decreased steadily since 1990, declining by -22% up until 2022. This can be attributed to a reduction in direct animal emissions of -13% diluted by an overall increase in milk production by 12%. Significant efforts in the sector have meant that efficiency gains in milk production have increased by 10% from 2000, with 21% fewer dairy cows and a 4% reduction in GHG emissions from dairy cows over the same period.²⁷

Of those farms with cattle (both beef and dairy), 87% used a mix of housed and grazing systems for their cattle, with 9% having a year-round grazing system, and 4% housing their cattle all year round.³⁰ Improved animal nutritional management and breeding programmes have produced better feed efficiencies. There will be variations within the UK due to a range of factors, such as calving system and manure management.

Animal health and welfare

The FAO highlights animal health as a key component to delivering sustainable livestock products.³¹ Optimal health and welfare is highly recognised by the UK dairy industry as being a key pillar of the long-term sustainability of the sector, understanding its importance to both economic and environmental viability. Clear ambitions around animal health and welfare are underpinned in the Dairy Roadmap.³²

Britain's dairy farms are widely recognised for proactive animal health and welfare practices. Robust farm assurance schemes – such as Red Tractor and RSPCA Assured – underpin these high standards, requiring farmers to maintain comprehensive herd health plans and exceeding baseline legal welfare requirements. Across the sector, producers are embracing proactive welfare strategies,³³ such as dedicated lameness management plans and rigorous mastitis control protocols.

The way in which farmers care for their herds is influenced by the farm's geographical location, the climate and surrounding landscape. On-farm practices are monitored by a number of professionals, such as vets, nutritionists and advisers.

Genetic developments

Breeding is another critical element of the FAO's pathway to lower livestock emissions, and the UK is at the forefront of genetic improvement for livestock farmers, particularly when it comes to dairy developments.

Genetic improvement and breeding practices in cattle can contribute to reducing livestock emissions via herd productivity and efficiency. Estimated breeding values (EBV) are used to value the genetic worth of animals using desirable traits such as milk yield.

Every year, the economic value of the genetic gain achieved by dairy farmers accumulates. In addition, a reduced level of greenhouse gases is achieved and is estimated to have been about 0.8% per year because of genetic improvement. AHDB's EnviroCow³⁴ is a further genetics tool to help farmers breed dairy cows for their environmental credentials. It incorporates cow lifespan, milk production, fertility and the ability to convert feed, which since its introduction has been re-estimated to

be now just over 1% per year. Genetic improvement is both permanent, and cumulative. The impact over a 20-year horizon is substantial.

Beef from dairy

Beef from the dairy herd is playing an increasingly important role in maintaining the UK's domestic beef supply. In 2024, over half of all cattle slaughtered in Great Britain were born to dairy dams, with dairy beef accounting for 37% of prime cattle aged 12–30 months.³⁵ The use of beef semen in dairy breeding has grown significantly, with dairy beef calf registrations increasing by 77% over the past decade.³⁶ This trend supports a more integrated and efficient livestock system, where dairy farms contribute meaningfully to both milk and meat production.

From a sustainability perspective, British beef – particularly from the dairy herd – is among the most environmentally efficient in the world. Beef from the dairy herd tends to have a lower carbon footprint to beef from the beef herd, due to the attributable emissions being split across both milk and meat and therefore the dam's emissions sitting separately.

Retailers and processors offer coordinated systems for dairy farmers, ensuring that beef from the dairy herd is utilised as part of a sustainable and integrated supply chain.

Land use

Summary points

- Dairy cows in the UK are not big consumers of purchased feeds, given that the majority of their diets are forage-based
- The UK imports approximately 1% of the world's total soya, with 90% of the UK imports being for animal feed³⁷
- In 2019, 62% of the soya imported to the UK was from sources at low risk of deforestation/conversion, with the eventual goal that this will be 100% in the coming years
- 56% of agricultural land in the UK is permanent grassland, unsuitable for growing anything else except grass³⁸
- Integrating grassland with grazing livestock has the potential to remove and sequester carbon, due to its extensive and diverse rooting system, twinned with the above-ground biomass
- Converting existing grassland to arable land is not a straightforward solution, taking into account soil quality, topography and unintended consequences, such as the release of carbon
- UK farmers are looking for other land management practices to integrate into their systems, such as the incorporation of trees and shrubs in agroforestry systems, enabling continued grazing alongside tree planting and the browsing of tree fodder where appropriate
- Livestock systems are the epitome of circular farming, enabling the careful use of by-products and nutrients to minimise waste and optimise output

Purchased feed

As outlined previously (see Livestock section), dairy cow diets are varied, with the majority of their composition made up from forage, with any concentrates fed forming a small proportion of the diet.

