Violife 100% vegan alternative to cheese vs. dairy cheese in Europe, UK, US and Canada.

Life Cycle Assessment
Technical Summary

January 2022

VIOLIFE 100% VEGAN ALTERNATIVE TO CHEESE VS. DAIRY CHEESE. LCA TECHNICAL SUMMARY

Violife is a world leading vegan brand, owned by Upfield, which offers a range of versatile products including alternatives to dairy cheese which can be used for cooking or eating on their own. In 2022, Quantis was commissioned to conduct a Life Cycle Assessment (LCA) of of certain Violife vegan alternatives to cheese products ("Violife Product") sold in Europe, the UK, United States, and Canada, compared to dairy (cow and sheep) cheese sold in the same markets. The study included 20 Violife Products (a "product" refers to a recipe / packaging /market combination). This document provides a summary of the study scope, functional unit and system boundaries, method and data sources, climate footprint and land occupation results, and equivalencies used for comparative claims for the Violife products.

LIFE CYCLE ASSESSMENT

Life cycle assessment (LCA) is a metric-based methodology used to assess environmental impacts resulting from, for example, greenhouse gas emissions, waste production, water, land, and energy use. Environmental impacts are calculated over the life cycle of a product, from extraction of raw materials to the end-of-life.

METHOD

This study followed the regionalized LCA methodology described by Liao et al. (2020) to compare the environmental impacts of 1 kg of Violife Products against the same amount of dairy cheese sold in Europe, UK, United States and Canada. Data was collected with a cradle-to-grave approach for the product recipe, key ingredients sourcing countries, production factory, energy mixes, packaging designs, transportation, and end-of-life scenarios. Spatially differentiated agricultural life cycle inventory data were generated (archetypes), as well as land use change (LUC) emissions for Violife Products to dairy cheese using an attributional approach as per PAS 2050 (BSI, 2012), aligned with the latest international standards for dairy products, published by the International Dairy Federation (IDF, 2015) and the European Dairy Association (EDA, 2016).

CRITICAL REVIEW

The LCA respects ISO 14040 and 14044 standards for public disclosure of results. The study has been peer reviewed by a panel of three independent experts on topics such as LCA, agronomy and dairy production.

FUNCTIONAL UNIT

The functional unit (FU) is a reference unit for which all results are calculated and presented. For Violife Products and dairy cheese, the functional unit (FU) was to provide the function of 1 kg of cheese or cheese alternative, packaged, at the consumer's home, in a given sales market.

ENVIRONMENTAL IMPACT INDICATORS CONSIDERED

The assessment includes a total of 16 indicators: 14 environmental impact indicators from the European Commission Environmental Footprint (EF) 3.0 method and two additional indicators: land occupation (m^2.y), which reflects the total area of land used over one year and is a proxy for biodiversity and ecosystem services (Nemecek et al. 2011, Milà i Canals et al. 2012), and water consumption (m^3), the total amount of fresh water consumed (ISO 14046), which includes, for example, evapotranspiration of irrigation water.

FROM CRADLE-TO-GRAVE

The LCA considers all identifiable activities across the product life cycle (cradle-to-grave) for certain Violife Products in Europe, UK, United States and Canada (see Figure 1).

The study includes impacts from:

- Farming (crop production or milk production)
- Packaging manufacturing of Violife Products or dairy cheese
- Distribution
- Retail
- Consumer use
- Packaging end-of-life

