

The Best Quality Diets Include Both Animal- and Plant-based Foods

THE NUTRITIONAL CASE FOR ANIMAL-BASED FOODS

The increasing promotion of more plant-based diets in recent years is often accompanied by calls to limit or avoid animal-based foods. However, growing evidence indicates that reducing the consumption of animal-based foods can increase the risk of adverse health consequences. Global health authorities recognize the value of animal-based foods in healthy diets. Current evidence provides good reasons to keep nutrient-rich animal-based foods like beef on the menu.

Key Take Aways:

1. Diets that exclude animal-based foods make it more challenging to obtain adequate amounts of certain essential nutrients, particularly those that are less bioavailable or absent in plant-based foods.
2. Red meat consumption in Canada has declined since the 1970s. In contrast, nearly half of all calories now come from ultra-processed foods, and the prevalence of obesity has tripled in adults.
3. Many Canadians do not meet recommendations for iron, zinc, calcium, or vitamin B₁₂ - essential nutrients that are easier to obtain or only available from animal-based foods.
4. Many Canadians under consume protein, and plant-based diets increase the risk of inadequate protein intakes. Older adults are most likely to be eating too little protein, which increases their risk of losing muscle and bone, and can lead to frailty, falls, and fractures.
5. Iron is a nutrient of public health concern in Canada and iron status is declining in children and adults. Diets that limit meat make it more difficult to meet daily iron needs.
6. Iron deficiency can impair brain development and impact long-term cognitive function. Current evidence also suggests that eating meat reduces the risk of dementia and Alzheimer's disease.
7. Efforts to limit nutrient-dense animal-based foods, such as red meat and dairy, distract from today's urgent nutrition challenges, including inadequate nutrient intakes, high consumption of ultra-processed foods, and the ongoing burdens of anemia, obesity, and other chronic diseases.
8. Animal- and plant-based foods are not nutritionally interchangeable. Research shows the best quality diets include a balance of both.

TABLE OF CONTENTS:

1. Diets that exclude animal-based foods make it more challenging to obtain adequate amounts of certain essential nutrients.

- 1.1 Global health authorities recognize the unique role of animal-based foods in healthy diets.
- 1.2 Many Canadians have low intakes of nutrients found in animal-based foods.
- 1.3 UN organizations recognize dietary diversity as one of the pillars of a healthy diet.

2. Many Canadians under consume protein, and protein recommendations are more difficult to achieve on mostly plant-based diets.

- 2.1 Shifts to more plant-based diets may lead to inadequate dietary protein intakes.
- 2.2 Many adults in Canada already eat less than the recommended amount of protein.
- 2.3 Meat, poultry, and fish are higher in protein than other protein containing foods.
- 2.4 Protein is especially critical for healthy aging.

3. Iron is a nutrient of public health concern in Canada, and studies show that eating red meat can help improve iron status.

- 3.1 National data shows iron status is declining in Canada.
- 3.2 WHO tracking data shows anemia is on the rise in women and children in Canada.
- 3.3 Adequate iron is critical for early brain development and cognitive function.
- 3.4 It is more difficult to meet daily iron requirements on diets that limit meat.
- 3.5 Higher grain intakes may increase the risk of iron deficiency.

4. Research shows that eating animal-based foods can benefit health in many ways.

- 4.1 Balancing animal and plant protein foods leads to better nutritional profiles.
- 4.2 Analysis shows life expectancy is better in countries with higher meat intakes.
- 4.3 Global study found the healthiest diet includes more red meat than the least healthy diet.
- 4.4 Studies find increasing animal protein is linked with lower risk of cancer mortality.
- 4.5 Scientific reviews have concluded eating meat is associated with better mental health.
- 4.6 Studies have found that eating meat is associated with a reduced risk of dementia.

5. Canadians eat a moderate amount of red meat, less than the global average.

- 5.1 Canadians eat less unprocessed red meat than people in several Mediterranean countries.
- 5.2 Beef consumption has declined in Canada, while obesity has tripled since the 1970s.
- 5.3 Almost half of Canadian's daily calories come from ultra-processed foods.
- 5.4 Most of the saturated fat Canadians eat comes from highly processed foods, not red meat.

6. Conclusion: Animal- and plant-based foods are not nutritionally interchangeable. Research shows diets that include both are better.

7. References

1. Diets that exclude animal-based foods make it more challenging to obtain adequate amounts of certain essential nutrients.

1.1 Global health authorities recognize the unique role of animal-based foods in healthy diets.

The Food and Agriculture Organization (FAO) of the United Nations (UN) recognizes the unique nutritional contributions animal-based foods make to healthy diets.¹⁻³ A 2023 FAO report¹ concluded:

“Meat, eggs and milk offer crucial sources of much-needed essential nutrients which cannot easily be obtained from plant-based foods.”²

This report notes animal-based foods provide high-quality protein, essential fatty-acids, iron, zinc, calcium, selenium, choline, vitamin B₁₂, and bioactive compounds like carnitine and creatine, important for health and development.² It highlights that this is especially vital during the most vulnerable life stages such as pregnancy, lactation, childhood, adolescence, and older age.²

Food-based dietary guidelines from at least 95 countries recognize animal-based foods as part of the daily healthy diet.³

- FAO, 2023

1.2 Many Canadians have low intakes of nutrients found in animal-based foods.

A worldwide study found animal-based foods including beef, organ meats, milk, eggs, small dried fish, and shellfish, as well as dark leafy greens, are top sources of priority micronutrients often lacking from the diet,⁴ including several key nutrients many Canadians don't get enough of.^{5,6}

Percentage of Canadians with Inadequate Intakes of Key Micronutrients from Foods ^{5,6}		
	Adults ⁵	Children ⁶
Iron	Nearly 30% of women 19-50 years	25% of girls 14-18 years
Zinc	30-34% of women, and 21-44% of men	28% of girls, and 20% of boys 14-18 years
Calcium	> 70% of women 19-50 years, > 90% of women 50+ and men 70+ years	>80% of girls, and 65% of boys 9-18 years
Vitamin B ₁₂	21% of women	13% of girls 14-18 years

These estimates are based on the most current national data collected in 2015.^{5,6} Shifts toward more plant-based diets since then may be worsening these nutrient inadequacies.

