

Scanning and collection of scientific evidence base to prepare a white paper about dairy in healthy, sustainable diets.

October 2019



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EXECUTIVE SUMMARY

There is much information about the value of dairy foods as part of healthy diets and their contribution to help meet nutrient requirements in populations at every life stage and across the world. Similarly, there are numerous studies documenting the health benefits of adequate dairy consumption, however, there is no authoritative consensus that summarizes specific conditions that could be avoided or ameliorated by meeting dietary recommendations for dairy foods. A new challenge is to understand the importance of dairy food production and consumption in the context of local and global environmental, economic and social impacts. Traditionally, these aspects of diets and agriculture have been studied as separate entities, but in the past decade innovative research is providing linkages that will assist in our ability to better define the role of dairy foods in healthy and sustainable diets. This scanning exercise provides a snapshot of information available from websites and a limited review of published research in the past 5 years to develop key messages; it is not intended to provide a thorough evaluation of the topics identified.

Key topics, statements	*Strength of evidence	References
<p>Nutrient rich, nutrient adequacy, health benefits</p> <ol style="list-style-type: none"> 1. Milk and dairy foods are nutrient-rich sources of essential nutrients like calcium that are needed across the lifespan and often under-consumed. 2. Consumption of recommended amounts of dairy foods contributes to nutrient adequacy and diet quality, nutrient security, reduced risk of chronic diseases, and potentially lower health-care costs. 	<ol style="list-style-type: none"> 1. High 2. High 	<ol style="list-style-type: none"> 1. Dairy UK Dairy nutrition and health, Bradley 2013, Cifelli 2016, Hess 2019, Australian Bureau of Statistics, FAO 2019 2. Hobbs 2019, Stylianou 2016, Doidge 2013, Javanbakht 2018, Lieffers 2018, McCarron 2004
<p>Plant-based alternatives</p> <ol style="list-style-type: none"> 1. Replacing dairy foods with plant alternatives is likely to have minimal impact on several environmental characteristics such as GHG, land and water use, but also may contribute lower levels of certain nutrients such as protein, calcium, Vitamin D and Vitamin B12. (Note that some countries fortify milk with vitamin D, however, in Australia dairy foods contain minimal vitamin D.) 	<ol style="list-style-type: none"> 2. Moderate 	<ol style="list-style-type: none"> 1. NZO 2015 brochure Environmental impact of dairy substitution, Van de Kamp 2018, Horgan 2016, Cifelli 2016, Gonzalez-Garcia 2019, Zhang 2016
<p>Protein conversion</p> <ol style="list-style-type: none"> 1. Most of the feed that dairy cows consume is not human edible and provides an efficient way to reduce waste and GHG emissions. 2. Cows are efficient converters of low protein quality feedstuffs into high quality protein in milk and meat. 	<ol style="list-style-type: none"> 1. High 2. High 	<ol style="list-style-type: none"> 1. National Dairy Council (US) Dairy & Sustainability: 6 things that may surprise you, Honor the harvest 2. Broderick 2019, Swensson 2017
<p>Responsible stewardship</p> <ol style="list-style-type: none"> 1. Dairy farmers around the world work for continuous improvement in their use of natural resources. In the past 50-70 years, milk production efficiency has significantly increased while reducing the amount of land and water needed to produce a gallon of milk. 2. Dairy farming can have a positive impact of on biodiversity and the ecosystem. 	<ol style="list-style-type: none"> 1. High 2. Moderate 	<ol style="list-style-type: none"> 1. National Dairy Council (US), Dairy Farmers of Canada, Dairy Council of California The Healthy Eating TABLE, ILRI Sustainable livestock systems

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		2. EDA Feeding the world with dairy, CNIEL
Affordable nutrition 1. In many developed countries, dairy foods are an affordable source of nutrition	1. Moderate	1. National Dairy Council (US) Does it cost more, Dairy Council of California The Healthy Eating TABLE, Drewnowski 2018
Economic benefits 1. Responsible dairy farming contributes economic benefits to families and communities by providing income, jobs both at the farm and away from the farm.	1. High	1. Dairy Cares, FAO (Dairy Development), ILRI Sustainable livestock systems, Jodlowski 2016
Food waste 1. Dairy foods contribute a modest amount of edible food waste as compared to fresh vegetables/salads. 2. Dairy organizations are exploring ways to reduce food waste via packaging and labeling initiatives.	1. Moderate 2. Moderate	1. Cooper 2018 2. NZO Factbook 2019 Sustainable Dairy in Europe

*Strength of Evidence: High, Moderate, Low. Subjective assessment based on number of studies, consistent results. Note that this scanning exercise was not intended to provide a thorough evaluation of the topics identified.

INTRODUCTION

Consumers and health authorities are increasingly raising concerns about sustainability aspects of food production and consumption. Many groups have focused mainly on environmental impacts of food choices, especially greenhouse gas (GHG) emissions, without considering the nutritional or other value characteristics inherent in different types of foods. This has led to oversimplified perceptions that plant-based foods are better for the population and planet than animal-based foods like milk and dairy products. This white paper is a compilation of currently existing evidence to understand what is known about dairy's place in a healthy, sustainable eating pattern in order to communicate the state of the science, identify knowledge gaps and prioritize research topics for the future. Three sources of information were investigated: websites of dairy organizations, published research studies available in PubMed, and NGO websites.

Website investigation of dairy organizations

International

International Dairy Federation (IDF): www.fil-idf.org

- Dairy Sustainability Outlook Nos 1 and 2, Reports 163, 164: case studies and country reports of research and targets aligned with environmental, economic and social aspects of sustainability. Initiatives include reducing carbon footprint and water use, better waste management, enhancing biodiversity, improving the work place, enriching opportunities for women and improving animal care.
- Chair of FAO LEAP program: "In 2019, IDF was pleased to take up the chairmanship role in the FAO Livestock Environmental Assessment and Performance (LEAP) partnership, an initiative focused on improving sustainability within the livestock sector." The LEAP program "develops comprehensive guidance and methodology for monitoring the environmental performance of livestock supply chains."

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- The role of ruminants in sustainable diets, an international symposium co-sponsored by IDF to assess the nutritional and environmental implications of ruminant livestock. [Videos](#) from the conference are available on the website, but no summary documents exist.
- Article by Caroline Emond, IDF Director General “[Dairy animals and their role in a sustainable food system](#)” describes some of the environmental and natural resource aspects of milk production and how farmers are making improvements.
- 2016 Fact Sheet “[Role of dairy in sustainable nutrition](#)” cites information from the 2013 FAO report on *Milk and Dairy Products in Human Nutrition*.
- Free publications are available as guides for animal health and welfare, biodiversity, water and carbon footprints.

