



# The Lactoferrin & Lactoperoxidase Global Markets study

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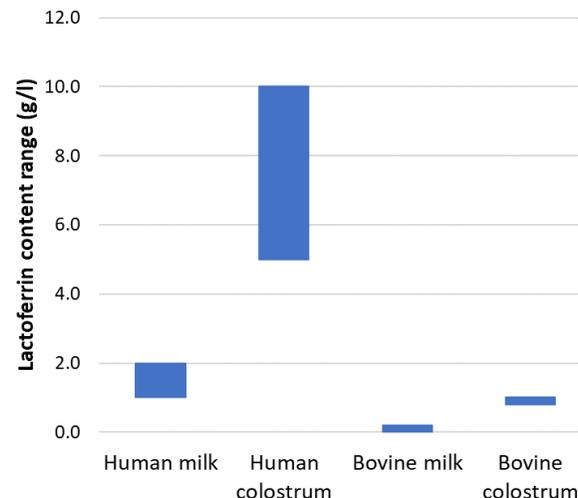
**Lactoferrin (LF)** and **Lactoperoxidase (LP)** are two bio-components of milk, both having various biological roles among which an anti-microbial activity as well as immune functions.

**Lactoferrin** is a globular glycoprotein naturally present in various secretory fluids, such as milk and colostrum, amniotic fluid, bile and pancreatic fluid, saliva, tears and nasal secretions. Human colostrum has the highest concentration, followed by human milk, then cow milk. LF is mainly synthesized by glandular epithelial cells.

LF is composed of two major lobes, the N-lobe and C-lobe, each of which binds a molecule of iron. **LF is one of the transferrin proteins that transfer iron to the cells** and control the level of free iron in the blood and external secretions.

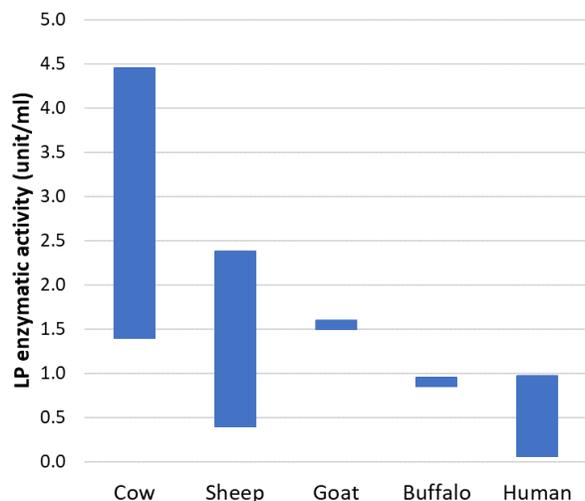
**LF belongs to the innate immune system.** Apart from its main function (binding and transport of iron), LF would also have **anti-bacterial, anti-viral, anti-parasitic, anti-cancer activities, immunomodulatory effect and impact on bone regeneration and wound healing.**