Many foods often promoted as nutrient-dense, including most vegetables and fruits, whole grains, and nuts and seeds are not particularly dense in bioavailable nutrients commonly lacking from the diet.⁴

1.3 UN organizations recognize dietary diversity as one of the pillars of a healthy diet.

The FAO and World Health Organization (WHO) guiding principles for sustainable healthy diets recognize they must help prevent all forms of malnutrition, including micronutrient deficiency.⁷ Minimum Dietary Diversity was added to the UN Sustainable Development Goal (SDG) indicators in 2025.⁸ This validated measure of diet quality, based on the variety of foods consumed, is seen as key to ending malnutrition.

Minimum Dietary Diversity measures include 3 categories of animal-based foods, including (1) meat, poultry and fish, (2) eggs, and (3) milk and milk products, as well as plant-based food categories.^{8,9}

2. Many Canadians under consume protein, and protein recommendations are more difficult to achieve on mostly plant-based diets.

2.1 Shifts to more plant-based diets may lead to inadequate dietary protein intakes.

A Canadian study found protein intake decreases as people eat a greater proportion of protein from plant-based foods.¹⁰ Importantly, when corrected for protein quality, average daily protein intake was inadequate in people eating more than 75% of their protein from plant-based foods.

2.2 Many adults in Canada already eat less than the recommended amount of protein.

- Many adults in Canada eat less than the minimum daily protein recommendation (Recommended Dietary Allowance (RDA)) of 0.8 g protein/kg of body weight.^{11,12}

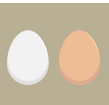
Adults with Protein Intakes Below the RDA	
Age Categories (years)	% Below RDA for Protein
Adults, 19-64	18.4%
Adults, 65+	32.5%

Source: Statistics Canada. 2023. Customized analysis of 2015 Canadian Community Health Survey – Nutrition data on protein intakes in adults.

- Even more fall short of optimal protein targets for older adults of 1.0 to 1.5 g/kg body weight (which differ depending on health status and physical activity).^{11,13-15}

2.3 Meat, poultry, and fish are higher in protein than other protein containing foods.

Whole, unprocessed meat, poultry, fish and seafood generally contain more protein per serving than plant protein foods including tofu, nuts, seeds, beans and lentils.¹⁶ Only meat, poultry, fish and seafood contain more than 20 g of protein per serving. For vegetarian diets that omit those foods, it's worth noting that eggs and dairy foods do not reach the 20 g of protein per serving threshold. Most legumes, nuts and seeds contain less than 10 g of protein per serving.

AMOUNT OF PROTEIN IN COMMON FOODS								
Based on Health Canada's standard serving sizes (in brackets below)								
								
More than 20 g			10 g to 20 g			Less than 10 g		
(100 g for each, cooked) Beef Pork Lamb Veal Goat Chicken and turkey Fish and seafood			Canned fish (55 g) Eggs (2) Tempeh (85 g) Deli meats (55 g) Cottage cheese (125 g) Greek yogurt (115 g) Edamame (125 mL) Hemp seeds (30 g)			Cheese (30 g) Plain yogurt (115 g) Milk or soy milk (250 mL) Nuts and seeds (30 g) Nut butters (15 g) Tofu (85 g) Beans and lentils (125 mL) Hummus (15 mL)		

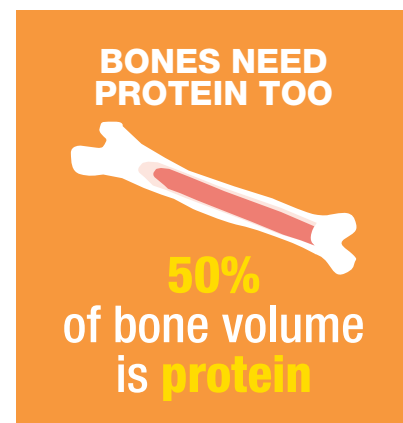
Source: Health Canada. 2026. Canadian Nutrient File.

Animal-based foods also provide complete protein with all 9 essential amino acids in proportions balanced relative to human needs.¹² Most of the protein found in plant-based foods is considered incomplete, because it tends to be lower in one or more essential amino acids.¹² The body's ability to use protein is limited if the right balance of essential amino acids are not present.¹²

2.4 Protein is especially critical for healthy aging.

Both muscle and bone depend on a regular supply of dietary protein for normal growth, repair and maintenance throughout the whole life cycle. Protein makes up 50% of bone volume.¹⁷ Not getting enough protein as we age can lead to muscle and bone loss, increasing the risk of frailty, falls, and fractures.¹²⁻¹⁴ Over time, this can contribute to loss of independence and health related quality of life.¹²⁻¹⁴ Animal-based foods contain protein and nutrients that can help to preserve muscle and bone health in older adults.¹

Source: Tsagari A. Dietary protein intake and bone health. J Frailty Sarcopenia Falls 2020;5(1):1-5.