The largest association between livestock production and rainforest loss is the indirect impact from the cultivation of soya for livestock feed in South America. The expansion of land use for this purpose is detrimental to important regions of biological diversity.

In 2023, the UK annual soya bean usage across all livestock sectors was 2.37 Mt,³⁹ with the dairy sector using an annual average of 7.3% of soya bean in feed.³⁹ The UK's total net imports of both soya beans and cake represent less than 1% of the world's soya.³⁷

The total proportion of soya imported into the UK in 2019 considered to be from sources at low risk of deforestation/conversion or covered by a deforestation- and conversion-free certified soya standard totalled 62%.⁴⁰ The UK Roundtable on Sustainable Soya was established in 2018, with the goal of developing a secure and resilient supply of sustainable and deforestation-free soya to the UK. The

forum comprises over 30 members, including major supermarkets, processors, farming organisations, feed businesses, foodservice businesses and soya traders.

In addition, the UK Soy Manifesto⁴¹ is a collective industry commitment to verified deforestation- and conversion-free (vDCF) soya to be fully implemented immediately where possible and no later than 2025. It includes UK retailers and food processors representing 60% of UK soya consumption, as well as soya importers and the animal feed industry.

Grassland

Grazing is a key part of UK farming, and for many, management of livestock is integral to a way of life. It has shaped the national landscape and helps determine which plants form the dominant vegetation over large areas. The raising of livestock for milk optimises the management of the land and resources for both food production and ecosystem services, as well as being important for the rural economy, especially if the land is unsuitable for growing crops direct for human consumption. In the UK as of 2024, 56% of agricultural land is permanent grassland,⁴² which is unsuitable for growing any other crop other than grass.

It is not straightforward to simply replace established grasslands with arable land in order to produce food direct for human consumption and there are many complex challenges that need to be considered. For example, such a change in land use would release carbon, with a considerable loss of soil organic carbon (SOC) widely recorded. Also, the topography, for example the gradient, high flood risk or climate, e.g. humidity, may be unsuitable. It is estimated by the UK Met Office that in many grassland regions, the soil is at field capacity (i.e. the amount of soil moisture or water content held in soil after excess water has drained away) for more than 200 days per year, which is at least 90 days longer than major arable regions in the UK.

Agricultural land is classified in England and Wales using the Agricultural Land Classification (ALC) system, which provides a method for assessing the quality of farmland and its ability to be used for certain types of food production. The ALC system classifies land into five grades, with 1 being the best and 5 being the worst, with the best land being capable for cropping. Most grassland is at grade 4 and 5 and so would not be as productive as existing arable land if it were converted. This would have implications for sowing, agrochemical application and associated run-off and harvesting. It would also have subsequent effects on grain quality and therefore profitability. Furthermore, there may be practical considerations, such as the proximity to processing infrastructure in the supply chain and field access for 'large' machinery (e.g. combines down narrow country lanes and hedge-lined fields).⁴³

The introduction of species diversity within grassland, such as growing clover legumes in grass swards, has been shown to lead to a reduction in nitrous oxide emissions. Including multi-species mixtures of legumes and herbs in grassland can provide a range of agronomic and environmental benefits, including increased dry matter, improved animal performance, increased nitrogen use efficiency, weed suppression and greater resilience to drought.⁴⁴

Integrating grassland with grazing livestock has a high potential to remove and sequester carbon, owing to its extensive and diverse root system and high turnover of above-ground growth. There can be variability due to different management practices, such as sward composition, fertiliser inputs,

grazing management (reseeding and grazing or cutting), frequency of renovation and soil types.⁴⁵ Compared with arable and horticultural land, improved grassland holds 85% more carbon³⁶. Indeed, many studies have demonstrated the range of soil carbon stocks that can be accumulated below grassland. For instance, at a depth of 30 cm, carbon stocks range between 72 and 204 t C ha⁻¹, with a mean of 121 t C ha⁻¹ beneath pasture with natural grasslands.⁴⁶