European Dairy Association (EDA): www.euromilk.org

- Nutrition and Sustainability Fact Sheets
 - Feeding the world with dairy, March 2019:
 - Discusses the nutrient contribution of dairy foods, the positive impact of dairy farming on biodiversity and the ecosystem, how dairy contributes to the Sustainable Development Goals via livelihoods, jobs and income generation and gender equity, how dairy helps to fight hunger and poverty, and recognition by the EAT-Lancet Commission that dairy foods are part of healthy, sustainable diets.
 - Why dairy is important for achieving a healthy and sustainable diet, Sept 2018:
 - States the FAO definition of sustainable diets
 - Describes concern for climate change driving interest in sustainable diets
 - Reports on early studies that assessed nutrient adequacy and environmental impacts of healthy diets; they are not always compatible.
 - Discusses the importance of nutrient density
 - Outlines dairy’s commitment to sustainability via the Dairy Sustainability Framework (DSF)

COUNTRIES

AUSTRALIA (Written by Dairy Australia)

Dairy Australia - Dairy Matters www.dairymatters.com.au

Dairy industry – sustainability framework

- Launched in 2012, and owned by the broader dairy industry, the [Sustainability Framework](#) is a commitment to helping the Australian industry deliver on its promise to create rewarding livelihoods for our people, nourish consumers with nutritious food, provide best-care for all our animals and leave the environment in better shape for the future. In 2018, new goals were set for 2030 which reflects a renewed sense of purpose for continuous improvement and practice change (where necessary). Our dairy promise is to provide nutritious food for a healthier world. To do this, the dairy industry is committed to: 1. [Providing the best care for all our animals](#) 2. [Improving the wellbeing of people](#) 3. [Enhancing farmer livelihoods](#) and 4. [Reducing environmental impact](#). The framework commitment to providing nutritious, safe, quality dairy food, has a specific focus on health and nutrition, with goal 6 focused on dairy’s contribution to improving health outcomes for all Australians.

Key initiatives being undertaken to drive change in the health of Australian communities include;

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1. A communication strategy to facilitate conversations around dairy as part of a nutritionally sustainable diet and address public concerns and expectations of the dairy industry.
 2. The dairy industry has commissioned CSIRO to investigate dairy's place in a high quality/lower GHG emission diets.
- You ask we answer - <https://www.dairy.com.au/dairy-matters/you-ask-we-answer> As an industry, we know people have questions about dairy, so we're here to clarify. You Ask, We Answer is the public's place to ask questions and get the answers they are looking for, from industry experts. The topics areas include animal welfare, environment, health, dairy products and people in dairy.

Dairy Australia partnered with [Jamie Durie's Groundswell](#) to look at the Australian dairy industry, and what steps it is taking to address sustainability. The documentary speaks with Australian dairy farmers, experts from the CSIRO and the packaging industry about the role dairy plays in Australian life, and how the sector is aiming to protect the environment.

Dairy Australia - <https://www.dairyaustralia.com.au/> has a number of resources to support farmers as they make decisions to improve their sustainability impact on farm.

CANADA

Dairy Farmers of Canada: www.dairyfarmersofcanada.ca. Few written articles provide information about dairy foods in sustainable diet/food systems, but several conferences have been organized to address the issue.

- 2019 Article: 5 steps we take to reduce our environmental impact, highlights:
 - "Canadian cows produce 3x more milk than 50 years ago, due to improvements in comfort, herd management and feed efficiency
 - Dairy production represents less than 1.3% of Canada's total GHG emissions
 - Reducing our dairy industry's environmental impact is an on-going effort and priority for Canadian dairy farmers"
- [2015 national nutrition symposium](#) on sustainability and the future of food, topics covered:
 - Sustainability of the global food supply
 - Sustainable diets: good for us, good for the planet (Dr. Brad Ridoutt, Australia)
 - Food waste concerns all of us
 - Milk production: a life cycle analysis
 - What is the contribution of milk production on the environment? A local dairy farmer's perspective
- Dairy Nutrition: www.dairynutrition.ca
 - Nutrition and health symposium 2019 (October) will discuss sustainable diets:
 - Better understand definitions and goals for sustainable diets
 - Expand understanding of the impact of animal agriculture on environmental sustainability, particularly as it relates to Canadian food production
 - Gain insights on the nutritional implications of plant-based or "flexitarian" diets as proposed by EAT-Lancet
 - Continuing education webinar in July 2019: [milk and the environment](#): get the facts: current environmental footprint of milk production in Canada and the ways farmers have proactively reduced it

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- The research funding solicitation in 2019 included the topic: Role of dairy products in a healthy sustainable diet (including plant-based diets)

DENMARK

Danish Dairy Board: <https://agricultureandfood.dk>

- No documents on dairy in the diet and sustainability
- New website (in Danish only): <https://mejeri.dk/forsking>
 - EMF report “Milk Nutritious by Nature”

FRANCE

French Dairy Association (CNIEL): <http://www.filiere-laitiere.fr/en>

- Section: *The dairy sector: a naturally virtuous industry*. Information is available only on the website, there are no papers/files available to download.
 - “Farming is a key stakeholder in rural territories, contributing to jobs and rural life, promoting heritage, maintaining the countryside, preserving biodiversity, and more.”
 - Statistics provided for number of direct and indirect jobs related to dairy farming, dairy processing and manufacturing revenues, contributions to rural tourism and enhancing landscapes, descriptions of how cows help preserve the ecosystem, biodiversity, crops and the nutrient cycle, and information about nutrition & health benefits of dairy food consumption.

NETHERLANDS

Dutch Dairy Association (NZO): www.nzo.nl/en

- Website section on “[Dairy is healthy and sustainable](#)”
 - 2015 Brochure: [Environmental impact of dairy substitution](#), Optimeal modelling of Dutch diet using national survey data. Dairy products or meat were added or removed from the diet and other foods added to meet nutrient requirements while minimizing changes to current eating patterns. The impact of these dietary changes on GHG and land use found that dairy products are just as environmentally efficient as the products used to replace them. This was not the case for meat, where increases resulted in elevated levels of GHG and land use.
 - Factbook [2019 Sustainable Dairy in Europe](#), provides statistics and sustainability priorities for 6 European countries. Chapter 3 discusses aspects of a sustainable diet, citing the FAO definition and comments from several researchers. French senior researcher Nicole Darmon points out that the whole diet must be considered to meet sustainability goals rather than individual foods, and one simple recommendation is to just eat fewer calories. Regarding dairy consumption “Our consumption of dairy products should be on the same level as today - but we must eat a little less cheese and more yogurt and milk.” “Dairy products have a high nutritional quality,” she continues. “They are cheap, culturally accepted and many of them do not have a particularly big climate print”. Additional content notes that the concept of “plant-based” is too simplistic and sustainable diets must consider characteristics beyond environmental (GHG) issues, nutrient density (plant-based, empty calorie foods have low GHG emissions), and culturally appropriate food choices.
 - Ideas to reduce [food waste](#) are discussed in another section, with particular emphasis on how to interpret expiration dates.

NEW ZEALAND

Dairy NZ: <https://www.dairynz.co.nz/>

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- Dairy NZ is an organization aimed to benefit dairy farmers to be efficient milk producers while preserving the environment.
- There are no projects or documents on sustainable diets.
- More than half of their research programs are focused on environmental sustainability with a current effort to improve water quality.

SWEDEN

Swedish Dairy Association: www.lrf.se/in-english, www.lrf.mjolk

- LRF: Federation of Swedish Farmers: coalition of green industry, agriculture and forestry
- No documents in English on nutrition or sustainability

UNITED KINGDOM

Dairy UK: www.dairyuk.org

- No specific section on sustainable diets or sustainable nutrition
- *Working for a healthy planet*: discusses sustainability efforts by the UK dairy industry, the UK Roadmap, how dairy contributes to the Sustainable Development Goals (SDGs) and the Dairy Declaration, the global dairy commitment to sustainability signed in 2016 with IDF and FAO.
- *Dairy Nutrition and Health*: provides information about dairy benefits throughout life stages and the essential nutrients provided by dairy foods.

