The Lactoferrin & Lactoperoxidase Global Markets study

2nd Edition, August 2024

Contact:
Christophe Lafougère – clafougere@girafood.com
Mylène Potier – mpotier@girafood.com
Guy Kientz – gkientz@girafood.com

Lactoferrin and Lactoperoxidase at a glance

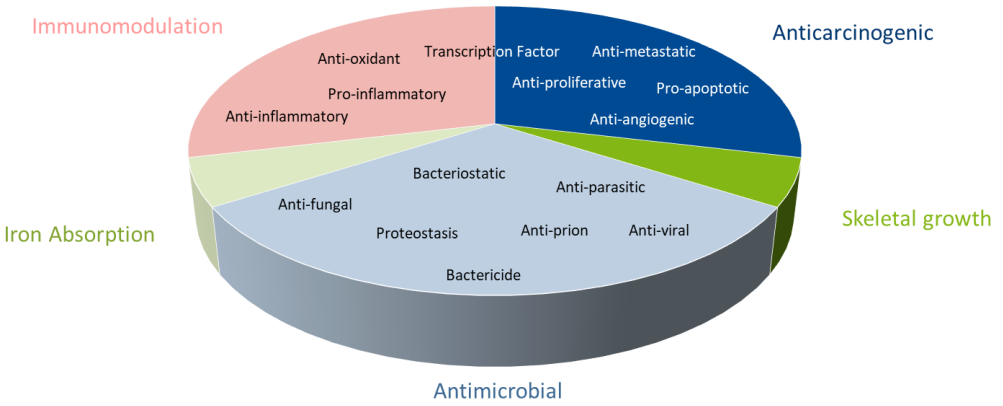
Lactoferrin (LF) and **Lactoperoxidase (LPO)** are two bio-components of milk, both having various biological roles among which are an anti-microbial activity, as well as immune functions.

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 synthesised 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 transporting iron), LF has potentiam **anti-bacterial, anti-viral, anti-parasitic, anti-cancer activities, immunomodulatory effect and impact on bone regeneration and wound healing.**

Functionalities of Lactoferrin



Lactoperoxidase activity in different species

Activation of the lactoperoxidase system

$$SCN^- + H_2O_2 \xrightarrow{LPO} OSCN^- + H_2O$$

Anti-bacterial compound

Lactoperoxidase activity in different species

Source	Activity (unit/ml)
Cattle	1.4 – 4.45
Sheep	0.4 – 2.38
Goat	1.55
Buffalo	0.9
Human	0.06 – 0.97

Source: Gira, based on scientific reviews

Lactoperoxidase is a glycoprotein naturally present in milk, colostrum and many other secretions like saliva and tears. LPO 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 LPO 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.

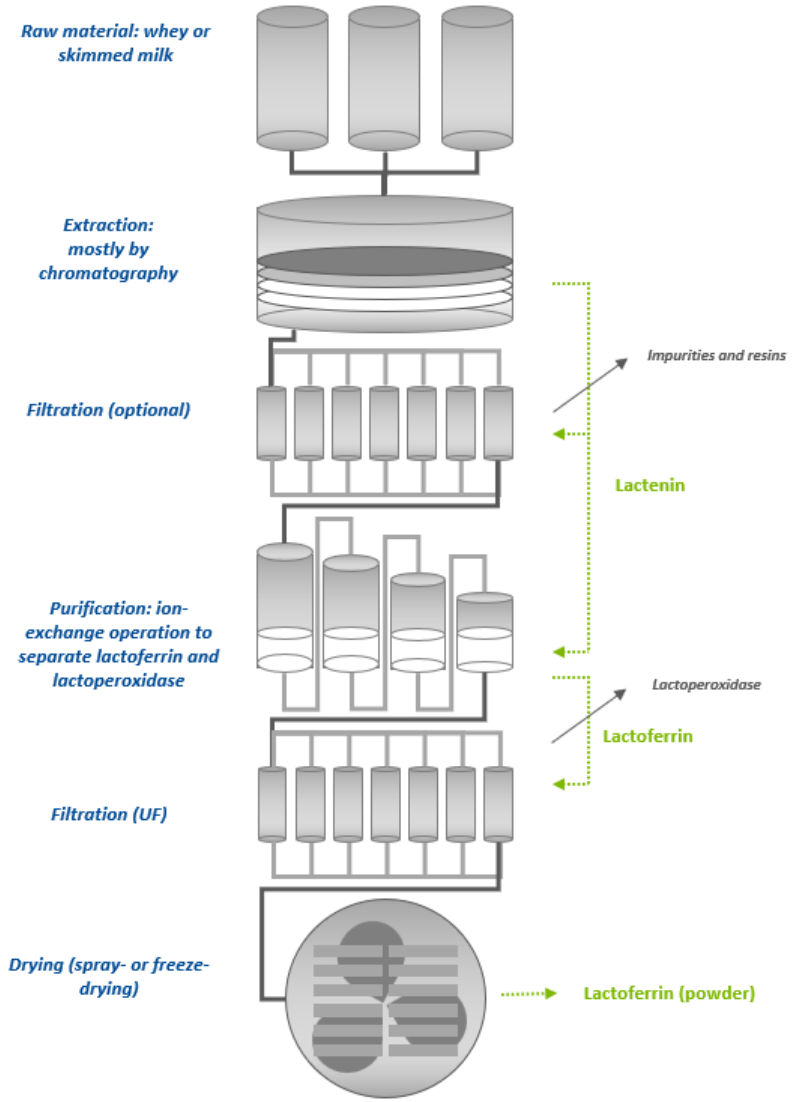
LPO is one abundant enzyme in bovine milk: its concentration is about 30 mg/l (i.e. around 1% of whey proteins). The LPO content in bovine colostrum is lower. However, it increases as days go by, reaching a maximum concentration at 3-5 days postpartum. There is also **a variation in the enzymatic activity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