Fertiliser inputs (manufactured and organic) in more intensive grassland systems can enhance carbon storage due to greater plant productivity, residue returns and root inputs to soil, although much of the extra productivity will also be removed as silage or animal biomass. Grazed grassland removes and sequesters more carbon than mown grassland due to the greater return of manure and nutrients. Furthermore, grazing alters the soil microbial community, which enhances the availability of substrate favouring carbon sequestration into the soil at depth³⁶.

Agroforestry

Farming systems may also incorporate agroforestry, where the land management combines agriculture and trees, hedges and shrubs. Livestock may be integrated with a grassland-based agroforestry system, known as silvopasture. As well as removing and sequestering carbon and encouraging biodiversity, the trees can provide shelter and shade for livestock in the face of drought and extreme rainfall events.⁴⁷ Silvopasture agroforestry comprises systems in which trees and/or shrubs are grown in grazed pasture. The Woodland Trust (2022)⁴⁸ has estimated that if silvopasture is established on 30% of grassland, UK net zero could be achieved in 2051. Moreover, by 2051, carbon sequestration was shown to exceed emissions for the entire UK grassland area, i.e. net negative. Whereas under a scenario where 50% of UK grassland is converted to silvopasture, based on 400 trees/ha, net zero is achieved seven years earlier, by 2044.

Circular farming

Livestock systems play a key part in circular farming through converting surplus arable and grass products into valuable food, fibre, pharma, energy and fertiliser. They can also influence soil organic carbon stocks, via manures or slurries, due to the range of carbon inputs and microbial functioning that can affect ecosystem services overall. Organic amendments can have profound effects on soil structure, soil chemistry and soil organisms (microbes and macrofauna) and have also been found to suppress soil pathogens and disease. Strategic management of animal manures can thus be a cost-effective way to increase soil organic matter content, stimulate soil biology, improve physical structure and ultimately improve crop yields. Though attention should be given to the application rate and timing, to minimise potential negative effects, such as nitrous oxide, ammonia and nutrient loss from soils. These are addressed by several regulations and good practice across the UK. A higher level of soil organic carbon (SOC) stock is associated with a better animal performance and less nutrient losses into watercourses.⁴⁹

It is estimated that 1 kg of plant-based food production generates at least 3–5 kg of crop material that is not suitable for human consumption but is suitable as feed for animal production.⁵⁰ Thus, there is a need for strategies to manage and recycle plant nutrients. In a given agricultural area, livestock

systems deliver high-quality food protein micronutrients and calories equivalent to 50–100% of primary plant-based food. In addition, livestock do not compete with humans for non-edible crop material.

Any losses in food production must be mitigated by maximising the feed efficiency of non-human edible material. Livestock has a central role in diverting what would be deemed waste from the food supply chain into animal feed, e.g. processing co-products from wheat,⁵¹ and therefore complementing production of plant-based food. Dairy cows play a valuable role in the circular economy by consuming food waste and co-products that would otherwise go unused. These include by-products from human food production, such as brewers' grains, bakery waste, citrus pulp and distillers' grains. By converting these materials into high-quality milk and meat, dairy cows help reduce overall food system waste and improve resource efficiency. This practice not only supports environmental sustainability by diverting waste from landfill but also reduces the need for conventional feed crops, lowering the carbon and water footprints of dairy farming. In the UK, this approach is increasingly recognised as a smart way to align livestock production with broader sustainability goals.

Waste and Resources Action Programme (WRAP) estimated that 660,000 tonnes of UK food waste (2016), both from retail and manufacture, were being used for animal feed – equivalent to 93% of the total food surplus.⁵² Analysis for 2025 suggested that 860,000 tonnes of food surplus could be suitable for use in animal feed, therefore redistributing what could be going to waste and helping to contribute to the UK Food and Drink Pact (formerly the [Courtauld Commitment](#)) – an industry collaboration and agreement to reduce food waste, GHG emissions and water stress⁵³.