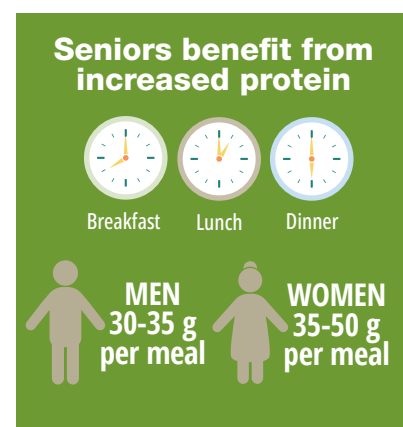


There is consistent strong evidence that lean red meat consumption has positive effects on muscle health.¹

- FAO, 2023

Older adults need more protein to stimulate muscle protein synthesis.^{13,14} The Quebec NuAge Study in older adults found optimal protein doses for better physical performance and strength were 30-35 g per meal in men and 35-50 g per meal in women.¹⁸ These levels of protein intake are more challenging to achieve without including meat, poultry, fish or seafood in meals.

Source: Hengeveld LM et al. Prospective associations of protein intake parameters with muscle strength and physical performance in community-dwelling older men and women from the Quebec NuAge cohort. Am J Clin Nutr 2021;113(4):972-983.



3. Iron is a nutrient of public health concern in Canada, and studies show that eating red meat can help improve iron status.

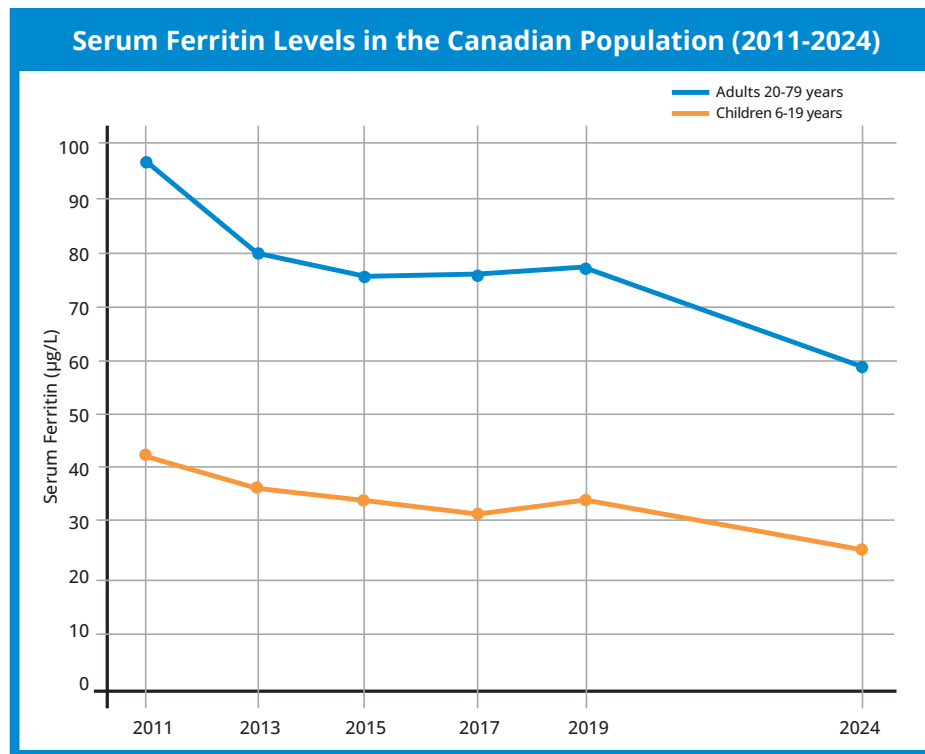
3.1 National data shows iron status is declining in Canada.

The risk of low iron (i.e., iron deficiency) is highest among females of childbearing age and young children. Based on 2012-2019 serum ferritin data (a measure of iron status),¹⁹ Health Canada has reported that low iron affects:²⁰

- 1 in 4 women 14-50 years
- 1 in 10 children 3-4 years
- Newcomers are twice as likely to have low iron

However, these numbers likely underestimate the number of Canadians affected by low iron now. The most current serum ferritin data for the Canadian population reveals iron status was already declining from 2011 to 2019, and went down even further from 2019 to 2024.²¹

Ferritin levels decreased by about 40% in school age children and adults from 2011 to 2024.²¹

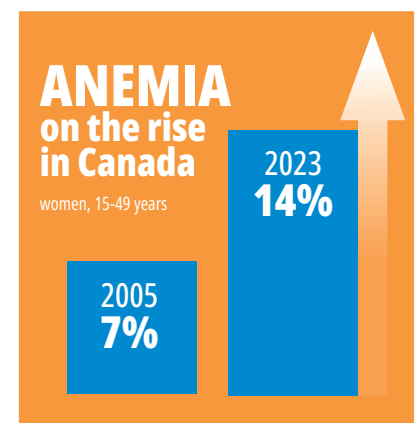


Source: Statistics Canada. 2026. Nutritional status of the household population. Table: 13-10-0336-01

3.2 WHO tracking data shows anemia is on the rise in women and children in Canada.

WHO tracking data for Canada shows the prevalence of anemia (often due to severe iron deficiency) has doubled in women of reproductive age, and is on the rise in children under 5.^{22,23} Anemia increased in:

- **Women of reproductive age (15-49 years)** - from about 7% in 2005 to 14% in 2023.²²
- **Children under 5 years (6-59 months)** - from about 10% in 2004 to over 13% in 2019.²³



Source: WHO. 2023. Prevalence of anemia among women of reproductive age (% of women ages 15-49) – Canada. The World Bank: WHO, Global Health Observatory Data Repository/World Health Statistics.