UNITED STATES

○ **National Dairy Council:** www.nationaldairycouncil.org

- Section "Farm to Table: Sustainable Nutrition". NOTE: no references were provided with these articles.
 - [Dairy and Sustainability: 6 things that may surprise you](#) (by Greg Miller)
 - Globally milk provides 5% energy, 10% protein and 9% fat consumed
 - Dairy farmers work to conserve resources including water, land and energy by using measurement tools that assist in their decisions.
 - 98% of US farmers are enrolled in FARM, a program with protocols for high-quality animal care.
 - Dairy cows with their unique 4-chambered stomachs can transform nutrients from plants that humans can't eat (grass, leaves, almond hulls, citrus pulp or peels) into nutrient rich milk. As part of the nutrient cycle, manure is made into fertilizer that nourishes new crops.
 - Many farms use anaerobic digesters to generate energy from cow waste that is used to run their farm and contribute to the electric grid that provides energy to the community. Other innovative ways to capture value from manure are being discovered by the company Newtrient.
 - A 2004 study showed that if all American adults consumed the recommended daily servings of milk, cheese and yogurt, healthcare savings would amount to \$26 billion in the first year.
 - NOTE: no references provided for any of this information
- [Sustainable diets](#) must be able to nourish people and protect planet (by Julie Hess)

- Comments on the EAT-Lancet report that the diet recommendations are nutrient inadequate, citing a low calcium requirement of 700 mg/day which is much lower than US and other national levels. Diets are not sustainable if they don't meet nutrient requirements.
 - Milk, cheese and yogurt contribute significant amounts of high quality protein, vitamin A, Vitamin D, vitamin B12 as well as calcium.
 - Inclusion of low fat and fat-free dairy foods
- [How nutrition and sustainability are inextricably linked](#) (by Greg Miller)
 - Dairy foods are nutrient rich and contribute to food and nutrition security
 - The DASH and Mediterranean diets are examples of healthy eating patterns that include dairy foods
 - The dairy community is demonstrating how it is part of the solution towards sustainable diets by reporting its efforts to continually improve sustainable production of nutrient-rich dairy foods worldwide through the Dairy Declaration and the Dairy Sustainability Framework.
- [Does it cost more](#) to follow healthy eating patterns? (by Julie Hess)
 - There is strong evidence that healthy eating patterns that include dairy foods are linked to a reduced risk of several health concerns, including cardiovascular disease, type 2 diabetes, certain types of cancer and overweight or obese.
 - Three healthy eating patterns identified by the 2015 US Dietary Guidelines were all more expensive than the typical American diet, with the Mediterranean diet the most expensive.
 - It is possible to obtain 3 servings of dairy foods in the US for about \$1 per day.
 - Realistic sustainable, healthy diets must take into account affordability and accessibility; food and diet costs are important considerations.
- [Honor the Harvest](#): describes how the dairy community contributes to a natural nutrient cycle
 - Nourish the people: ensure a variety of nutritious foods, including nutrient-rich dairy foods, are available and affordable to help all people thrive.
 - Nourish the animals: cows have specific nutrient needs but they can unlock nutrition from parts of plants people can't or won't eat. 80% of what dairy cows eat can't be eaten by people (in the US)
 - Nourish the land: Cow manure's helps restore nutrients in the soil, so food can be grown with reduced use of synthetic fertilizer, which is fossil fuel-based.
- Is dairy [environmentally friendly](#)?
 - In 2008 a collaboration of US dairy groups committed to sustainability. Baseline data from 2007 showed the US dairy sector contributed about 2 percent of total U.S. greenhouse gas (GHG) emissions and used about 5 percent of total water withdrawal. The dairy community set a voluntary goal to reduce GHG emissions 25 percent from 2007 to 2020.

- The environmental commitment is one part of a multi-dimensional approach to achieving sustainable food systems via contribution to nutrition, public health, social wellbeing, economics and thriving communities.
- **Innovation Center for US Dairy:** www.usdairy.com
 - Nutrition and sustainability are treated separately and not viewed as sustainable diets
 - US dairy farms have the lowest average GHG intensity of milk production globally: 10.6 # CO₂/gallon of milk (US) vs 20.4 # CO₂/gallon of milk (world average).
 - US dairy stewardship [commitment](#): focus on responsible production, nourishing communities, and continuous improvement
- **Dairy Council of California:** www.healthyeating.org
 - 2019 publication, [The Healthy Eating TABLE](#), section on sustainable food systems:
 - Dairy agricultural community has been a leader in implementing technologies that reduce the environmental impact of producing and processing dairy foods. During the past 70 years “efforts have led to a 90% decrease in land use, 63% decrease in GHG and 65% decrease in water needed to produce the same amount of milk (from 1994-2007)”. (Capper 2009)
 - Sustainable food systems are linked to population health. Dairy foods as part of school meal programs improve nutrient intakes, academic and health outcomes among children and adolescents. (Bradley 2013)
 - A multi-dimensional approach that includes environmental considerations, food affordability, access and availability, in addition to economics, nutrition, culture and other sociological factors are important aspects of sustainability.
 - Dietary recommendations that restrict nutrients or food components (like saturated fat) without considering the whole food matrix could unintentionally limit access to nutritious foods like milk and dairy products and the health benefits they contribute to as part of healthy dietary patterns.
 - [Dairy Sustainability](#): California dairy farm families
 - “Provide jobs for hundreds of thousands of Californians,
 - Produce healthy, nutritious and affordable dairy products for millions of families
 - Demonstrate environmental stewardship and innovation, always looking for ways to improve upon their practices.
- **Dairy Cares:** www.dairycares.com
 - “Dairy Cares is a statewide coalition with a mission to ensure the long-term sustainability of California’s dairy farm families.”
 - Most of the focus of this coalition involves environmental efforts to conserve resources, reduce GHG, protect water, air and biodiversity and create renewable energy.
 - Additional efforts involve animal care and preserving dairy farm families, their values and their communities
 - “Dairy is the leading agricultural commodity in California, making it crucial to the well-being of the fifth-largest economy in the world.”

Commercial Companies

Arla Foods: www.arla.com

- Sustainability is a priority for Arla, particularly environmental impacts of milk production. The website does not address sustainable diets or sustainable nutrition.
- Their core sustainability strategy involves climate, animals and nature, with a goal to become carbon net zero by 2050, increase renewable energy (shifting away from fossil fuels), decrease food waste, innovate sustainable packaging, and improve animal care.

Fonterra: www.fonterra.com/nz

- Sustainability is a core piece of Fonterra's strategy to provide nutritious dairy products. "We're committed to producing dairy nutrition in a way that cares for people, animals and the land, and brings value to our communities."
- Sustainable diets are referenced in the nutrition section, *Investigating Complementary Nutrition* "To help meet the world's increasing need for food, especially protein, we believe a sustainable diet will involve a combination of traditional and alternative nutritional sources." In the *2018 Annual report*, complementary nutrition sources such as plant and fermentation-produced nutrients are being investigated to give customers and consumers more options in the future.
- Sustainability priorities are: animal welfare, open gates (transparency on the farm), sustainable palm sourcing, healthy waterways and sustainable livelihoods. "The natural nutritional value of milk and the ability to produce high quality, safe products starts on the farm. This means caring for the environment and caring for the health and well-being of dairy cows."