Renewable energy

UK dairy farms are increasingly harnessing renewable energy as part of their sustainability efforts and to improve resilience against volatile energy costs. On-farm renewable energy generation encompasses technologies such as solar photovoltaics (PV), wind turbines, anaerobic digestion (AD), heat pumps and the use of green fuels (e.g. farm-produced biofuels or renewable electricity in farm equipment). These solutions allow dairy farms to reduce their carbon footprint and energy bills and sometimes create new income streams by exporting green energy. In recent years, the case for farm renewables has strengthened due to improved technology and supportive policies. As a result, adoption has grown, with official statistics showing that in 2023–24 about 32% of English farm businesses generated some form of renewable energy on-site.⁵⁴ This aligns with industry progress reports; for example, by 2018 an estimated 43% of British dairy farmers were producing or using renewable energy on their farms.⁵⁵

Solar photovoltaic (PV)

Solar photovoltaic panels are a well-established renewable energy option in UK agriculture and have proven particularly popular on dairy farms. Dairy operations have substantial electricity demands (for milking systems, milk cooling, water heating, lighting, etc.) which often align well with solar generation during daylight hours. Many farms have large roof areas on barns and sheds that can host solar panels. As of 2024, solar PV is by far the most widely adopted on-farm renewable – about 27% of English farms have solar panels installed (mostly roof-mounted).⁵⁴ Utilising solar directly lowers a farm's carbon footprint by displacing grid. A 50 kW system used on farm can avoid roughly 4–5 tonnes of CO₂ emissions per year (saving ~100 g CO₂/kWh vs grid power).⁵⁶

Wind turbines

Wind power is another renewable resource with potential on dairy farms, particularly in exposed, windy regions of the UK (e.g. South West England, Wales, Western Scotland). Onshore wind turbines can generate significant energy, often complementing solar PV (wind tends to blow more at night and in winter when solar is less available). In theory, a farm-scale turbine (50–250 kW) could produce enough electricity to supply a dairy farm and export surplus. However, uptake of wind turbines on UK farms has been much more limited than solar – government data shows only around 3% of farms nationally have any wind generation.⁵⁷ The key reasons are planning limitations both for size and location and grid constraints – wind turbines need to be connected to the national grid (for safety and export) and in rural areas grid capacity can be a limiting factor.

Anaerobic digestion (biogas)

Anaerobic digestion (AD) is a natural process that converts organic materials (like cattle slurry, manure and crop residues) into biogas – a methane-rich gas that can be used as a renewable fuel. AD offers a twofold environmental benefit for dairy farms: it captures methane that would otherwise escape from manure stores and produces usable energy (biogas) that can replace fossil fuels. The typical set-up on a dairy farm is an anaerobic digester tank where microbes break down the farm's slurry/manure (often supplemented by other feedstocks like silage, food waste or crop by-products) in the absence of oxygen. The resulting biogas can be burned in a combined heat and power (CHP) unit to generate electricity and heat or upgraded to biomethane and injected into the gas grid or used as vehicle fuel. The remaining digestate is a nutrient-rich fertiliser that can be applied to fields, recycling nutrients and reducing the need for synthetic fertilisers.

AD is highly effective but capital-intensive, so its adoption has been mostly on larger dairy farms or through cooperative projects. AD also requires a consistent feedstock and so is better suited to indoor dairy units where the cattle slurry can be consistently fed into the digester. As of the early 2020s, farm-based AD in the UK grew substantially from around 25 agricultural AD plants in 2010 to over 300 by 2020,⁵⁸ but grid connectivity continues to be a hurdle. AD plants exporting electricity require a grid connection capable of handling the output, and some farms have had to limit their generator size due to network constraints.

Heat pumps

Dairy farms also use substantial heat energy: primarily for heating water (for equipment wash-down, milk parlour cleaning) and sometimes for space heating (calf sheds, farmhouses, etc). Traditionally, this has meant using oil or gas boilers. Now, renewable heat technologies such as heat pumps and biomass boilers are being adopted to reduce fossil fuel use.