Canada is not on track with the UN Sustainable Development Goal to cut the global prevalence of anemia in women of reproductive age in half by 2030.^{22,24}

3.3 Adequate iron is critical for early brain development and cognitive function.

Health Canada and the Canadian Paediatric Society both recognize iron as critical for healthy brain development.^{20,25,26} Iron deficiency can impair brain development.²⁶ Research shows iron deficiency in early childhood disrupts neurodevelopment, leading to long-term adverse effects on cognition, motor skills, behaviour, and neuroendocrine functions.²⁷

Iron deficiency is associated with suboptimal neurodevelopment that may not be reversible.²⁶

– Canadian Paediatrics Society, 2019/2025

3.4 It is more difficult to meet daily iron requirements on diets that limit meat.

The FAO report on the contribution of animal-based foods to healthy diets states, “Robust evidence shows that meat intake (85 to 300 g/day) is positively associated with iron status in adults.”¹

– FAO, 2023

A recent Canadian study showed that women who eat red meat more frequently are less likely to be iron deficient.²⁸ This study found that more frequent red meat consumption is one of the strongest dietary predictors of better iron status in women. The authors note their results show:

- **Heme iron-rich foods (like red meat) contribute to body iron stores.**
- **No such associations were seen for plant-based foods, which contain only non-heme iron.**

A Swedish study found teenage girls who limited their meat consumption were much more likely to be iron deficient compared to those who ate more red meat.²⁹ Researchers found that serum ferritin levels decreased with increasing dietary restriction (from omnivores who eat meat, to pescatarians who eat fish but not meat, to vegetarians/vegans who do not eat meat):

- **Serum ferritin levels were 45% lower in vegetarians/vegans compared to omnivores.**
- **69% of vegetarians/vegans were iron deficient, more than twice the % of omnivores.**



The infographic 'Foods That Provide Iron' is divided into three columns: Vegetarian Sources, Seafood Sources, and Meat Sources. It lists various food items and their iron content per 100g. For example, under Vegetarian Sources, it lists lentils (4.1 mg), chickpeas (3.6 mg), and tofu (2.7 mg). Under Seafood Sources, it lists salmon (0.9 mg) and tuna (0.8 mg). Under Meat Sources, it lists beef (2.6 mg), pork (2.1 mg), and chicken (0.7 mg). It also includes a section for 'Iron-rich plant-based foods' and a note about iron absorption.

See also: [Foods That Provide Iron](#)

Iron requirements are 1.8 times higher for vegetarians than for non-vegetarians due to the lower bioavailability of iron from a vegetarian diet (without meat, poultry or fish).³⁰

– Institute of Medicine, 2001

3.5 Higher grain intakes may increase the risk of iron deficiency.

While nearly half of the iron in the Canadian diet comes from grain products,³¹ higher grain intake is associated with an increased risk of iron deficiency in premenopausal women.²⁸

Despite their relatively high contributions to dietary iron intakes,³¹ grains also contain phytates, plant compounds which inhibit iron absorption.^{28,32} Phytates in grains, legumes like beans, peas and lentils, nuts and seeds are the main inhibitor of iron absorption in plant-based diets.³²

While many grain products such as cereals are fortified with elemental iron, researchers note this iron is poorly absorbed and makes “little practical contribution to improving iron status”.³³

Recognising the shift to a more grain-based diet and reduced meat intake, Health Canada researchers noted the need to educate Canadians to ensure they consume enough bioavailable iron from meat, poultry, and fish, as well as vitamin C to boost non-heme iron absorption in a 2006 paper on the iron status of Canadians, two decades ago.³⁴ In 2025, Health Canada published an infographic encouraging Canadians to focus on getting enough iron.²⁰



For a more detailed review on iron, see [Iron Essentials – Key Facts and Evidence](#).

4. Research shows that eating animal-based foods can benefit health in many ways.

4.1 Balancing animal and plant protein foods leads to better nutritional profiles

Canadian studies have concluded that adults and children who eat a balance of animal and plant protein foods are more likely to meet their nutrient requirements.^{35,36}

Analysis in adults showed the most nutritionally adequate diets include both animal and plant protein foods.³⁵ Dietary patterns with more than 75% of protein from either may compromise nutritional adequacy. The authors note that “Balancing plant- with animal-based protein foods leads to healthier dietary patterns with more favourable nutritional properties.”

Analysis in children showed that a 3 to 1 ratio of animal-to-plant protein is nutritionally optimal for children.³⁶ This study found a diet with three times more animal protein than plant protein provides an optimal balance to help children 9-18 years meet their needs for most essential nutrients. The authors concluded that, “Canadian children may be at risk of developing nutrient inadequacies when the majority of protein is derived from plant-based foods, particularly without attention to dietary diversity and nutrient density.”

It's a tie!

	ANIMAL FOOD	PLANT FOOD
Creatine	✓	✗
Vitamin B ₁₂	✓	✗
Folate	✗	✓
Fibre	✗	✓

We need both, so why the debate?