FrieslandCampina: www.frieslandcampina.com

- Sustainability is fully integrated into the FrieslandCampina strategy, but no documents discuss sustainable diets/nutrition. "By offering trustworthy, relevant and nourishing dairy products, FrieslandCampina contributes to food and nutrient security. FrieslandCampina's purpose – nourishing by nature – stands for better nutrition for the world's consumers, a good living for our farmers, now and for generations to come."
 - Better nutrition: helping to feed the global population with nutritious and affordable dairy products
 - Good living for farmers: FrieslandCampina adds value to the milk to maximize farmers incomes and assists in improving farm management and productivity
 - Now and future generations: strive to reduce the ecological footprint of dairy farming (reduce GHG and water use), retaining pasture grazing, improving animal health and welfare, preserve biodiversity
- FrieslandCampina nutrition policy includes four programmes: Better products, responsible communications, lifestyle education and broadening access to nutrition. None of these programs discuss sustainability.

Summary of Dairy Organizations:

- Most of the information provided by dairy organizations discusses the nutrition and health benefits separate from environmental, economic or social aspects of sustainability. Few published references are provided with the information.
- Dairy foods are nutrient rich sources of essential nutrients such as high quality protein, vitamins A, D, B12 and calcium that are needed across the lifespan.
- Dairy foods can make an important contribution to fight hunger and provide nutrient security

- Adequate consumption of dairy foods as part of a healthy diet can help the academic performance and health of school children and lower the risk of chronic diseases such as cardiovascular disease, type 2 diabetes, cancer and over weight/obesity.
- Health benefits associated with adequate dairy consumption (meeting recommended amounts) can significantly reduce health care costs.
- Dairy foods are affordable. In the US 3 servings of dairy cost about \$1 per day.
- Responsible dairying provides economic benefit to families and communities by providing jobs and income that contribute to livelihoods.
- Dairy cows can transform nutrients from plants that humans can't eat into nutrient-rich milk. In the US, 80% of what cow's eat are inedible by people.
- Dairy foods are as environmentally efficient (GHG, water, land) as plant replacements according to Dutch research.
- Dairy farmers across the globe work for continuous improvement in natural resource conservation. US farmers use 90% less land, 65% less water and produce 63% less GHG during the past 70 years. In Canada, cows are able to produce 3 times more milk than they did 50 years ago.
- Dairy farms are using innovative methods to improve management of manure such as biodigesters that recycle manure into a renewable source of energy and other products like fertilizer to improve crop efficiency while reducing GHG emissions related to animal waste.
- Dairy farming enhances landscapes and biodiversity and contributes to rural tourism in France.
- Dairy farmers work to provide high-quality animal care.

Literature search in PubMed during the last 5 years for studies that examined linkages of dairy food consumption with any aspect of the 4 pillars of sustainability: environmental, social, health and economics.

The following search criteria were used to find relevant published research:

- Terms (Abstract/title): Dairy OR milk NOT human milk OR cheese OR yogurt AND sustainability
- Filters: 1 January 2014 through 30 July 2019, humans

Environmental impact of diets

- Replacing cheese with plant alternatives (like peanut butter, cherry tomatoes or nuts) in the Dutch diet reduces GHG emissions, but greater GHG reductions are achieved by decreasing consumption of meat and alcoholic beverages. Reducing intakes of meat, but not dairy, is targeted as a practical dietary strategy to reduce GHG (Van de Kamp 2018).
- An analysis of the 2011-2012 Australian national dietary survey found that excess calories and intake of discretionary foods such as snacks contribute to higher GHG of the average diet as compared to recommended healthy diets (Hendrie 2016). Diet recommendations to reduce discretionary foods would allow for increases in core foods like dairy, vegetables and grains that would provide a nutritional benefit at little environmental expense.
- A modeling study of individual UK diets using data from the 2008-2011 national survey assessed what food changes would be needed to obtain nutrient adequate and sustainable diets (reduced GHG) while minimizing changes to current eating patterns (Horgan 2016). Achieving a healthy diet does not also result in a sustainable diet. Changes in dairy food intakes would be only slight, with a shift to less cheese and more milk. However, to achieve a healthy and sustainable diet, reductions in total meat, especially beef and lamb, sweet cakes, biscuits and desserts, alcohol, and bread would have the greatest impacts.

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- The 2008-2010 Irish national survey was used to determine the amount of GHG per food group. Red meat, dairy and starchy staples were the largest contributors of GHG emissions, due to intake patterns and GHG impacts of the foods (Hyland 2016). When considered on a calorie basis, dairy food contribution of GHG is similar to its calorie contributions, while sugar snack foods have low GHG but high calorie contributions and starch has high of both. Consuming low GHG foods may not be conducive to maximizing good health.
- Gonzalez-Garcia (2019) reviewed 21 studies that evaluated different dietary choices and their impacts on nutritional quality and carbon footprint. The Mediterranean and Atlantic diets were identified to have high nutritional scores and low carbon footprints, in contrast to European and US diets with high carbon footprints due to high intakes of dairy products. Diets rich in vegetables have a better environmental profile than those rich in animal source foods, especially ruminant meat. The authors suggest a shift in meat consumption from beef to chicken, pork and poultry, and alternative protein sources such as quinoa. However, they acknowledge that complete elimination of meat and dairy foods could result in inadequate amounts of certain nutrients such as calcium and vitamin D.

Average percentage contribution of food groups to total dietary greenhouse gas emissions among Australian adults (Hendrie 2016) and Irish adults, excluding energy misreports (Hyland 2017)

Hendrie 2016	Hendrie 2016	*Hyland 2017	Hyland 2017 Total dietary GHG: 6532 g CO ₂ eq/d	
†Food Group	% of total dietary GHG	g CO ₂ eq/d	Food group (matched to similar description of Hendrie 2016)	
Fresh meat & alternatives	33.9	38.0	584	Red Meat + Eggs, poultry, pork + Fish
Discretionary foods	29.4	0.0		Not available
<i>Red meat</i>	17.6	25.2	1646	Red meat
Breads and cereals	13.6	9.9	647	Starchy staples
<i>Processed meat, burgers, tacos, pizza</i>	11.3	4.6	303	Processed meat
<i>Poultry</i>	11.0	8.9	584	Eggs, poultry, pork
Dairy	10.5	11.2	732	Dairy
Vegetables	6.5	1.1	71	Vegetables
<i>Alcoholic beverages</i>	5.7	8.2	533	Alcoholic beverages
Fruit	3.5	1.1	75	Fruit
<i>Fish</i>	3.3	3.8	249	Fish
<i>Sugar sweetened beverages</i>	3.1	3.3	217	Carbonated beverages
<i>Savoury and sweet biscuits, cakes</i>	2.2	0.0		
<i>Dairy based desserts, cream, butter</i>	2.1	0.0		
<i>Vegetarian alternatives</i>	2.0	0.8	49	Legumes, pulses, nuts
Other beverages (non sugar sweetened)	2.0	6.2	402	Other beverages
<i>Muesli bars, confectionary, chocolate</i>	1.7	0.0		
<i>Sweet and savoury pastries, pies</i>	1.5	3.4	221	Savoury snacks
<i>Other - stock salt, dry soups</i>	1.2	0.0		