## Lactoferrin concentrations in human and bovine milk and colostrum



Source:  
Scientific  
Publications

## Lactoperoxidase activity in different species



Source:  
Scientific  
Publications

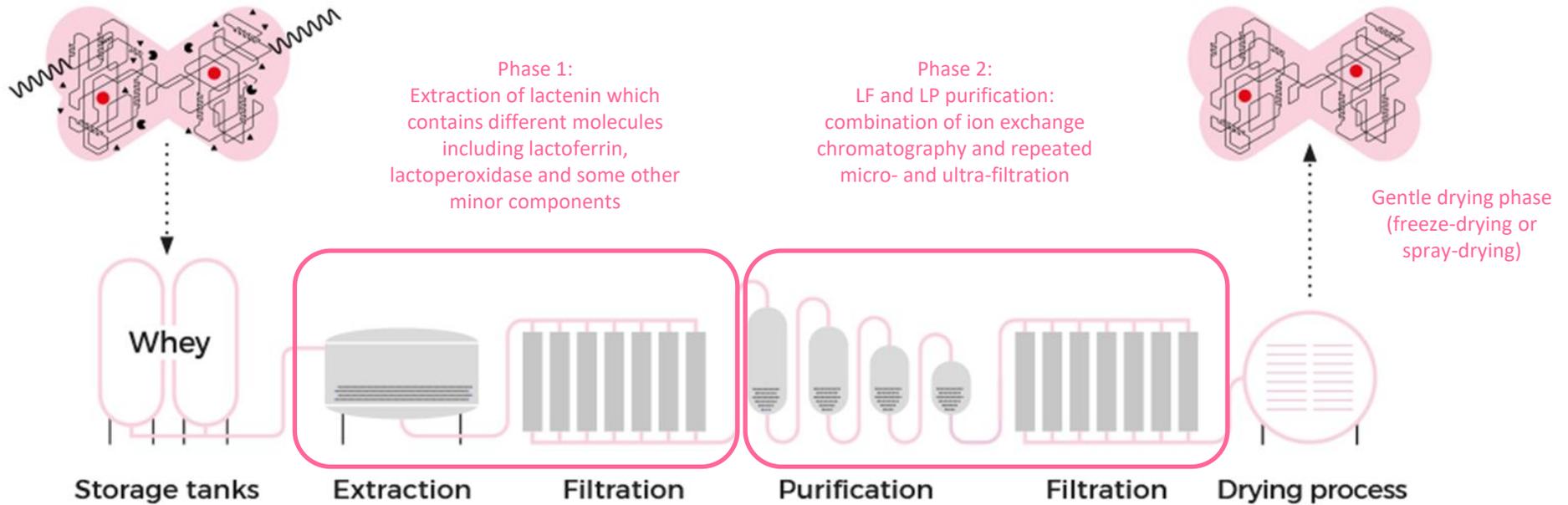
**Lactoperoxidase** is a glycoprotein naturally present in milk, colostrum and many other secretions like saliva and tears. LP is synthesised in the gastrointestinal tract of infants and is also the most abundant enzyme synthesised by the mammary gland.

The main biological role of LP is associated with the **protection of the milk itself, the mammary gland and the intestinal tract of infants** against pathogenic microorganisms which may be present in milk.

**LP is one abundant enzyme in bovine milk:** its concentration is about 30 mg/l (i.e. around 1% of whey proteins). The LP content in bovine colostrum is lower. However, it increases as the days go by, reaching a maximum concentration at 3-5 days postpartum. There is also **a variation in the enzymatic activity among the species:** the enzymatic activity of LP is between 1.4 and 4.45 unit/ml in cows and only 0.06-0.97 unit/ml in humans.

LP is heat-stable until 85°C, is resistant to acidity up to a pH equal to 3 and to the proteolytic action of gastric juice. However, it is irreversibly inactivated by some chemical reaction with or by excessive microorganism growth.

## Process of lactoferrin and lactoperoxidase extraction from milk or whey



Source: Lactoferrin.de

Commercial production of lactoferrin and lactoperoxidase mainly comes from cow's milk. It is often roughly estimated that it takes **10'000 liters of milk to obtain 1 kg of lactoferrin, lactoperoxidase being the co-product of lactoferrin.**

LF and LP are extracted from skim milk, cheese whey or native whey, but when starting from milk, one issue is that the skimmed milk cannot be processed anymore into Codex SMP.

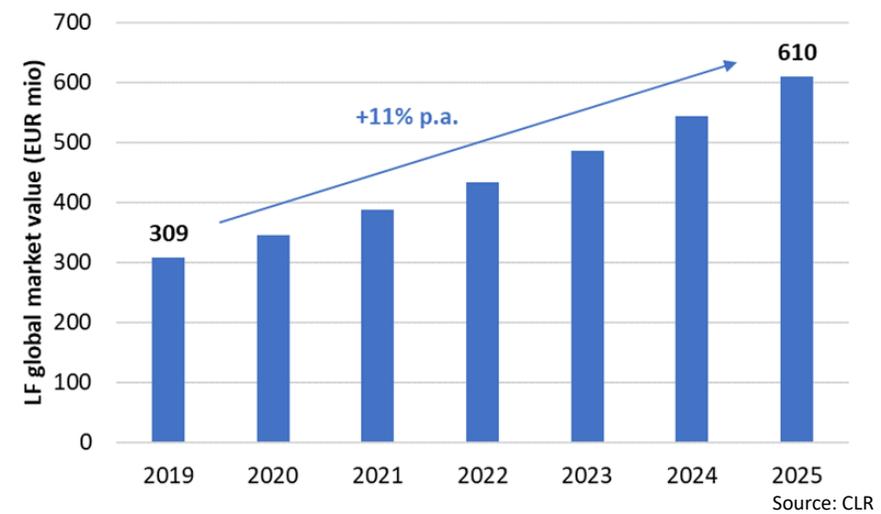
Conversely to lactoperoxidase, lactoferrin is heat sensitive and its functionalities are significantly reduced if the protein is denatured. That's why the initial production process to extract LF in one unique phase, which led to a high level of denaturation, is now replaced by a two-phase processing method: first extraction, then purification. This way the protein can be handled using a lower heat.