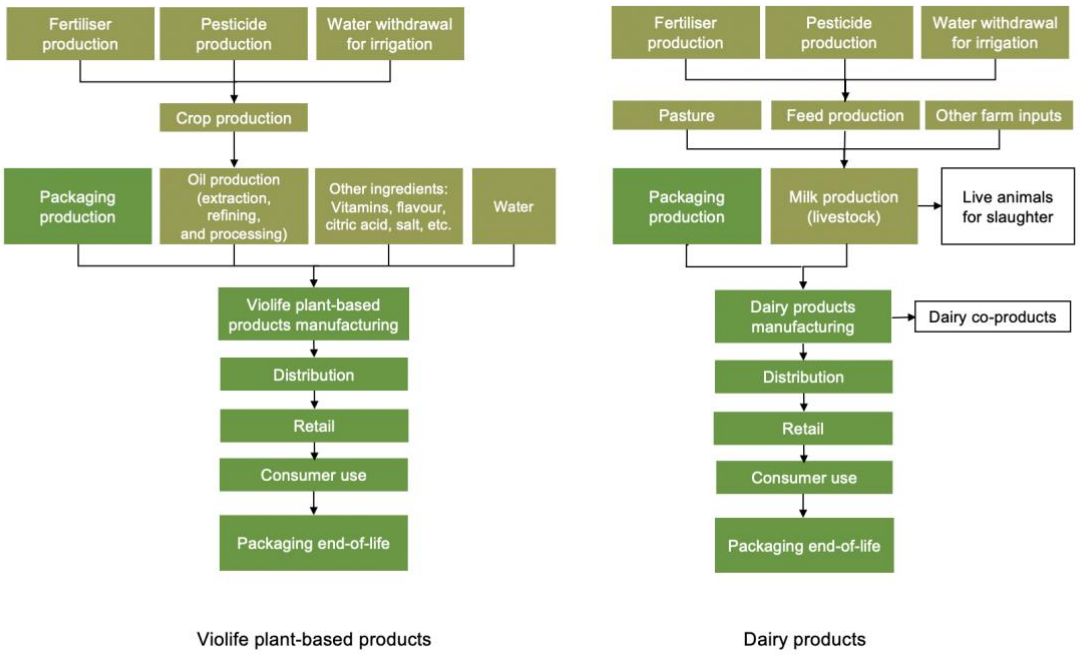

Figure 1. Schematic of the systems evaluated

The study does not include impacts from:

- Capital goods at the distribution centre and at the point of retail.
- Labour, commuting of workers, administrative work, cattle insemination, and disease control processes.
- Food loss and food waste during distribution, at retail point and at the consumer's home.

DATA COLLECTION AND MODELLING

- Violife Products: primary data for the recipes and ingredient sourcing for Violife Products were provided by Violife.
- Dairy cheese for Europe: Default data representative of European averages and published by the European Dairy Association and the European Commission were used to model dairy processing, packaging, and distribution.
- Dairy cheese for UK: Data representative of UK dairy practices were used to model dairy processing. Data representative of European averages and published by the European Dairy Association and the European Commission were used to model packaging and distribution.
- Dairy cheese for US and Canada: Default data representative of US and Canada averages and published by the USDA were used. Canadian milk modelling was updated with the latest available data from Dairy Farmers of Canada (DFC, 2018).

All data has been assessed to ensure that it meets the quality standards required to make comparative assertions. Data was compiled for different product recipes, key ingredient sourcing countries, production factory locations, energy mixes, packaging designs, transportation, and end-of-life scenarios. Spatially differentiated agricultural life cycle inventory data were generated (archetypes), as well as LUC emissions for agricultural ingredients in all markets relevant

to each system's supply chain. The LCA modelling tool SimaPro version 9.2 was used to model individual datasets (such as oilseeds and packaging) required for 100% plant-based products and for the life cycle of dairy products.

RESULTS AND DISCUSSION

CLIMATE CHANGE IMPACTS

Table 1 shows that all Violife Products assessed have lower climate impacts than dairy cheese. The climate change impacts of 1 kg Violife Products vary between 2.2 and 3.2 kg CO_2-eq per kg of product depending on recipe and market, whereas the impacts for dairy cheese vary between 6.1 and 11.9 kg CO_2-eq per kg dairy cheese. The average climate change impacts of Violife Products assessed across recipes and markets is 2.8 CO_2-eq per kg of product whereas the average impact for dairy cheese across markets is 8.4 CO_2-eq. Violife Products have an overall average savings of 72% compared to dairy cheese.