4.2 Analysis shows life expectancy is better in countries with higher meat intakes.

Meat has been an important component of the human diet for millions of years. A worldwide population analysis shows life expectancy is greater when there’s more meat in the diet, even in countries with a Mediterranean diet.³⁷

4.3 Global study found the healthiest diet includes more red meat than the least healthy diet.

The global PURE study evaluated the diets of adults in 21 countries on 5 continents.³⁸ This study found the most healthy diet, associated with the lowest risk of major cardiovascular disease (CVD) (i.e., heart attack and stroke), included more vegetables, fruit, legumes, nuts, dairy foods, unprocessed red meat, fish and poultry, compared to the least healthy diet.

PURE Study – Most Healthy Diet vs Least Healthy Diet		
Food Categories	Most Healthy Diet (grams/day)	Least Healthy Diet (grams/day)
Vegetables and Fruit	563.1	130.6
Legumes	48	21
Nuts	28.2	3.9
Dairy Foods	185.5	31.2
Red Meat (unprocessed)	54.5	24.1
Fish	26.1	6.1
White Meat (poultry)	22.1	10.3

Source: Mente A et al. Diet, cardiovascular disease, and mortality in 80 countries. European Heart Journal 2023;44(28):2560–2579.

The PURE study findings³⁸ underscore that healthy diets focus on a balance of nutritious foods from both animal and plant sources.

4.4 Studies find increasing animal protein is linked with lower risk of cancer mortality.

A landmark study published in 2025 found that increasing animal protein intake was associated with a small but significant reduction in the risk of death due to cancer.³⁹ The authors concluded that eating animal protein may offer some protection against cancer mortality, noting that they did not see this for plant protein.

Another study that followed older adults in Italy for 20 years also found those who ate more animal protein had a lower risk of cancer mortality, as well as cardiovascular disease, and all-cause mortality.⁴⁰

4.5 Scientific reviews have concluded eating meat is associated with better mental health.

Broad reviews of the scientific evidence have concluded that eating meat is associated with better mental health, including lower depression and anxiety, compared to eating no meat.^{41,42}

- People who ate meat had lower depression and anxiety compared to vegans.⁴¹
- People who did not eat meat had higher rates or risk of depression, anxiety, and/or self-harm behaviors.⁴²

Research shows that iron deficiency can lead to mood changes (such as irritability and low mood), and is associated with anxiety, depression, and post-partum depression.⁴³⁻⁴⁵

4.6 Studies have found that eating meat is associated with a reduced risk of dementia.

A comprehensive review of studies exploring meat and cognitive function, dementia, and Alzheimer’s disease found that people who ate meat weekly or more were 27% less likely to have cognitive disorders, compared to those consuming meat less frequently.⁴⁶ Other studies support this conclusion, finding the following associations:

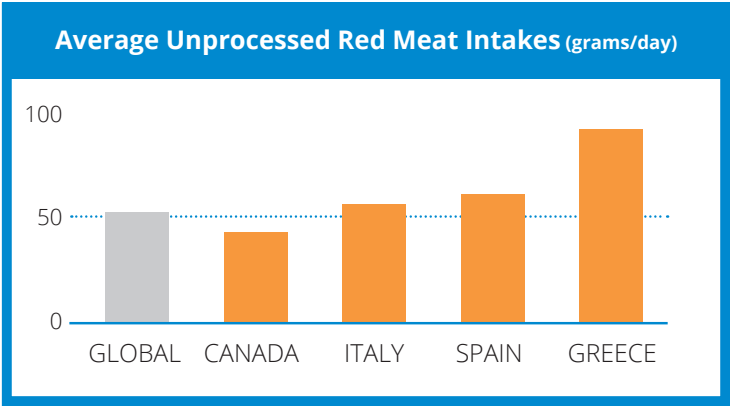
- Eating unprocessed red meat reduced the risk of Alzheimer’s disease and dementia.⁴⁷
- Low meat intake (≤ 1 time per week) increased the risk of Alzheimer’s disease and dementia compared to regular intake ($\geq 4 \times / \text{week}$).⁴⁸
- Older adults who ate meat (i.e., were not vegetarian) had better memory and a four-fold decrease in dementia.⁴⁹
- Those who ate more tofu had worse cognitive performance and increased risk of cognitive impairment.⁴⁹

5. Canadians eat a moderate amount of red meat, less than the global average.

5.1 Canadians eat less unprocessed red meat than people in several Mediterranean countries.

Based on the most recent national nutrition survey, Canadians were eating 41.1 grams of cooked unprocessed red meat per day on average.⁵⁰ That’s 288 grams per week, roughly enough to account for about 3 meals – 2 dinners and a lunch for example.