Lactoferrin can also be produced using genetic engineering, by precision fermentation process and by cell-based technology (from lab-grown mammary glands cells).

From 170 tons in 2011, the global lactoferrin market has doubled in 2021. A rapid growth (>+10% p.a.) is expected for the coming years as several main players have recently invested to significantly increase their production capacity (or plan to do so).  
**Will lactoferrin production be measured in kttons soon?**

The global Lactoperoxidase market is estimated to be around **400-450 tonnes globally in 2019**. A lower than for LF but sustained growth is also expected for the period 2021-2026, driven by LF market growth (LP being a coproduct) as well as growing demand for food sectors and personal care.

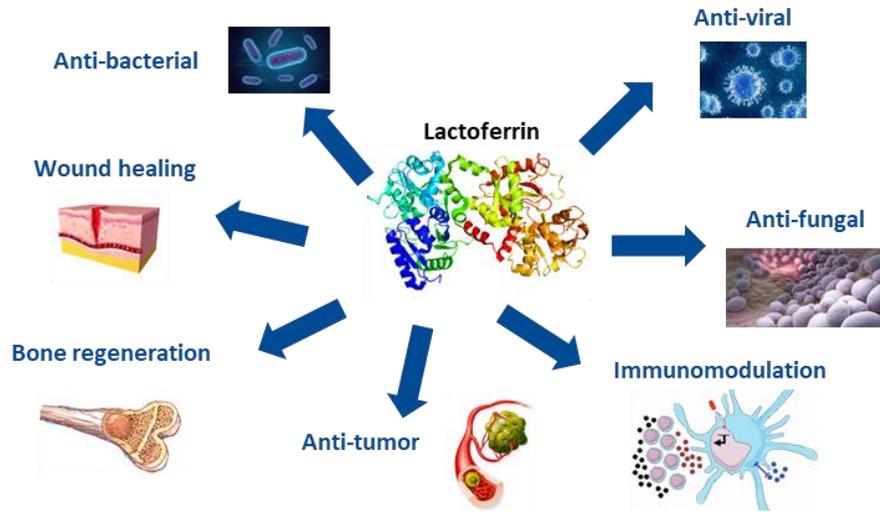
Global lactoferrin market value, 2019-2025



Main Lactoferrin and/or Lactoperoxidase producers

Europe		Oceania		United States		Taiwan	

### The different biological functions of Lactoferrin



**Lactoperoxidase acts as a natural antibacterial agent** as an element of non-specific cellular immunity. The lactoperoxidase system thus plays an important role in the innate immune system by killing bacteria in milk and mucosal secretions.

- In vitro studies showed that LP has bactericidal activity against Gram-negative bacteria such as E. coli, Salmonella, Pseudomonas, Campilobacter and bacteriostatic properties against Gram-positive ones such as Listeria, Staphylococcus and Streptococcus.