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<i>Fried potato and extruded snacks</i>	0.6	0.0		
Healthy fats and oils	0.5	4.3	281	Fats/oils
Miscellaneous	0.2	3.9	257	Miscellaneous
<i>Other, reptiles, offal</i>	0.0	0.0		

†Italicized food groups are subsets of Fresh meats & alternatives and Discretionary foods

*Percentages calculated from GHGE per food group divided by total dietary GHGE of 6532 g CO₂ eq/d

Studies that evaluated multiple aspects of sustainability:

- Barre et al (2018) provide one of the first assessments of the environmental impact and diet cost of foods taking into account the bioavailability of several nutrients, including iron, zinc, provitamin A and protein (assessed as protein quality). This study also looked at the interrelationships between foods that are linked; for example, 35% of beef in France is from dairy cows, so indirectly co-produced with milk. Data from the French national diet survey, INCA2 (2005-2007), were modeled to determine dietary changes from current diets that would improve sustainability based on environmental impacts of GHG, atmospheric acidification and marine eutrophication. A large decrease in meat consumption had the greatest effect on environmental metrics with no increase in diet cost. All of the modeled diets cost less than the current French diet. Total intake of dairy products was very stable (under the environmental impacts), however there would be a shift to more milk and less cheese and yogurt. Taking nutrient bioavailability into account had minor effects on food groups, with some shifts required within food groups and no significant effect on dairy foods. However, it was noted that there is no established algorithm for calcium bioavailability from different sources (like milk vs fortified plant drinks), so the impact on available calcium could not be assessed. This is a knowledge gap identified for future research. When co-production of beef and milk was considered, intake of dairy products would remain stable, but ruminant meat would increase. In this scenario, alcoholic beverages and hot drinks would be reduced to meet the environmental constraints. This study acknowledged the positive environmental effects of dairy production to benefit pasturelands.
- Using consumption data from the 2011 Swiss national survey, diets were modelled to assess impact on indicators of nutritional quality, environment, economics and health. Diets that met the Swiss Dietary Guidelines had the best performance on 5 indicators of environment (GHG, water, land, nitrogen and phosphorus use), expenditure (diet cost) and health (assessed as DALY) compared to the current Swiss diet (Chen 2019). Meeting the recommended Swiss diet would result in reduced meat, cereals and vegetable oils but slight increase in dairy products as compared to the current diet. It was noted that vegetarian or vegan diets may lack several micronutrients including vitamin B12, choline and calcium. The authors recommend evaluating multiple indicators to assess sustainable diets rather than relying on a single factor like GHG.
- A cross-sectional analysis of 4 national UK diet surveys assessed the impact of higher vs lower dairy intakes on several measures of nutritional adequacy, environmental impact, financial cost and health (Hobbs 2019). Higher vs lower dairy intakes showed better diet quality and nutrient adequacy (protein, calcium, iodine), health benefit of lower systolic blood pressure, no effect on blood lipids and lower dietary cost. However, the environmental impact was mixed; higher dairy intakes had lower GHG but higher water eutrophication potential. The authors call out the lack of available data on the environmental impact of many food groups.
- Dr. Adam Drewnowski uses data from the US, France and other countries to consider the sustainability of dairy foods (Drewnowski 2018). "Milk and dairy products can be described as nutrient-rich, affordable and appealing," while new technologies are helping to reduce the impact

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on natural resources and the environment. While few foods are able to meet all aspects of sustainable diets, Drewnowski pleads that meeting nutrient requirements and economic limitations must be weighed against environmental constraints.

- Excessive consumption of discretionary foods rather than core foods was found to have the greatest impact on the water scarcity footprint (25%) of adult diets assessed from the 2011-2013 Australian National Health Survey (Ridoutt 2019). Discretionary foods are energy dense foods high in added sugar, saturated fat, sodium and alcohol and are not necessary for a healthy diet. Discretionary foods provide about 30% of calories to the diet, contributing to overweight and can displace nutrient-dense foods. They contribute similar levels of GHG and water scarcity footprint. Among food groups, the fruit group contributed the next highest level of water scarcity footprint at 19% followed by dairy at 16% and meats at 11.6%. When diet quality was assessed, individuals who consumed diets with higher quality also had lower water scarcity footprints. A shift from the current diet to the recommended diet could significantly improve water footprint in Australia.
 - Many discretionary foods also would be considered ultra-processed foods found to make up more than 40% of energy intake among Australians, and similarly displace minimally processed core foods like dairy recommended in the Australian Dietary Guidelines (Machado 2019).
 - Note that Australians are not meeting the recommended amounts of dairy foods, contributing to inadequate calcium intake among 73% of females and 51% of males ([Australian Bureau of Statistics](#)).

Nutritional adequacy of diets, comparing dairy and plant food alternatives

- A modelling study using the US national survey (NHANES 2007-2010) evaluated the impact of doubling either plant foods or dairy foods on macronutrient intake and nutrient adequacy (Cifelli 2016). Doubling plant foods resulted in better adequacy of vitamin C, magnesium, vitamin E, folate and iron, but lower adequacy of calcium, protein, vitamin A and vitamin D, depending on the plant foods consumed. Doubling protein-rich plant foods did not affect nutrient adequacy because of the low amounts consumed in the baseline diet. Doubling dairy food intake improved intakes of calcium, vitamin A, vitamin D, magnesium, protein, but also increased SFA and sodium. This study demonstrates that recommendations to increase plant foods could lead to unintended nutrient deficits without more specific dietary guidance.
- A proof of concept study that evaluated both health and environmental impacts found that adding one serving of fluid milk to the average American diet could result in an overall health benefit measured as disability adjusted life years (DALY) (Stylianou 2016). Health impacts linked to milk consumption were based on epidemiological established benefits of colorectal cancer, stroke and prostate cancer while selected environmental impacts included global warming potential and particulate matter.
- The 2015 Dietary Guidelines for Americans (DGA) includes a Healthy Mediterranean-Style Eating Pattern (HMEP) as an example of how to construct a diet that will meet most of the nutrient requirements. However, the HMEP differs from the current DGA in that it recommends only 2 servings of dairy foods per day in contrast to 3 servings per day in the DGA and therefore the nutrients calcium and vitamin D may be insufficient. A modelling study that added 0.5 or one serving of dairy to the HMEP resulted in improved calcium and vitamin D adequacy and several other nutrients (Hess 2019).
- Herforth et al (2019) reviewed global food-based dietary guidelines (FBDG) and finds that dairy recommendations are present in 59% of countries with national dietary guidelines. Dairy has its own food group in 64% of countries; 11% of FBDG include alternatives in the dairy food group. Several FBDG include health outcomes associated with food groups or nutrients, such as this example from

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the Philippines “Consume milk, milk products and other calcium-rich foods, such as small fish and shellfish, everyday for healthy bones and teeth”. A compilation of health outcomes associated with adequate dairy intake identified from FBDG could be a useful resource to discuss the importance of dairy in healthy, sustainable diets.