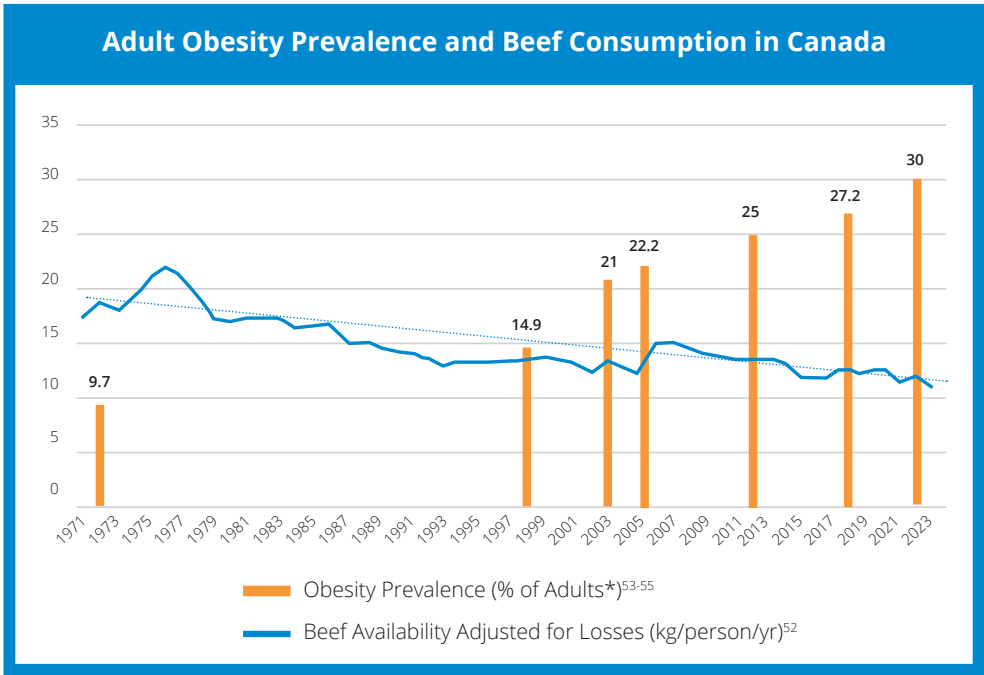
Canadians ate less unprocessed red meat than the global average of 51 grams per day in 2018,⁵¹ and less than people in several Mediterranean countries like, Italy, Spain, and Greece.⁵¹



Source: Miller V et al. Lancet Planet Health 2022;6(3):e243-e256.
Supplementary Appendix: Table S13 - 2018 Global Dietary Database Data.

5.2 Beef consumption has declined in Canada, while obesity has tripled since the 1970s.

Beef consumption has declined over the last 50 years.⁵² Meanwhile, the prevalence of obesity in adults in Canada has tripled.⁵³⁻⁵⁵

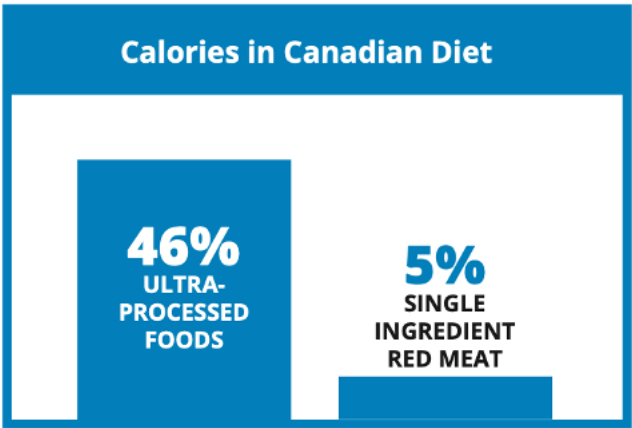


*Obesity prevalence in adults 20-64 years old in the years prior to 2000, and in adults 18+ years old in the years after 2000.

Sources: Statistics Canada. Table 32-10-0054-01 Food available in Canada. Beef, boneless weight adjusted for losses from 1971 to 1923.
Katzmarzyk PT. The Canadian Obesity Epidemic: An Historical Perspective. *Obes Res* 2002;10:666-674.
Statistics Canada. 2024. An overview of weight and height measurements on World Obesity Day.
Lytvyak E et al. Trends in obesity across Canada from 2005 to 2018: a consecutive cross-sectional population-based study. *CMAJ Open* 2022;10(2):E439-E449.

5.3 Almost half of Canadian’s daily calories come from ultra-processed foods.

Canada’s food guide encourages Canadians to focus on eating nutritious whole foods as the foundation for healthy eating.⁵⁶ However, 46% of Canadians’ daily calories come from ultra-processed foods,⁵⁷ compared to only 5% of calories from unprocessed red meat.⁵⁰



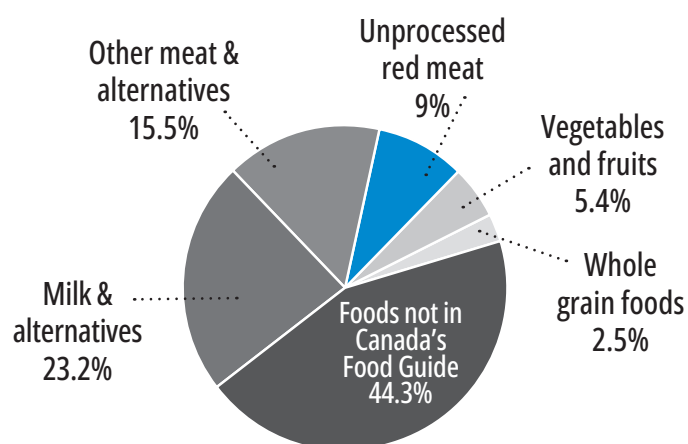
Sources: Polsky JY et al. 2020. Consumption of ultra-processed foods in Canada. *Statistics Canada health reports*.
Statistics Canada. 2018. Customized analysis of 2015 Canadian Community Health Survey - Nutrition data.
(Mean red meat intakes for Canadians 1+ years).