	Climate change (kg CO_2eq/kg product)		Calculated savings	
PRODUCTS COMPARED (Violife/dairy cheese)	Violife	Dairy	kg CO_2eq/kg	%
EUROPE				
Europe average	**2.6**	**10.0**	**7.4**	**-74%**
1. Mozzarella flavour / Mozzarella, grated, 200 g (old doypack), EU	2.6	10.6	8.0	-75%
2. Mozzarella flavour / Mozzarella, block, 2.5 kg, EU	2.2	10.2	8.0	-79%
4. Cheddar flavour / Cheddar, sliced, 200 g (hard tray), EU	2.9	11.8	8.9	-75%
6. Original / Cheddar, grated, 200 g (old doypack), EU	2.6	11.6	9.0	-77%
8. Original / Cheddar, sliced, 200 g (hard tray), EU	2.9	11.8	9.0	-76%
10. Mature cheddar fl. / Cheddar, block, 200 g, EU	2.3	11.3	9.0	-80%
13. Creamy original / Cream cheese, tub, 200 g, EU	2.6	6.5	3.9	-60%
17. Feta flavour / Feta, block, 200 g, EU	2.6	6.4	3.8	-59%
UK				
UK average	**2.6**	**10.2**	**7.6**	**-74%**
3. Mozzarella flavour / Mozzarella, block, 2.5 kg, UK	2.2	10.3	8.1	-79%
5. Cheddar flavour / Cheddar, sliced, 500 g (refi), UK	2.5	11.5	9.0	-78%
7. Original / Cheddar, grated, 200 g (old doypack), UK	2.7	11.7	9.0	-77%
9. Original / Cheddar, sliced, 200 g (hard tray), UK	3.0	11.9	9.0	-75%
11. Epic mature / Cheddar, block, 200 g, UK	2.6	11.5	8.9	-78%
12. Epic mature / Cheddar, grated, 150 g (old doypack), UK	2.7	11.7	8.9	-77%
14. Creamy original / Cream cheese, tub, 200 g, UK	2.6	6.5	3.9	-60%
18. Feta flavour / Feta, block, 200 g, UK	2.7	6.4	3.7	-58%
CANADA				
Canada average	**2.8**	**6.6**	**3.7**	**-57%**
16. Creamy original / Cream cheese, tub, 200 g, CA	2.8	6.1	3.3	-54%
20. Feta flavour / Feta, block, 200 g, CA	2.9	7.1	4.2	-59%
US				
US average	**3.1**	**6.9**	**3.7**	**-55%**
15.Creamy original / Cream cheese, tub, 200 g, US	3.1	6.5	3.4	-53%
19. Feta flavour / Feta, block, 200 g, US	3.2	7.2	4.1	-56%
TOTAL AVERAGE	2.7	9.4	6.8	-72%

Table 1. Climate change impacts for Violife Products in Europe, UK, US and Canada and dairy cheese in the same markets. Results are expressed in kg CO_2-eq per kg of product

Figure 2 shows that the main drivers of climate impacts for Violife Products are the farm / ingredients stage (coconut farming and associated LUC emissions), as well as the distribution stage, which can vary significantly depending on distances travelled to consumer markets.