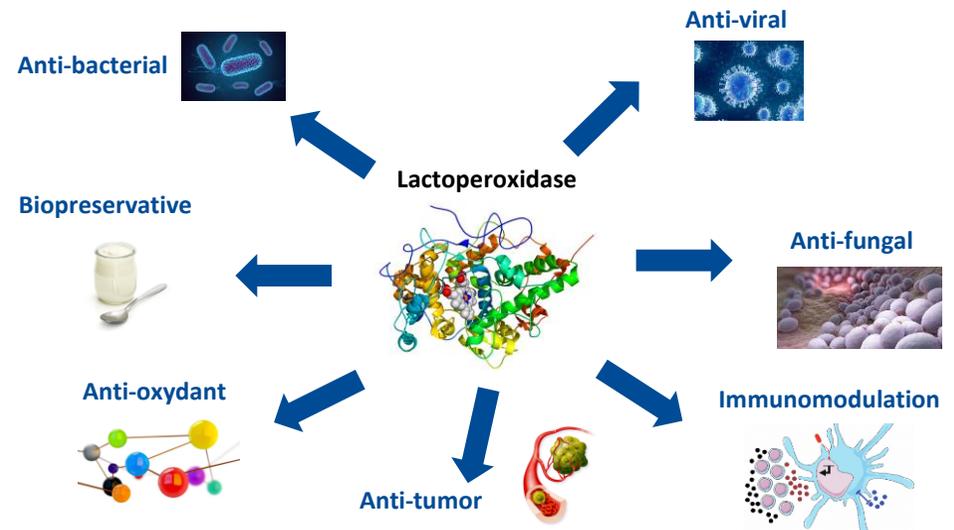
The augmentation of the lactoperoxidase system may have therapeutic applications. Furthermore, addition or augmentation of the lactoperoxidase system has potential applications in controlling bacteria in food and consumer health care products.

Why such a huge interest for lactoferrin and lactoperoxidase?

**Lactoferrin** is a multi-functional protein:

- LF demonstrated **anti-bacterial activities** due to several mechanisms like the reduction of the concentration of iron ions that are necessary for bacterial proliferation. LF also increase the permeability and damages bacteria cell walls.
- LF also showed **anti-viral activity**, and the potential effect of LF against is the subject of numerous current scientific researches. The antiviral activity of LF is based on the affinity of LF for host's cell receptor which blocks the access to the viruses.
- LF has an **anti-fungal activity**, also based on iron sequestration and the capacity of LF to damage cell membranes of fungi.
- Lactoferrin is active as an **immunomodulator** via several mechanisms, for instance like the stimulation of the phagocytic activity of multinucleated leukocytes and the reduction of pro-inflammatory cytokines.
- Some studies also demonstrated that LF has an **anti-cancer activity**.
- LF is also involved in **bone regeneration** and in **skin wound healing**.

### The different biological functions of Lactoperoxidase



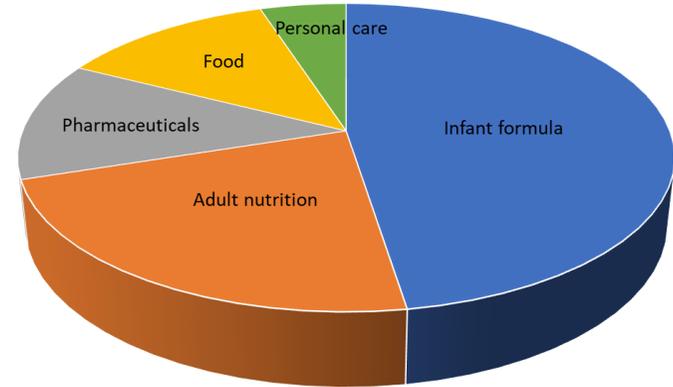
Today the main applications of lactoferrin are:

- **Infant formula:** to strengthen the new-born immune system by enhancing anti-infective, anti-inflammatory activities and increasing iron absorption.
- **Adult nutrition:** this segment has been particularly boosted by the Covid-19 epidemic which led to a growing demand for whatever can boost immune functions.

**Food** is an important segment for both lactoferrin and lactoperoxidase. In particular, LP can find wide application **in the dairy industry** for milk preservation in situation where prompt refrigeration is difficult. Moreover, LP being destroyed at temperatures above 85°C, its detection could be a marker to see whether milk has been heat treated.

**Cosmetic applications**, including skin and dental care, are particularly developing in terms of new products launches.

### Main applications of lactoferrin



Source: Compilation from articles

### New applications of Lactoferrin and lactoperoxidase, in food, supplements, oral and personal care



**This study will address the characteristics of the lactoferrin and lactoperoxidase global markets:**

**State of the art about lactoferrin/lactoperoxidase:**

Short analysis of proven health effects of LF and LP.  
Regulation on LF and LP use in food and supplement by main geographical areas

**How LF and LP are produced?**

The different processes (technology, raw material)  
Technical challenges and potential improvements  
Impacts on quality, yield, etc.