In 2021, Health Canada reported that many plant-based ‘alternative’ products introduced to the Canadian marketplace (after the launch of the more plant forward 2019 Canada’s food guide) were high in sodium, saturated fat, and, or sugar.⁵⁸

An earlier 2009 study of the Canadian food supply found that while the calories available per person from animal-based foods such as beef, milk, and eggs had declined since the 1970s, this did not lead to healthier food choices.⁵⁹ Instead, total calories available per person increased by 18% over this period, largely driven by ingredients found in calorie-dense convenience foods.

5.4 Most of the saturated fat Canadians eat comes from highly processed foods, not red meat.

Almost half (44.3%) of the calories from saturated fat consumed by adults in Canada come from foods that are not included in Canada’s food guide.⁶⁰ Most of these foods are ultra-processed and nutrient-poor. In contrast, only 9% of calories from saturated fat come from unprocessed red meat.⁵⁰



Sources: Statistics Canada. 2018. Customized analysis of 2015 Canadian Community Health Survey - Nutrition data. (Mean red meat intakes for Canadians 19+ years).
Harrison S et al. Consumption and sources of saturated fatty acids according to the 2019 Canada Food Guide: Data from the 2015 Canadian Community Health Survey. *Nutrients* 2019;11(9):1964.

6. Conclusion: Animal- and plant-based foods are not nutritionally interchangeable. Research shows diets that include both are better.

Animal- and plant-based foods make unique nutritional contributions and are both part of the foundation for healthy eating.⁵⁶ Animal-based foods provide complete protein, vitamins, minerals, and bioactive compounds that are absent from or not as easy to obtain from plant-based foods.¹ Animal-based foods can help Canadians meet their needs for key nutrients many lack.

Efforts to limit nutrient-dense animal-based foods, such as red meat and dairy, distract from today's urgent nutrition challenges, including inadequate nutrient intakes, high consumption of ultra-processed foods, and the ongoing burdens of anemia, obesity, and other chronic diseases.

Since animal- and plant-based protein foods have different nutrient profiles and make unique contributions to the diet, they should not be viewed as nutritionally interchangeable. Including a healthy balance of animal- and plant-based foods on the menu can help Canadians meet their nutrient needs for optimal health.