Health and economic consequences of diet shifts

- An Australian study determined the potential health benefit for policies that incorporated taxes on saturated fat, sugar, sugar-sweetened beverages and salt and a subsidy on fruits and vegetables, alone or in combination (Cobiac 2017). Note that the saturated fat tax did not apply to drinking milk and the salt tax did not apply to dairy foods; the sugar tax did apply to ice cream. The combination of taxes and subsidy determined that as many as 470,000 disability-adjusted life years could be averted in the Australian population of 22 million, along with a net cost-saving of AU\$3.4 billion (US\$2.3 billion) in healthcare costs. The sugar tax was found to have the greatest impact on health, while a subsidy on fruits and vegetables (on its own) did not lead to a health benefit due to predicted increased intake of other less healthy foods (sodium and energy). This study is unique and quite important to determine that a stimulus to increase fruit and vegetable consumption, one of the most frequent dietary recommendations around the globe, did not have a predicted beneficial impact on health. More studies like this simulation are needed before making a conclusion about fruits and vegetables.
- Four studies have now estimated beneficial savings in health care costs associated with consumption of dairy foods that meet dietary recommendations in: Australia, Canada, Iran and US. Each of these studies indicated that current intakes of milk or dairy foods were low and the need for an increase in dairy food intake to meet recommendations. These collective studies suggest the potential for additional research that confirms a core list of health conditions that appropriate dairy consumption as part of a healthy diet helps to avoid. Similar calculations in other regions of the world, especially Europe, Latin America and Asia also would be of interest.

Author	Country	Health issues improved by dairy	Servings of dairy per day	Savings in healthcare costs
Doidge 2013	Australia	type 2 diabetes, ischemic heart disease, stroke, osteoporosis, obesity, hypertension	2-3	AUD\$2.1 billion per year
Javanbakht 2018	Iran	type 2 diabetes, cardiovascular disease	3	USD\$15 million over 20 years
Lieffers 2018	Canada	colorectal cancer	2 (milk only)	CAD\$112.3 million (direct costs) CAD\$536.4 million (indirect costs)
McCarron 2004	US	obesity, hypertension, stroke, coronary artery disease, type 2 diabetes, osteoporosis, kidney stones, certain pregnancy outcomes, colorectal cancer	3-4	USD\$26 billion (first year) > USD\$200 billion (cumulative 5 years)

Food waste

- A US study found that replacing conventional (fresh) fluid milk with shelf-stable milk or soy beverage in schools as part of the School Breakfast Program could reduce GHG by 28.5% (shelf-stable milk) or

79.8% (soy) per student meal due to reduced food waste. However, these substitutions also would result in increased costs of 1.9% (shelf-stable milk) and 59.4% (soy) per student meal (Beckerman 2019).

- A UK study was able to identify the exact types of foods wasted and then calculate the associated nutrients lost and the environmental impact (Cooper 2018). The dairy/egg category had a modest food waste of 8% compared to fresh vegetables at 25%, drinks at 13%, bakery at 11%, processed vegetables at 3%, fresh fruit 6%. Calcium is an under-consumed nutrient in the UK and its loss was estimated to be 27%, with equal amounts lost from milk + cheese (13%) and bread (13%). The environmental impacts associated with the dairy/egg food waste is estimated between 2-5% for 5 environmental categories including land, water, climate change, non-renewable resource depletion, and ecosystem quality. These values are quite low in comparison to other food groups such as meat/fish, fresh vegetables, drinks and bakery.

Food production efficiency, protein conversion

- Dairy cows and other ruminants have the ability to transform human inedible, low-quality protein in roughage and food by-products into high-quality protein found in milk and meat. This physiological trait of dairy cows provides important economic and environmental contributions to delivering a nutrient dense food product, milk, as part of a sustainable food system. The ratio of human edible protein output in cow's milk per human edible protein input (in cow's feed) (edible feed protein conversion ratio, eFPCR) is one measure of the protein conversion efficiency of milk production. Broderick (2019) review existing studies and identify strategies to optimize protein conversion by cows in order to continually improve the environmental impact of milk production.
- Swensson (2017) present data for the protein conversion efficiency of high-yielding, intensive dairy farming practices in Sweden, and demonstrate that the eFPCR is greater than 1.0 for four out of five dairy regions in Sweden. The human edible component of a cow's diet is critical to protein conversion and must be minimized to justify dairy production.

Country	Edible feed protein conversion ratio (eFPCR)	Source
Argentina	1.64	Broderick 2019
US	2.08	Broderick 2019
UK	1.41	Broderick 2019
Sweden	0.70-1.62	Swensson 2017

Professionals' Attitudes about # Dairy Servings

- A New Zealand study evaluated professionals in the agriculture, environment, and health sectors to determine their agreement regarding sustainability characteristics and inclusion of sustainability statements within dietary guidelines (Jones 2019). "Two-thirds (63%) of respondents disagreed that NZ's current food system is sustainable." "Overall, 77% of respondents agreed that sustainability characteristics should be included in guidelines". There was high level of agreement for five of eight sustainability characteristics, however there was disagreement regarding a characteristic statement about dairy "to consume recommended serves of dairy products."

Summary of PubMed Search:

- The environmental impact, especially GHG emissions contributing to climate change, of dietary patterns and food groups is still a major focus of research.

- A majority of food-based dietary guidelines (FBDG) include a dairy food group as part of a healthy diet. Some FBDG include specific health benefits of dairy foods, such as “healthy teeth and bones”; a compilation of health benefits of dairy foods from FBDG could be a useful resource.
- Replacing dairy foods with plant foods has a modest/minimal effect on GHG, while reducing meat consumption has a much greater impact to reduce GHG.
- In several studies to reduce environmental impact of diets where total dairy intakes would remain about the same, some have suggested a shift to more milk and less cheese and yogurt. No studies so far have reported environmental impacts related to fat content of milk/dairy foods.
- Higher levels of dairy consumption have been associated with greater water eutrophication potential.
- Excess total calories and consumption of discretionary foods such as snacks, sweets and alcohol contribute significantly to GHG emissions and should be considered in recommendations to reduce environmental impact of diets.
- Some plant foods with a low carbon footprint are energy dense but not nutrient dense, such as sugar and starchy foods, and would not contribute a beneficial impact on health despite being environmentally friendly. Dietary recommendations to increase plant foods need to provide careful guidance.
- Increasing plant foods does not always result in better quality diets; some essential micronutrients such as calcium and vitamins A and D may be lower as a result.
- One study determined that a subsidy on fruits and vegetables to increase intake by itself would not result in improved population health. This points out the need to base dietary recommendations on sound evidence as unintended consequences can occur.
- Higher levels of dairy foods in the diet have been shown to result in better diet and nutritional quality, especially regarding protein, calcium, vitamin D and vitamin B12.
- Eliminating all animal source foods, including dairy, could result in inadequate intakes of several nutrients such as protein, calcium, vitamin D, vitamin B12 and choline.
- Mediterranean diets are frequently recommended for the health of people and planet. Typical Mediterranean diets contain 2 servings of dairy foods per day. Adding another serving of dairy to the Mediterranean diet can improve calcium adequacy.
- Accounting for nutrient bioavailability of iron, zinc, provitamin A and protein (quality) in dietary modeling to improve sustainability aspects of diets did not significantly affect the type or amount of foods. However, algorithms to assess calcium bioavailability are not currently available.
- Diet cost does not always increase when current dietary patterns shift to match national dietary guidelines or sustainability characteristics. One study found that diets with higher vs lower levels of dairy had a lower food cost.
- Cows are efficient converters of low protein quality feedstuffs into high quality protein in milk and meat.
- Dairy food waste is low compared to other food groups like fresh vegetables, drinks and bakery products. Shifting to shelf-stable fluid milk products provided to a school breakfast program could significantly reduce food waste and GHG associated with food waste, however, will increase cost.
- Consistent results from analyses of meeting dairy food recommendations in 4 countries show a significant reduction in healthcare costs: (US, Australia, Iran, Canada). However, each analysis used different chronic diseases to determine the impact on health. A potential research program could obtain consensus on specific health benefits associated with meeting national dairy food recommendations and expand the health care cost analyses to countries in Europe, Latin America and Asia.