**LF and LP production (2020, 2021 and 2026):**

Size and five-year forecast growth, globally and by main geographical areas (EU, US, NZ, AU)  
Share of bovine LF and LP in the global market and analysis of the opportunities for alternatives (from other species, from fermentation and cell-based)  
Short profile of the main producers of LF and LP

**LF and LP markets and applications:**

Size and five-year forecast growth (2021-2026) by geographical areas (Europe, North America, Oceania, China, Japan/South Korea, South-East Asian and others)  
Size and five-year forecast growth (2021-2026) by applications (infant formula, adult nutrition, supplements, cosmetics, foods, other nutritional sectors)

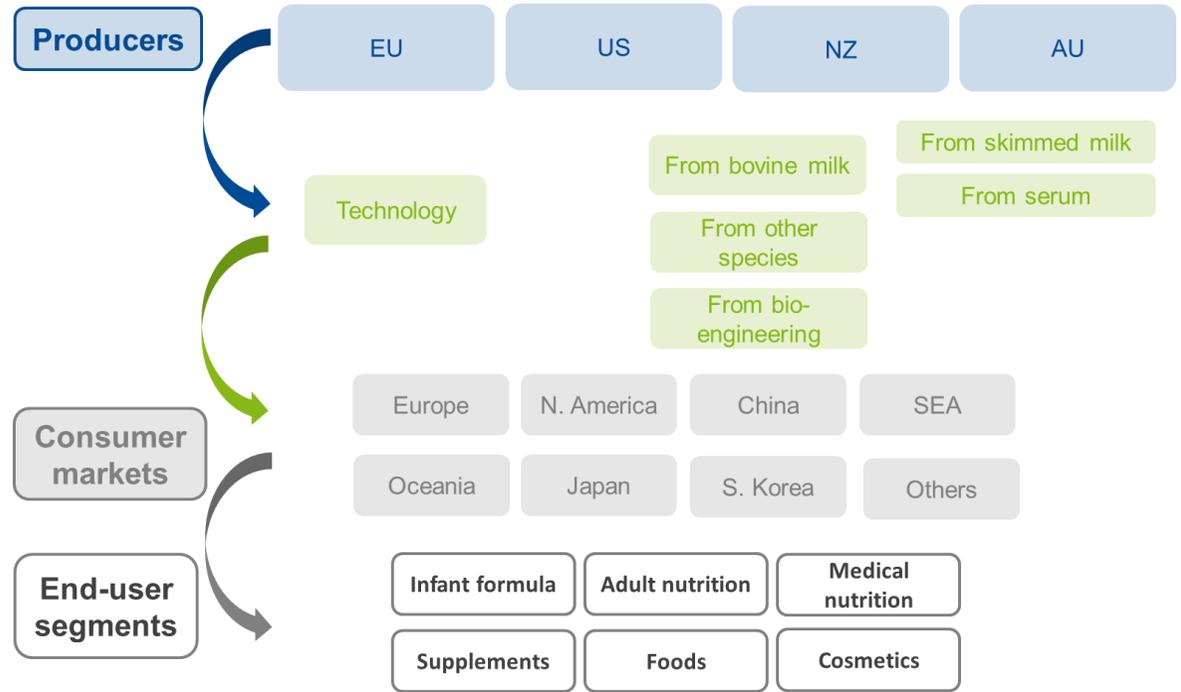
**LF and LP prices:**

Analysis of factors impacting price: end-user segments, quality, production volume scale, etc.

**Conclusion:**

Opportunities and supply "gaps" existing in the market  
Key factors of success

**Gira's findings and analysis will be delivered in a report in English and in pdf format. Clients will have a one-hour free presentation of the results and conclusions during a personalised workshop.**



## Methodology

We will use our tried and tested combination of **3 primary research approaches** in order to obtain the broadest possible coverage across the key aspects to help identify the market drivers to be analysed and forecast:

- 1. Internal database** on the dairy sector compiled from 11 years of Gira Dairy Club data and the 2<sup>nd</sup> edition of the Technical Ingredients study (2020).
- 2. Extensive documentary research** covering all aspects of the product supply chains and the markets to be analysed
  - All available documentation: trade press; company, retailer and association websites; national and customs data; consumer and sector studies.
  - Gira's own extensive dairy ingredient production, trade and consumption databases built up over 30 years of sector experience.
- 3. A program of at least 30 interviews with:**
  - Large dairies based in Europe, the United States and Oceania.
  - Food, food supplements and non-food end-users (oral and personal care) of LF and LP in the selected countries.
  - Associations, authorities and experts.