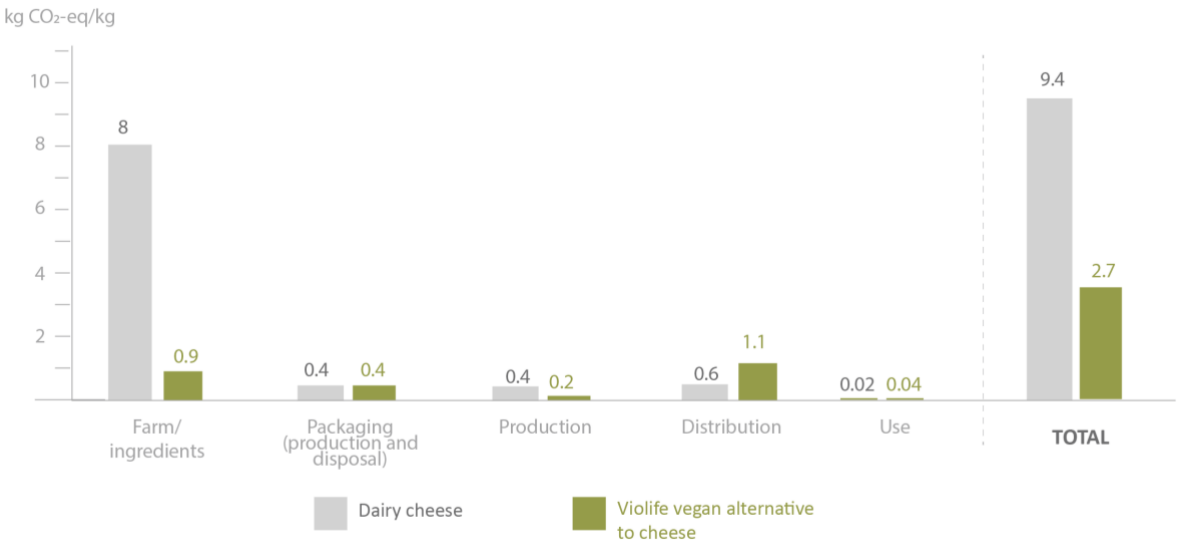

Figure 2. Average climate change results per life cycle stage for 1 kg of product in Europe, UK, US and Canada

There are opportunities for further reducing the environmental impacts of 100% plant-based cheese alternatives by avoiding land use change related climate risks and implementing regenerative agricultural practices. Meanwhile, it is important to consider potential constraints, such as the choice of oils based on consumer preferences (taste, nutritional benefits, and product function).

LAND OCCUPATION

In terms of land occupation, all Violife Products have lower results compared to dairy cheese (Table 2). The land occupation of 1 kg Violife Products varies between 1.5 and 2.1m^2.y per kg of product depending on recipe and market, whereas that of dairy cheese varies between 5.2 and 11.6 m^2.y per kg of dairy cheese. The average land occupation of Violife Products across recipes and markets is 1.7 m^2.y per kg of product whereas the average occupation for dairy cheese across markets is 7.6 CO_2-eq, having Violife Products an average savings of 82%.

	Land occupation (m^2.y /kg product)		Calculated savings	
PRODUCTS COMPARED (Violife/ dairy cheese)	Violife	Dairy	m^2.y /kg	%
EUROPE				
Europe average	**1.7**	**10.2**	**8.5**	**-83%**
1. Mozzarella flavour / Mozzarella, grated, 200 g (old doypack), EU	1.8	10.1	8.3	-83%
2. Mozzarella flavour / Mozzarella, block, 2.5 kg, EU	1.6	10.0	8.3	-84%
4. Cheddar flavour / Cheddar, sliced, 200 g (hard tray), EU	1.7	11.0	9.3	-84%
6. Original / Cheddar, grated, 200 g (old doypack), EU	1.8	11.0	9.3	-84%
8. Original / Cheddar, sliced, 200 g (hard tray), EU	1.7	11.0	9.3	-84%
10. Mature cheddar fl. / Cheddar, block, 200 g, EU	1.5	10.9	9.4	-86%
13. Creamy original / Cream cheese, tub, 200 g, EU	1.5	5.7	4.2	-73%
17. Feta flavour / Feta, block, 200 g, EU	1.9	11.6	9.7	-84%
UK				
UK average	**1.8**	**9.5**	**7.8**	**-81%**
3. Mozzarella flavour / Mozzarella, block, 2.5 kg, UK	1.6	9.1	7.5	-82%
5. Cheddar flavour / Cheddar, sliced, 500 g (refi), UK	1.7	10.0	8.4	-83%
7. Original / Cheddar, grated, 200 g (old doypack), UK	1.8	10.1	8.4	-83%
9. Original / Cheddar, sliced, 200 g (hard tray), UK	1.7	10.1	8.4	-83%
11. Epic mature / Cheddar, block, 200 g, UK	2.1	10.0	7.9	-79%
12. Epic mature / Cheddar, grated, 150 g (old doypack), UK	1.9	10.1	8.2	-81%
14. Creamy original / Cream cheese, tub, 200 g, UK	1.5	5.2	3.7	-71%
18. Feta flavour / Feta, block, 200 g, UK	1.9	11.6	9.7	-84%
CANADA				
Canada average	**1.7**	**8.8**	**7.0**	**-81%**
16. Creamy original / Cream cheese, tub, 200 g, CA	1.5	5.9	4.3	-74%
20. Feta flavour / Feta, block, 200 g, CA	1.9	11.7	9.7	-84%
US				
US average	**1.7**	**8.9**	**7.2**	**-81%**
15.Creamy original / Cream cheese, tub, 200 g, US	1.5	6.1	4.6	-75%
19. Feta flavour / Feta, block, 200 g, US	1.9	11.7	9.7	-84%
TOTAL AVERAGE	1.7	9.7	7.9	-82%

Table 2. Land occupation for Violife Products in Europe, UK, US, Canada, and dairy cheese in the same market. Results are expressed in m^2 per year per kg of product.