On a dairy farm, a heat pump can provide hot water for cleaning the milking system and bulk tank. Some dairy farms have installed ground-source heat pumps (with buried loops in fields) to exploit stable ground temperatures. Others use air-source units that draw ambient air. Solar thermal panels (roof-mounted collectors that heat water directly from sunlight) have also been used: a well-designed solar thermal system can meet most hot water needs in summer and save ~50% of water-heating costs over a year.⁵⁹ These systems significantly reduce oil or LPG consumption – cutting both costs and emissions.

Adoption of heat pumps on dairy farms is expected to grow as the UK moves towards phasing out oil heating for decarbonisation. The technology is proven, and, in some cases, dairy farms can cleverly integrate, using off-peak or surplus solar electricity to run a heat pump and store heat in a hot water tank, which is effectively a form of energy storage.

Heat recovery

Heat recovery from milk cooling is another important on-farm innovation. Modern milk refrigeration units often come with heat exchangers that reclaim the waste heat from cooling milk. This free heat can pre-heat water up to ~50°C, significantly reducing the energy needed to get it to full wash temperature. Many UK dairies have installed such plate heat recovery systems, cutting down on boiler run-time and saving energy.

Overall, similar to heat pumps, heat recovery systems do not generate electricity or fuel; they address the thermal side of farm energy use – an important part of the carbon footprint.

In conclusion, on-farm renewables directly cut GHG emissions by displacing fossil fuel use. Every kWh of solar or wind power used on the farm is a kWh not drawn from the grid (which, while getting greener, still has associated emissions) – this reduces CO₂ emissions. Anaerobic digestion has an even more dramatic GHG benefit by capturing methane that would naturally emanate from manure, in addition to displacing fossil fuels required for energy generation. Each cow produces methane from its manure; capturing that and utilising it can cut a farm's methane emissions by 50% or more (depending on how much manure is processed). Studies have estimated that widespread AD of livestock manures could reduce total agricultural GHG emissions by several percent; the Anaerobic Digestion and Bioresources Association (ADBA) suggests up to 6% of UK emissions could be avoided if all feasible AD were implemented.⁶⁰ Additionally, renewables often enable net emissions avoidance beyond the farm; if a farm exports green power to the grid, it helps decarbonise the broader electricity supply. Many dairy farms are approaching or achieving carbon neutrality in electricity – some even export more renewable electricity than the farm's own consumption, effectively offsetting others' emissions.

Natural resource management

Summary points

- Farms play a key role in managing natural resources and delivering ecosystem services
- It is important to differentiate between farming systems that utilise the majority of their water from direct rainfall (green) and those that rely on mains water (blue)
- UK dairy farmers are committed to reducing their total environmental impact by actively addressing risks around pollutants to air and water, such as ammonia, nitrogen, and phosphorus
- UK farmers play an important role in managing and enhancing biodiversity alongside producing nutritious food

Water

Water is a vital resource in dairy farming, both being consumed directly and indirectly, playing a central role in cow hydration, hygiene, milk cooling and feed production (both grass and concentrate feedstuffs). Dairy cows require large volumes of water daily to maintain health and productivity.

Effective water management is essential not only for animal welfare and milk quality but also for controlling operational costs and meeting sustainability targets. As water scarcity becomes an increasing concern, improving water efficiency across dairy operations is critical to building resilience and ensuring long-term viability.

Water issue can be divided into blue and green water. Blue water is that abstracted from rivers or groundwater or taken from mains water supplies. Green water is the rainwater used by growing plants (e.g. grass, forage and feed crops) as evapotranspiration at the place where the rain falls. In the UK, dairy farming tends to operate in the west of the country, where historically rain has been in abundance, ideal for grass growth. As a result, green water usage is not a sustainability issue.

In addition, the UK is not immune to the impacts of climate change, in particular changing weather patterns, including spells of drought and extreme rainfall. Nevertheless, the UK, although impacted, is believed to be impacted to a lesser degree than other countries globally. In particular, it is predicted that the UK will have warmer, wetter weather by mid-century,⁶¹ providing opportunities for UK farmers to harness water more effectively to mitigate during times of water scarcity.