## Staffing

**Christophe Lafougere**, CEO, 30 years with Gira.

Supervisor of this study and lead contact for clients. He has headed up a vast number of strategic consultancy, due diligence and research assignments throughout the food & drink chain worldwide. He also directs all of Gira's consulting and research activities in the dairy sector. He is well-known expert throughout the dairy industry and he initiated and supervises the annual Gira Dairy Club.

**Mylène Potier**, senior consultant (10 years with Gira).

With a PhD in Human Nutrition, with particular reference to milk proteins, she is responsible for all studies and research on technical dairy ingredients within Gira. She will be responsible for the study.

**Guy Kientz**, Senior consultant with Gira.

Guy has held a number of positions including Managing Director of Milchwerke Mittelbe GmbH and Lactoland Trockenmilchwerk GmbH (Kruger Group), Managing Director of Meggle International and Member of the Board, COO of Ingredia Group. Guy will bring his vast expertise in the industry to this study.

**Over the last 25 years**, Gira has **built up a major reputation and client base in the international dairy sector**. A list of our more recent dairy clients is given at the end of this proposal.

Gira has **carried out many assignments in recent years for worldwide dairy companies** in areas and product sectors similar to those to be covered in this study.

Gira has **produced one of the first multi-client studies on technical dairy ingredients in 2017/2018 and 2020/2021**, and we **regularly produce multi-client studies** relating to several of the **ingredient and end-user sectors, and all the countries covered in this study**. The most relevant being the annual Gira Dairy Club, for which the latest list of members is on the next page.

Gira is **active in strategy consulting and market research in most food and drink sectors worldwide**. More details are available on [www.girafood.com](http://www.girafood.com).

Gira's **extensive network of international experts, contacts and clients**, in most dairy sectors, means that it is **uniquely qualified to carry out this innovative and highly challenging research and analysis project**. Experience has also shown that our long-standing reputation for research and consultancy in the global market opens doors for us to the most informed and competent sources of information.

Our specialist consultants - our high credibility in the dairy sector - our long client list - along with the multi-client studies for which Gira is widely known, all give us privileged access to information and decision-makers in dairies and end-user markets throughout the world.

## Timing:

Work should start in February 2022 with reports being available to clients by May 2022.

## Subscription:

**A subscription to the complete study programme and a presentation, as previously set out, cost 9900 EURO (before any applicable taxes). For Dairy Club Members, the price is 8000 EURO. The price will increase for subscriptions after the work has started.**

Payment will be invoiced and requested as follows:

- 50% at the start of work
- 50% on delivery of the final reports.

In the unlikely event that insufficient Founder Client subscriptions are obtained, Gira reserves the right to not start work on the study. In this case, existing subscription contracts will become null and void.

## Dairy-Sector Clients

- Agropur
- Agrial/Eurial
- ALIC
- Alpma
- Arla Foods
- CHR Hansen
- Coveris
- Dairygold
- DanTrade (Danone)
- DSM
- Dupont (IFF)
- Emmi
- EU Commission
- Eucolait
- Fedegan
- FIT
- Fonterra
- Friesland Campina
- Glanbia
- Kerry
- Lactalis
- Laïta
- Mondelez
- Mueller
- Meggle
- Nestlé
- DMK
- Rupp
- Savushkin
- Sealed Air
- Sodiaal
- Unilever
- USDEC
- Valio
- Yili

## Members of GDC 2021

- Agropur
- Arla Foods
- Bel
- BordBia
- CHr Hansen
- Dantrade
- DMK
- DSM
- Emmi
- Eurial
- The EU Commission
- Ferrero
- FIT
- Fonterra
- Glanbia
- IFC World Bank
- Land'OLakes
- Meggle
- Sodiaal
- USDEC
- Valio

As well as Retailers, Caterers, Banks and Investment Funds

## For more information, please contact:

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