WATER CONSUMPTION

LCA results show that 8 from 20 (40%) of Violife Products have significantly lower water impacts, but the rest are not significantly better (table 3). For these scenarios, with an * in the calculated saving percentages in table 3 given the uncertainty, water consumption is not considered significantly better than their dairy counterpart.
The quality of water consumption data in LCA databases is not robust enough to support external communications and comparative claims.
Contrary to cheese, for spreads and butter despite the high uncertainty related to the water consumption results, the conclusions can still be considered valid; the comparative conclusions are less sensitive to data choice, due to the higher concentration of dairy milk in butter.

	Water consumption (m^3 /kg product)		Calculated savings	
PRODUCTS COMPARED (Violife/ dairy cheese)	Violife	Dairy	m^3 /kg	%
EUROPE				
Europe average	0.030	0.054	0.024	-45% *
1. Mozzarella flavour / Mozzarella, grated, 200 g (old doypack), EU	0.030	0.058	0.028	-48% *
2. Mozzarella flavour / Mozzarella, block, 2.5 kg, EU	0.026	0.054	0.028	-52%
4. Cheddar flavour / Cheddar, sliced, 200 g (hard tray), EU	0.039	0.067	0.029	-42% *
6. Original / Cheddar, grated, 200 g (old doypack), EU	0.030	0.063	0.033	-52%
8. Original / Cheddar, sliced, 200 g (hard tray), EU	0.039	0.067	0.029	-43% *
10. Mature cheddar flavour / Cheddar, block, 200 g, EU	0.027	0.061	0.034	-55%
13. Creamy original / Cream cheese, tub, 200 g, EU	0.024	0.039	0.015	-39% *
17. Feta flavour / Feta, block, 200 g, EU	0.026	0.024	-0.002	9% *
UK				
UK average	0.030	0.055	0.025	-45% *
3. Mozzarella flavour / Mozzarella, block, 2.5 kg, UK	0.026	0.054	0.029	-53%
5. Cheddar flavour / Cheddar, sliced, 500 g (refi), UK	0.033	0.063	0.029	-47% *
7. Original / Cheddar, grated, 200 g (old doypack), UK	0.030	0.064	0.034	-53%
9. Original / Cheddar, sliced, 200 g (hard tray), UK	0.039	0.068	0.029	-43% *
11. Epic mature / Cheddar, block, 200 g, UK	0.029	0.061	0.031	-52%
12. Epic mature / Cheddar, grated, 150 g (old doypack), UK	0.031	0.064	0.032	-51%
14. Creamy original / Cream cheese, tub, 200 g, UK	0.024	0.039	0.015	-40% *
18. Feta flavour / Feta, block, 200 g, UK	0.026	0.024	-0.002	9% *
CANADA				
Canada average	0.025	0.041	0.017	-40% *
16. Creamy original / Cream cheese, tub, 200 g, CA	0.023	0.053	0.029	-56%
20. Feta flavour / Feta, block, 200 g, CA	0.026	0.030	0.004	-13% *
US				
US average	0.025	0.033	0.007	-23% *
15.Creamy original / Cream cheese, tub, 200 g, US	0.024	0.041	0.017	-42% *
19. Feta flavour / Feta, block, 200 g, US	0.027	0.024	-0.003	11% *
TOTAL AVERAGE	0.029	0.051	0.022	-43%

Table 3. Water consumption for Violife Products in Europe, UK, US, Canada, and dairy cheese in the same market. Results are expressed in m^3 per kg of product

For further information, please contact ESGinquiries@upfield.com for vegan alternative to cheese information.