Most dairy feed in Britain comes from rain-fed crops with no irrigation (i.e. blue water) used.⁶² A 2012 study concluded that about 99% of the water used in milk production is green water.⁶² Dairy farmers continue to both harness natural water sources and reduce the amount of water used in their systems through careful usage planning and recycling of water on farm where appropriate. The Dairy Roadmap incorporates targets for sector water usage.⁶³

The UK dairy sector is actively working to minimise and prevent water pollution through a combination of best practice, investment and strategic planning. One of the key initiatives is the Dairy Roadmap, a

cross-industry strategy. It sets ambitious targets for improving water quality, including optimising nutrient use, managing soils effectively and reducing diffuse pollution from fertilisers and manure. The roadmap encourages collaboration between farmers and processors and promotes science-based targets to ensure sustainable water management across the supply chain.⁶⁴

On the ground, many dairy farmers are implementing practical measures to reduce water pollution risks. These include improved slurry storage, nutrient management planning using tools like the Nutrient Management Guide (RB209).⁶⁵ and buffer zones to prevent run off into watercourses. The industry utilises research and international connections to explore new innovative approaches, such as learning from Dutch practices to reduce phosphate losses and research from Harper Adams University on mitigating nutrient contamination. These efforts are supported by educational resources and live events to share knowledge and encourage uptake of effective solutions.⁶⁶

Nitrogen is another critical component of our agricultural systems, with food production dependent on the cycling of nitrogen in the rural environment. However, nitrogen loss, either from livestock, manures or fertiliser application, can lead to issues when that loss is in gaseous forms such as nitrous oxide or ammonia, or through nitrates draining into run off water.

Nitrogen aids the growth of most plants but can also damage plant species that desire low nitrogen concentrations. These species then find themselves out-competed by the species that can utilise nitrogen more effectively, leading to biodiversity loss, soil acidification and changes in ecosystem structure and function.

Soil nutrient balances estimate the annual nutrient loadings of nitrogen and phosphorus to agricultural soil. These indicate the potential risk of losses of nutrients to the environment, which can affect air and water quality, e.g. eutrophication, as well as climate change. The UK nitrogen and phosphorus balances in 2022 were the lowest observed since 2000, thought to be brought about by lower inputs from inorganic fertilisers because of high prices. However, nitrogen and phosphorus from manure does contribute to eutrophication. Thus, reducing the excretion of nitrogen and phosphorus is of utmost importance.

In 2023, over two-thirds (69%) of livestock farmers routinely tried to keep livestock out of watercourses and this has risen steadily since 2019.⁵ Nitrogen and phosphorus inputs have decreased across the following livestock sources between 2000 and 2022 (See Table 2).

Table 2. Nitrogen and phosphorus input changes for UK, 2000–2022⁶⁷

Total inputs associated	Nitrogen (% change in thousand tonnes of N)	Phosphorus (% change in thousand tonnes of P)
Cattle	-18	-18

These decreases have resulted from reductions in the application of both inorganic manufactured fertiliser and cattle manure.

Air

Ammonia is inherently produced from the amalgamation and breakdown of livestock urine, faeces and nitrogen fertilisers. Emissions from agriculture accounted for 87% of total ammonia emissions in 2022 and have decreased by 17.4% since 1990, and by 2.6% since 2005. Furthermore, 67% of the agricultural ammonia emissions are from livestock, with a further 18% coming from fertiliser application⁵³.

A significant amount of UK agricultural ammonia emissions is in low concentrations and is not harmful to human health. However, ammonia can react with other compounds in the air to form secondary particulate matter and can pose a risk to people's health and sensitive habitats. Measures to reduce ammonia will have direct environmental benefits.⁶⁸ The Government is committed to a 16% reduction in ammonia emissions by 2030 (2005 baseline).⁶⁹

Farmers have been reducing ammonia emissions, for instance by using protein more efficiently in the diet, frequent cleaning of livestock areas (e.g. automatic scrapers), covering slurry stores, using low-emission spreading techniques and carefully managing any urea-based fertiliser. In the 2023 Defra Farm Practices Survey,¹¹ 53% of farmers stated that they were improving efficiency in manure/slurry management and application. The number of livestock farmers planning to enlarge, upgrade or reconstruct their manure or slurry storage facilities has risen steadily from 14% in 2019⁷⁰ to 22% in 2023. Of these, 71% are planning to make these changes within at least three years, while 89% have at least four months' slurry (the amalgamation of livestock urine and faeces) storage capacity and 49% have seven or more months' slurry storage capacity.¹¹

Farmers are also embracing nature-based solutions in the reduction of ammonia emissions, such as strategic tree-planting near potential sources, like collecting yards and slurry lagoons.