Website Investigation of NGOs

CODEX: www.fao.org/fao-who-codexalimentarius/home/en/

The CODEX mission is to “Protect consumer health and promote fair practices in the food trade by setting international, science-based food safety and quality standards.”

- There are no specific work themes or documents on sustainable diets within the CODEX website, however, CODEX programs to ensure all consumers have access to safe food at a fair price will contribute to SDGs #2 (ending hunger) and #3 (healthy lives).

Currently there are two CODEX projects related to dairy foods:

- As part of the Joint FAO/WHO Expert Meetings on Nutrition (JEMNU), the Codex Committee on Nutrition and Foods for Special Dietary Uses (CCNFSDU) hosted an expert meeting in July 2019 to determine [appropriate protein conversion factors](#) for milk-based and soy-based infant and follow-up formulas.
- At the request of UNICEF, the CCNFSDU is also working on a text to provide technical and [nutritional guidance on the production of Ready to Use Therapeutic Foods \(RUTF\)](#) for children aged 6 to 59 months with severe acute malnutrition.

FAO: www.fao.org

- A new publication, [Climate change and the global dairy cattle sector](#) documents GHG emissions by the dairy sector and discusses ways to improve to meet the goals of the 2016 Paris Agreement.
 - “Between 2005 and 2015, GHG emissions from dairy farming have increased by 18 percent due to increased overall milk by 30 percent, in response to increased consumer demand”
 - Milk and dairy “are nutrient-dense foods that supply energy and significant amounts of protein and micronutrients, including calcium, magnesium, selenium, riboflavin, and vitamins B5 and B12”.
 - “They are the fifth largest provider of energy and the third largest provider of protein and fat for human beings and an important source of affordable nutrition to meet recommended levels.”
 - “In about 25 percent of cattle-keeping households, or in about 35 million farms, dairy cows are directly owned and/or managed by women (FAO, 2016).” “about 80 million women are to some extent engaged in dairy farming (FAO, 2016)”
 - Gains in milk production efficiency and increased yield will contribute to lower GHG intensities.
- Section on [Dairy Development](#): describes the social and economic impacts of dairy farming and milk production to provide nutritious food in addition to a regular source of income, on and off farm employment, creates opportunities for women and contributes to food security and poverty reduction.
- Link to [sustainable food and agriculture](#), goals and principles:
 - New publication [Make agriculture, forestry and fisheries more productive and more sustainable](#): has established “5 key principles that balance the social, economic and environmental dimensions of sustainability:
 - Increase productivity, employment and value addition in food systems
 - Protect and enhance natural resources
 - Improve livelihoods and foster inclusive economic growth
 - Enhance the resilience of people, communities and ecosystems
 - Adapt governance to new challenges”

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- External link to [sustainable food system programme](#): a “multi-stakeholder partnership focused on catalyzing more sustainable food consumption and production patterns.”

Global Allowance for Improved Nutrition (GAIN): www.gainhealth.org

- Article on “[What is the role of animal-source foods in sustainable food systems?](#)”, a synopsis of a May 2019 Univ California-Davis conference *Aligning the Food System for Improved Nutrition in Animal-Source Foods*.
- [Blog article with 3 reviews of the EAT-Lancet](#) report: highlights some issues that were not given adequate consideration, such as affordability and accessibility of healthy foods, potential impact on livelihoods with recommended food system transformation, lack of evidence for low quantities of animal source foods and nutrient gaps that could result among some subgroup populations, no roadmap for what needs to happen next.
- [Critique on EAT-Lancet](#) report by GAIN Executive Director Lawrence Haddad; comments similar to above blog post.
- [More milk please?](#) Not directly related to sustainable diets, but important support for dairy foods by GAIN. Editorial about the Lancet paper results of the PURE study that demonstrated protective effects of whole-fat dairy on risk of cardiovascular disease.

Heifer International: www.heifer.org

- Heifer International helps families achieve self-reliance by providing tools, training and livestock to sustain themselves.
- There are no specific documents on sustainable diets, however, reports of project results provide examples of how livestock donations and best practices (sustainable agro-ecology/environmental impacts) can contribute to nutritionally adequate diets, empower women and enhance income for the receiving families and the communities where they live.
- [Case studies and research reports](#) on the impact of animal source foods and milk in particular within families who receive livestock. Increased milk and meat in Zambian diets facilitated meeting nutrient requirements while increased plant food staples did not (Zhang 2016). Families who received cows in Zambia resulted in improved nutrition, more income and better diet diversity, both directly and indirectly from consuming milk produced on the farm and the economic ability to purchase other foods (Jodlowski 2016).

International Food Policy Research Institute (IFPRI): www.ifpri.org

- [IFPRI blog](#) by Sheggen Fan discusses the EAT-Lancet report “Healthy diets and sustainable food systems for all: A differentiated approach for animal-sourced foods (ASFs)
 - “As the report highlights, transforming to healthy diets by 2050 will require drastic changes. Global consumption of healthy foods, such as fruits and vegetables, will need to double, while overconsumption of foods like added sugars and red meat will need to be more than halved (primarily to address excessive consumption in wealthier countries).
 - At the same time, it will be equally important to take a differentiated approach for healthy and sustainable diets in developing countries and for poor populations. For many developing countries and the poor, undernutrition and access to healthy foods remain as persistent challenges, as noted in the report. Small amounts of animal-sourced foods (ASFs) (like dairy, eggs, fish or chicken) for young children and women during pregnancy and lactation is crucial for nutrition and health, especially in poor populations. For instance, research finds a strong association between reduction in stunting and ASF consumption.

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- Furthermore, the accessibility and affordability of healthy and nutritious foods—both animal-sourced and plant-based—will be key. Many nutrient-dense foods (such as fruits, vegetables, and animal foods) are highly perishable, often making prices significantly higher than that of ultra-processed, nutrient-poor, and calorie-dense staple foods.”
- Enabling the business environment for healthy and sustainable food: IFPRI-GAIN/SBN [RoundTable event](#): Engagement with the private sector is recognized as being a key component of transforming the global food system to meet all criteria associated with sustainable diets. IFPRI’s Food Industries for People and Planet (FIPP) Program was developed for this purpose and intends to hold annual meetings to assess progress.
- There are many country-specific, dairy-related research projects and programs described that address various aspects of sustainability, from gender equity to food safety, improved productivity, nutrition, food security and resource preservation.