CONCLUSIONS AND OUTLOOK

This study shows that Violife Products have at least 50% lower climate impacts and occupies less than 30% of land than dairy cheese. The climate impacts of Violife Products are dominated by coconut oil production and distribution to consumer markets. When moving towards transparency of sustainable supply chains and developing potential mitigation strategies, producers can only understand the impacts of their products and look for opportunities to reduce these impacts if they thoroughly and accurately assess their product supply chains. When moving towards more sustainable 100% vegan alternatives to cheese, a key factor would be to reduce impacts related to the product distribution and the embodied environmental impacts from coconut oil through better understanding and improvements in supply chain sourcing, farm level agricultural practices, and product recipe design.

EXTERNAL COMMUNICATIONS

For this study, 20 representative products in the four main markets were selected. For external communications and claims a conservative approach was used since Violife's entire product portfolio was not assessed.
For comparative claims communicating on product categories, the lowest climate change savings of all products evaluated globally and in each market is used.

Reduction percentages are rounded conservatively so that they are easy to understand by the general public and to avoid overclaiming (e.g. 58% savings is rounded to 55% savings), therefore claims percentages may be different than the percentages shown in Table 2. As approximations exist in any life cycle assessment, a conservative approach avoids misleading communication and greenwashing.

CALCULATION OF EQUIVALENCIES

Equivalencies are used to put into perspective the climate and land occupation results of Violife Products and dairy cheeses to render the information more meaningful and understandable for a larger audience. The equivalencies were calculated based on the CO_2-eq savings when comparing Violife Products and dairy cheese, by converting the savings amount into equivalencies of different daily activities such as CO_2-eq emissions of charging a smartphone over night or driving a car. Table 4 presents the data sources and units used for the equivalencies calculated.

EQUIVALENCIES FOR RETAIL PRODUCTS			
Equivalency	Equivalency unit	Climate change (kg CO_2eq)	Source
Charging a phone over night	daily	0.008	PEFCR Retail
Driving a car (petrol car EURO 5)	1 km	0.35	ecoinvent
Flying by plane	1 km	0.22	ecoinvent
Equivalency	Equivalency unit	Land Occupation (m^2.y)	Source
Average size of a parking spot	m^2	17.7	Internet various sources
Average pizza size (14 in / 35 cm)	m^2	0.10	Internet various sources
EQUIVALENCIES FOR PROFESSIONAL PRODUCTS			
Equivalency	Equivalency unit	Climate change (kg CO_2eq)	Source
3 combi oven	Daily	15	https://doi.org/10.1093/ijlct/ctt068
Commercial fridge	Daily	19.5	https://www.energy.gov/eere/femp/purchasing-energy-efficient-commercial-refrigerators-and-freezers
Industrial dishwasher	Daily	5	https://www.energy.gov/eere/femp/purchasing-energy-efficient-commercial-dishwashers
Kitchen aid	Hourly	0.2	https://www.kasa.cz/document/9/8/4/doc_2182489.pdf
Equivalency	Equivalency unit	Land Occupation (m^2.y)	Source
Cucumbers fields	1 hectare	10,000	-
Average size restaurant kitchens	1 restaurant	98	https://yourbusiness.azcentral.com/national-average-size-restaurant-kitchen-29446.html

Per capita consumption of dairy cheese	Source
Europe	Statista - https://www.statista.com/statistics/183785/per-capita-consumption-of-cheese-in-the-us-since-2000/
United Kingdom	https://www.statista.com/statistics/281114/household-consumption-of-cheese-in-the-united-kingdom-uk/
Canada	https://www.clal.it/en/?section=tabs_consumi_procapite
United States	Statista - https://www.statista.com/statistics/183785/per-capita-consumption-of-cheese-in-the-us-since-2000/

ABOUT QUANTIS

Quantis guides top organizations to define, shape and implement intelligent environmental sustainability solutions. In a nutshell, our creative geeks take the latest science and make it actionable. They deliver resilient strategies, robust metrics, useful tools, and credible communications.

With offices in the US, France, Switzerland, Germany, Italy and Colombia and clients around the world, Quantis is a key partner in inspiring sustainable change on a global scale.

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