Biodiversity

UK dairy farms house a series of interconnected ecosystems that can offer invaluable habitat for maintaining and enhancing nature. Dairy farmers are embracing the role their farms play in managing the natural environment, with 65% of dairy managed farmland being part of an agri-environmental scheme.⁷¹ Both newly created and restored hedgerows are managed to provide food, shelter and nesting sites for wildlife – from pollinating bees to farmland birds and bats – while connecting habitats across the landscape.

Grassland dairy systems can deliver many ecosystem services, which are the direct and indirect contributions that ecosystems provide to humans, including biodiversity, erosion control and climate regulation.⁷² Livestock positively impacts biodiversity through the effect on sward structure, plant composition and distribution, which in turn affects the habitat value of the grassland for other groups, such as invertebrates, birds, reptiles and small mammals. Grazing can enhance biodiversity by creating a patchier environment within fields, which in turn provides microhabitats within the sward that can be used by different types of plants and animals. The diversity can be produced within and between paddocks and fields, as well as at a landscape or catchment scale.

Ruminant grazing can be particularly beneficial for creating and maintaining suitable habitat for different animal species, including ground-nesting birds. In some instances, biodiversity gain can be achieved with improved pasture utilisation, and related production efficiencies can lead to lower GHG emission intensities and decreased feed costs.

A recent study has confirmed that the cessation of grazing causes below-ground biodiversity loss, in terms of soil microbes and fauna, and found that some of the healthiest soils are in areas grazed by livestock. This reinforces the important role that grazing animals have for maintaining the diversity of soil communities, which is pivotal in the functioning of ecosystems.⁷³

What next?

Summary points

- The dairy sector is working together across the entire supply chain to progress environmental sustainability through partnerships and collaborations
- The UK dairy sector is embracing the opportunity to provide nutrient-dense food for a growing global population alongside maintaining and enhancing the natural environment

Industry

As outlined in What are we already doing? the dairy sector, including the whole value chain in the UK, is already committed to environmental sustainability via the Dairy Roadmap. The historic step undertaken in 2025 to broaden the breadth of the collaboration through the roadmap demonstrates the industry-wide commitment for environmental delivery. The Dairy Roadmap is committed to:

- Reducing emissions
- Protecting and enhancing nature
- Safeguarding animal welfare
- Supporting the global goal to limit temperature rise to 1.5°C, and the UK government's commitment to net zero
- Maximising the social and economic benefits for the UK dairy sector from these improvements

UK farmers will continue to embrace farm management practices that seek to reduce their carbon footprint and improve their broader environmental sustainability, by taking a proactive 'no-regrets' approach; taking action to address mitigations that are cost-effective and appropriate based on today's science in consistently tackling climate change at farm level.

Alongside this work, the broader agricultural sector is working together to enhance the volume and quality of farm-level environmental data, ensuring that it reflects what is happening on UK farms rather than global averages. It is working on enhanced data platforms that make getting farm-level data more accurate and easier.⁷⁴

Data that is more representative of UK farming systems and production is required and therefore sourcing that at farm level is vital. Collectively, it gives crucial primary data to inform IPCC tier 3 methodology, resulting in more accurate product or commodity assessments, such as LCAs, as well as providing evidence that better reflects environmental performance at a national level. Defra, through its Food Data Transparency Partnership (FDTP), is bringing the supply chain together to deliver consistent, accurate and accessible environmental impact quantification for the agri-food industry.⁷⁵

Net zero vs zero hunger

In late 2023, the FAO outlined its Global Roadmap³¹ to achieving global zero hunger within the 1.5°C global temperature rise, plus a report on livestock pathways to net zero.³¹ The comprehensive reports outlined scientific and pragmatic goals to ensure that environmental action and worldwide food security do not conflict. Modelling to assess the greatest impact each mitigation action could bring to reduce emissions demonstrated that globally dietary change had one of the lowest reduction impacts, just ahead of energy use and manure management.