International Livestock Research Institute (ILRI): www.ilri.org

- [Presentation](#) “Livestock enhanced diets in the first 1,000 days: Pathways to healthy and sustainable futures in low-income countries?” <https://www.slideshare.net/ILRI/eat-first1000days>
- [Sustainable livestock systems](#): describes projects:
 - Dairy cooperatives [support livelihoods of women](#) in India:
 - rural dairy enterprises are viable, generating incomes for farmers and delivering high-quality products to poor consumers at competitive prices. Milk prices and production levels have increased by 17% and 300% respectively. There have been clear improvements in the livelihoods of families involved in the federations. The women have used the income from dairy production largely for household expenses, such as school fees, but have also invested in new farm inputs. Some households have also purchased crossbred improved livestock, such as poultry.
 - [Research increases milk production](#), productivity and sales in Ethiopia:
 - the number of households selling milk has increased by 81%, from 17,900 to 32,000, and the volume of milk traded increased by 226%, from 14.6 million litres to 47.6 million litres, a 36% increase in the number of litres sold per cow.
 - Better estimates find [GHG emissions from cattle in Kenya are significantly lower](#) than reported levels:
 - The preliminary results indicate that the actual enteric methane emissions from cattle in small-scale livestock systems are up to 40% lower than current IPCC Tier I estimates. Furthermore, GHG emissions from livestock manure and urine applied to soils in western Kenya are between 50% (methane) and 90% (nitrous oxide) lower than the IPCC estimates.

SAI Platform: <https://saiplatform.org>. Nothing specific about sustainable diets.

- The [Dairy Working Group](#) is a collaboration to enhance innovative sustainability approaches at the farm level.
- The [Circular Dairy Economy](#): report prepared by FrieslandCampina for the 2016 World Dairy Summit, provides insights into the potential of circular dairy farming from a Dutch perspective.

UNICEF: www.unicef.org. There is no information about sustainable diets.

World Food Program (WFP): www.wfp.org

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The World Food Program works with countries to help the most vulnerable and food insecure communities meet their everyday needs for livelihood and to manage their natural resources in sustainable ways.

- There are no documents specifying information about sustainable diets, however, WFP recognizes that just providing calories is not enough; healthy diets must provide all of the essential nutrients.

World Health Organization (WHO): www.who.org

The focus of WHO is to promote health, especially among vulnerable populations. A current emphasis is on universal health coverage.

- There are no current projects or programs listed on sustainable diets, however, several years ago they defined and continue to update a “[healthy diet](#)” with an emphasis on breast feeding for infants, reduced intakes of salt, sugar and fat, especially saturated and industrially produced trans fat.
- WHO is a partner with other UN agencies on the [Decade of Action on Nutrition](#) with a goal to reduce malnutrition in all its forms, including under and over nutrition.
 - In February 2019, Australia and France initiated the [Global Action Network on Nutrition labelling](#), to encourage accelerated efforts of nutrition labelling.

Summary of NGO Websites:

- Recognition of the nutrient contribution of dairy foods and their role in nutrient security and health benefits such as reducing stunting and risk of chronic diseases
- Economic benefits of affordable nutrition, income generation and poverty reduction, improved livelihoods
- Empowerment of women by providing income
- Improving environmental impacts, especially GHG intensity with greater production efficiency

EAT-Lancet (E-L) Commission Report: [Food in The Anthropocene: the EAT-Lancet Commission on Healthy Diets From Sustainable Food Systems](#). This is an example of a well-funded influencer group trying to shape global food policy with narrowly defined scientific evidence, and demonstrates the importance of high-quality data and facts about dairy production and consumption. The report focuses on the challenge of how to feed a future global population of 10 billion people by 2050 while current eating patterns and agricultural food production are causing harm to the planet’s natural resources.

A primary concern is the impact of GHG emissions especially from livestock used for animal source foods, and therefore a main conclusion is to transform the current food system by reducing consumption and production of animal source foods and shift to more plant-based foods.

Some considerations:

- The Commission has proposed a “healthy reference diet” and global environmental targets, and it has recommended policy actions to implement them. Calls for a significant, global food system transformation based on a single publication without 1) a full systematic review and critique of the relevant evidence, 2) public input, and 3) stakeholder engagement, would be inconsistent with the usual practices of national governments.
- Dairy is not a major contributor to GHGe. Globally, the dairy sector contributes just 2.7 percent of total global anthropogenic GHG emissions. (FAO. Greenhouse Gas Emissions from the Dairy Sector: A Life Cycle Assessment. 2002;30(5):385395. doi:10.1016/S0301-4215(01)00105-7.)

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- The E-L report's healthy reference diet contains zero to two servings of dairy foods; however, this is lower than many national dietary guidelines that recommend three servings of dairy foods or more depending on age.
- The E-L healthy reference diet contains about 700 mg/d of calcium (with one serving of dairy), which is also lower than many national recommendations. The official WHO calcium recommendation of 1,000 mg/day (for most adults) (WHO | Diet, nutrition and the prevention of chronic diseases Report of the joint WHO/FAO expert consultation (WHO 2003). <http://www.who.int/dietphysicalactivity/publications/trs916/download/en/>).
- The body of evidence linking dairy foods to health outcomes, such as better bone health, reduced risk for cardiovascular diseases (CVD), blood pressure, type 2 diabetes (T2D) and lower mortality has been essentially ignored.
- The E-L report does not address how the healthy reference diet could be modified to address needs of specific age/sex groups or vulnerable or undernourished populations.
- Dairy food production has social and economic benefits, including food-security and poverty-reduction implications, especially for women in developing countries. Up to one billion people globally rely on the dairy sector to support their livelihoods.
- Protein quality was not considered in the recommendations to increase more plant foods. On average, plant foods contain lower quality protein due to lack of certain indispensable amino acids and the presence of anti-nutrients such as fiber that reduce digestibility. This may require greater consumption of these foods, and thus more calories, to match the amount of high quality protein from animal source foods.
- Dairy cows are able to convert plant materials, residues and by-products that humans can't eat into nutritious milk with high-quality protein. The majority of what cows eat does not compete with human food and is grown on land that is not suitable for crops. Thus, dairy farms and cows are not major users of cropland.
- Recycling use of manure into fertilizer, renewable energy or other products is an important contribution to reduce GHG emissions.

Knowledge gaps and research opportunities

This scanning exercise uncovered several research topics that could enhance the evidence base for dairy's role in sustainable diets.

- Several studies determined an economic benefit to national health care costs when dairy dietary intakes were modelled to meet dietary recommendations. However, the studies used different morbidities to determine beneficial effects of dairy consumption. It would be useful to achieve agreement or confirmation of a core list of health conditions that appropriate dairy consumption, as part of a healthy diet, contributes to a significant benefit. Then, replication of the reduced health care costs attributed to dairy could be repeated for several countries and especially in other regions of the world, such as Europe, Latin America and Asia.
- One study incorporated nutrient bioavailability into environmental and cost impacts of foods, but noted that for calcium this was not possible since there is no established algorithm for calcium bioavailability from different sources like milk vs fortified plant drinks. Research is needed to assess calcium bioavailability from fortified foods and beverages in order to understand the ability to meet calcium requirements by consuming these foods as compared to milk and dairy products.
- Some food-based dietary guidelines (FBDG) include specific health benefits of dairy foods, such as "healthy teeth and bones" (Philippines). A compilation of health benefits of dairy foods from FBDG

could be a useful resource and would complement the information used to assess health care cost reductions associated with adequate dairy in a healthy diet.

- The improved efficiency of milk production, increased milk by using fewer resources (water, land), has been quantified by a few countries. Repeated calculations to demonstrate the continuous and progressive improvement in milk production/processing in other countries/regions would enhance dairy's image as protective of the environment.

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