7. References

1. FAO. 2023. Contribution of terrestrial animal source food to healthy diets for improved nutrition and health outcomes.
2. FAO. 2023. Meat, eggs and milk essential source of nutrients especially for most vulnerable groups, new FAO report says.
3. FAO. 2023. Animal source foods contribute to healthy diets.
4. Beal T and Ortenzi F. Priority micronutrient density in foods. *Front Nutr* 2022;9:806566.
5. Ahmed M, Praneet Ng A, and L'Abbe MR. Nutrient intakes of Canadian adults: results from the Canadian Community Health Survey (CCHS)-2015 Public Use Microdata File. *Am J Clin Nutr* 2021;114(3):1131-1140.
6. Ng A, Ahmed M and L'Abbe M. 2021. Nutrient intakes of Canadian children and adolescents: Results from the Canadian Community Health Survey (CCHS) 2015 – Nutrition public use microdata files.
7. FAO and WHO. 2019. Sustainable healthy diets – Guiding principles. Rome.
8. FAO. 2025. New SDG indicator on Minimum Dietary Diversity adopted by UN Statistical Commission.
9. WHO. 2025. The Global Health Observatory - Minimum Diet Diversity (6-23 months).
10. Marinangeli CPF et al. The effect of increasing intakes of plant protein on the protein quality of Canadian diets. *Appl Physiol Nutr Metab* 2021;46(7):771-780.
11. Statistics Canada. 2023. Customized analysis of 2015 Canadian Community Health Survey – Nutrition data on protein intakes in adults.
12. Institute of Medicine. 2005. Dietary Reference Intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids. Washington, DC: The National Academies Press.
13. Bauer J et al. Evidence-Based Recommendations for Optimal Dietary Protein Intake in Older People: A Position Paper From the PROT-AGE Study Group. *J Am Med Dir Assoc* 2013;14(8):542-559.
14. Deutz NE et al. Protein intake and exercise for optimal muscle function with aging: recommendations from the ESPEN Expert Group. *Clin Nutr* 2014;33(6):929-936.
15. Alberta Health Services, Nutrition Services. 2019. Nutrition Guideline Seniors Health Overview (65 Years and Older).
16. Health Canada. 2026. Canadian Nutrient File.
17. Tsagari A. Dietary protein intake and bone health. *J Frailty Sarcopenia Falls* 2020;5(1):1-5.
18. Hengeveld LM et al. Prospective associations of protein intake parameters with muscle strength and physical performance in community-dwelling older men and women from the Quebec NuAge cohort. *Am J Clin Nutr* 2021;113(4):972-983.
19. Cooper M et al. Population iron status in Canada: results from the Canadian Health Measures Survey 2012–2019. *J Nutr* 2023;153:1534–1543.
20. Health Canada. 2025. Iron: a powerhouse nutrient for your health.
21. Statistics Canada. 2026. Nutritional status of the household population. Table: 13-10-0336-01.
22. WHO. 2023. Prevalence of anemia among women of reproductive age (% of women ages 15-49) – Canada. The World Bank: WHO, Global Health Observatory Data Repository/World Health Statistics.
23. WHO. 2019. Prevalence of anemia among children (% of children ages 6-59 months) – Canada. The World Bank: WHO, Global Health Observatory Data Repository/World Health Statistics.
24. Daru J. Sustainable development goals for anaemia: 20 years later, where are we now? *Lancet Glob Health* 2022;10(5):e586–e587.
25. Health Canada. 2012. Nutrition for healthy term infants – recommendations for birth to six months.
26. Canadian Paediatric Society. 2019/2025. Iron requirements in the first 2 years of life.
27. Theola J, Andriastuti M. Neurodevelopmental impairments as long-term effects of iron deficiency in early childhood: A systematic review. *Balkan Med J* 2025;42(2):108-120.
28. Chang VC et al. Iron status and associated factors among Canadian women: results from the Canadian Health Measures Survey. *J Nutr* 2023;153(3):781-797.
29. Stubbendorff A et al. Iron insight: exploring dietary patterns and iron deficiency among teenage girls in Sweden. *European Journal of Nutrition* 2025;64:107.
30. Institute of Medicine. 2001. Dietary Reference Intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. Washington (DC): National Academies Press.
31. Health Canada. 2025. Food source contribution tool – iron.
32. Hurrell R, Egli I. Iron bioavailability and dietary reference values. *Am J Clin Nutr* 2010;91(5): S1461–1467.
33. Geissler C and Singh M. Iron, meat and health. *Nutrients* 2011;3(3):283–316.
34. Cooper MJ, Cockell KA, and L'Abbe MR. The iron status of Canadian adolescents and adults: Current knowledge and practical implications. *Can J Diet Pract Res* 2006;67(3):130-138.
35. Fabek H et al. An examination of contributions of animal- and plant-based dietary patterns on the nutrient quality of diets of adult Canadians. *Appl Physiol Nutr Metab* 2021;46:877-886.
36. Fabek H, Salamat S, and Anderson GH. Association Between Dietary Protein Sources and Nutrient Intake in the Diet of Canadian Children. *Nutrients* 2025;17(11):1834.
37. You W et al. Total meat intake is associated with life expectancy: A cross-sectional data analysis of 175 contemporary populations. *Int J Gen Med* 2022;15:1833-1851.
38. Mente A et al. Diet, cardiovascular disease, and mortality in 80 countries. *European Heart Journal* 2023;44(28):2560–2579.
39. Papanikolaou Y, Phillips SM, and Fulgoni 3rd VL. Animal and plant protein usual intakes are not adversely associated with all-cause, cardiovascular disease-, or cancer-related mortality risk: an NHANES III analysis. *Appl Physiol Nutr Metab* 2025;50:1-8.
40. Meroño T et al. Animal protein intake is inversely associated with mortality in older adults: The InCHIANTI Study. *J Gerontol A Biol Sci Med Sci* 2022;77(9):1866-1872.
41. Dobersek U et al. Meat and mental health: A meta-analysis of meat consumption, depression, and anxiety. *Crit Rev Food Sci Nutr* 2021 Oct 6:1-18.
42. Dobersek U et al. Meat and mental health: a systematic review of meat abstinence and depression, anxiety, and related phenomena. *Crit Rev Food Sci Nutr* 2021;61(4):622-635.
43. Sholzberg M et al. Diagnosis and management of iron deficiency in females. *CMAJ* 2025;197:E680-7.
44. Raise the Bar. Initial assessment and diagnosis: acute and chronic symptoms of iron deficiency. Accessed March 2026 at: <https://www.hemequity.com/raise-the-bar-assessment-diagnosis>.
45. Berthou C, Iliou JP, Barba D. Iron, neuro-bioavailability and depression. *E J Haem* 2022;3(1):263-275.
46. Zhang H et al. Meat consumption, cognitive function and disorders: A systematic review with narrative synthesis and meta-analysis. *Nutrients* 2020;12:1528.
47. Zhang H et al. Meat consumption and risk of incident dementia: Cohort study of 493,888 UK Biobank participants. *Am J Clin Nutr* 2021;114(1):175-184.
48. Ngabirano L et al. Intake of meat, fish, fruits, and vegetables and long-term risk of dementia and Alzheimer's disease. *J Alzheimers Dis* 2019;68(2):711-722.
49. Xu X et al. Tofu intake is associated with poor cognitive performance among community-dwelling elderly in China. *J Alzheimers Dis* 2015;43:669-675.
50. Statistics Canada. 2018. Customized analysis of 2015 Canadian Community Health Survey - Nutrition data.
51. Miller V et al. Global, regional, and national consumption of animal-source foods between 1990 and 2018: Findings from the Global Dietary Database. *Lancet Planet Health* 2022;6(3):e243-e256. Supplementary Appendix – Table S13.
52. Statistics Canada. Table 32-10-0054-01 Food available in Canada. Beef, boneless weight adjusted for losses from 1971 to 1923.
53. Katzmarzyk PT. The Canadian Obesity Epidemic: An Historical Perspective. *Obes Res* 2002;10:666-674.
54. Statistics Canada. 2024. An overview of weight and height measurements on World Obesity Day.
55. Lytyak E et al. Trends in obesity across Canada from 2005 to 2018: a consecutive cross-sectional population-based study. *CMAJ Open* 2022;10(2):E439-E449.
56. Health Canada. 2019. Canada's Food Guide.
57. Polsky JY et al. 2020. Consumption of ultra-processed foods in Canada. Statistics Canada health reports.
58. Health Canada. 2021. Food and nutrition highlights 2020 – Annual Report.
59. Slater J et al. The growing Canadian energy gap: more the can than the couch? *Public Health Nutrition* 2009;12:2216-2224.
60. Harrison S et al. Consumption and sources of saturated fatty acids according to the 2019 Canada Food Guide: Data from the 2015 Canadian Community Health Survey. *Nutrients* 2019;11(9):1964.