While globally dietary change has one of the lowest reduction impacts, the FAO highlights the potential in environmental gain in a true cost accounting method in developed countries if diets transition.⁷⁶ Alternatively, improved productivity driven by efficiencies would have, by far, the most impact on reducing emissions, followed by focused breeding strategies and proactive animal health management, especially in Africa and Asia.

Given this, and the need for 70% more food by 2050, the FAO goes on to determine that a 1.7% annual rise in livestock productivity is required globally to achieve zero hunger targets⁶. Most of that increase will come from countries such as the UK, where extreme weather will be least impactful and where livestock production is among the most sustainable in the world, offering the unique opportunity to contribute to global food security and delivering zero human hunger, while protecting and enhancing the environment.

Glossary

Acidification A measure of the impact from acids emitted to the atmosphere and deposited in water and soil. These can be ammonia from slurry/manure, or sulphur dioxide (SO₂) from the combustion of fossil fuels, which have the potential to react with water in the atmosphere to cause a change in acidity. Any change from the natural pH can have detrimental effects on plant and aquatic life.

Agroforestry Land use that integrates woody vegetation (trees or shrubs) into agricultural crops and/or livestock production on the same piece of land, to benefit from the resulting ecological and economic interactions.

Carbon sequestration The removal and subsequent 'long-term' storage of carbon dioxide (CO₂) from the atmosphere by nature. If the carbon dioxide sequestered is more than the carbon dioxide emitted, the store is increasing and is known as a carbon sink.

Climate change A measure of the adverse impact of greenhouse gas (GHG) emissions that cause heat to be trapped in the atmosphere and results in a temperature rise of the Earth's surface. GHGs include carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), among others. The main consequence of climate change is global warming, which results in increased temperatures and regional climate changes.

Emissions intensity The amount of emissions per unit of output.

Eutrophication A measure of nutrient pollution in aquatic ecosystems, typically generated from phosphorus or nitrogen compounds through sewage, storm water run-off, fertiliser or manure. This can lead to excessive microbial consumption, which in turn results in oxygen depletion. Oxygen depletion can result in short- or long-term damage and potentially death to organisms that are exposed.

Field capacity The amount of soil moisture or water content held in soil after excess water has drained away.

Global warming potential (GWP) This describes how much impact a gas will have on atmospheric warming over a period of time compared with carbon dioxide. Each greenhouse gas has a different atmospheric warming impact, and some gases remain in the atmosphere for longer than others. Carbon dioxide (CO₂) has the lowest warming potential, is the most abundant and lasts for thousands of years, so it is used as the baseline. The most commonly used GWP measure is GWP100, meaning the average warming potential over 100 years.

GWP* This is an alternative GWP, which better takes account of the warming impact of short-lived gases such as methane and the change in rate of emissions over time.

Intergovernmental Panel on Climate Change (IPCC) This is the United Nations body for assessing the science related to climate change.

IPCC tiers A tier represents a level of methodological complexity. Usually, three tiers are provided. Tier 1 is the basic method, tier 2 is intermediate and tier 3 is the most demanding in terms of complexity and data requirements. Tiers 2 and 3 are sometimes referred to as higher-tier methods and generally considered to be more accurate.

Life cycle assessment (LCA) A methodology or process to assess and evaluate the environmental impacts of a product across all stages of its life cycle.

Nutrient balance The difference between the inputs and the offtake for each nutrient.

Nutrient inputs The total amount of inputs of each nutrient to the soil. This can be through application of mineral fertilisers or organic manures, atmospheric deposition or biological fixation.

Nutrients The key macronutrients required for crop growth, such as nitrogen and phosphorus.

Offtake The total amount of nutrients removed from the soil by the growth of crops, which are either harvested or grazed by livestock.

Ruminants Mammals that obtain nutrients from plant material through a symbiotic relationship with anaerobic micro-organisms in the fore-stomach, which ferments the feed and in so doing provides energy and protein to the mammal but as a by-product produces methane gas.

Silvopasture Integration of trees with grazing animal systems.

vDCF soya Verified deforestation- and conversion-free soya.

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Produced for you by:

AHDB

Middlemarch Business Park
Siskin Parkway East
Coventry
CV3 4PE

T 024 7669 2051

E comms@ahdb.org.uk

W ahdb.org.uk



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