LPO is heat-stable up to 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.

Lactoferrin and Lactoperoxidase extraction

10’000 liters of milk to obtain 1 kg of Lactoferrin!

Process of lactoferrin and lactoperoxidase extraction from milk or whey



Commercial production of lactoferrin and lactoperoxidase mainly comes from cow’s milk. It is often roughly estimated that it takes **10,000 litres of milk to obtain 1 kg of lactoferrin**, **lactoperoxidase being the co-product of lactoferrin**.
LF and LPO are extracted from skimmed milk, cheese whey or native whey.

Lactoferrin produced by Precision Fermentation (PF) and cultivated cells are also in development from several companies.

TurtleTree, helaina, harmony, De Novo Foodlabs, all G, Daisy Lab Rethinking Dairy, Triplebar, VIVICI, WILK, FORTE PROTEIN, BIOMILQ, nūmi

A fast-growing market

From 300 tons in 2021, **the global lactoferrin market is now close to 400 tons**, whereas the valorisation of lactoperoxidase is still low.

The global demand for lactoferrin is expected to be robust over the coming years, with a continuous strong demand in the core sector of infant formula, but also new developing end-user segments: functional foods, supplements, as well as mainstream foods, pet food, and non-food applications.

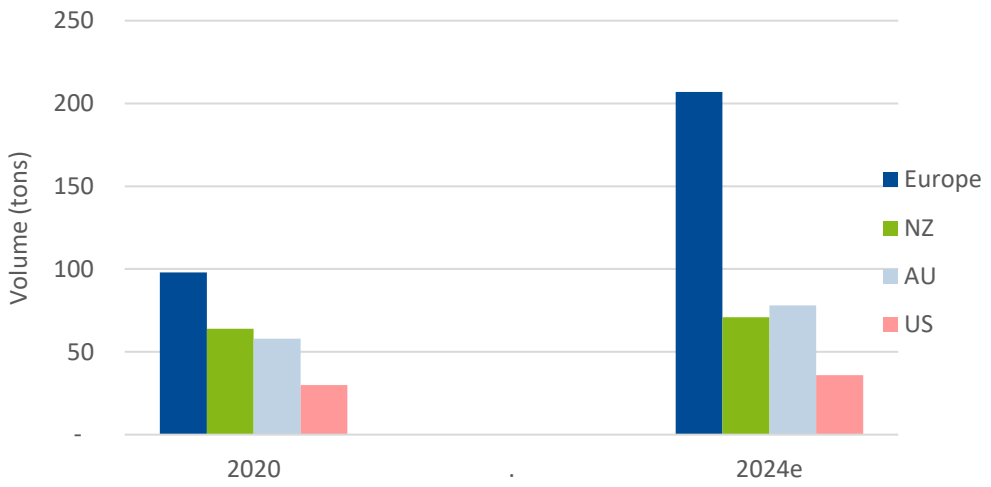
Why such an interest in Lactoferrin?

Lactoferrin is a multi-functional protein:

- LF demonstrates **anti-bacterial activities, anti-viral activity** and **anti-fungal activity**
- Lactoferrin is active as an **immunomodulator**
- Some studies also demonstrate that LF has **anti-cancer activity**.
- LF is also involved in **bone regeneration** and **skin wound healing**.

All these properties are valorised in a multitude of applications.

Lactoferrin production by region, 2020 and 2024e



Main Lactoferrin and/or Lactoperoxidase producers (extracted from milk)

EUROPE

ingredia NUTRITIONAL
armor proteines
MILEI
cremo
FrieslandCampina
Mercurius Production WE MAKE LACTOFERRIN

OCEANIA

ProviCo NUTRITION
Saputo Dairy Australia
TATUA
Fonterra Dairy for life
Synlait
bega bionutrients
BESTON GLOBAL FOOD COMPANY
Westland Milk Products Hokitika · New Zealand

UNITED STATES

Hilmar Cheese Company
MILK SPECIALTIES GLOBAL
UDA Since 1960
California DAIRIES inc.
glanbia

Objectives and content of the study

This study addresses the characteristics of the lactoferrin and lactoperoxidase global markets.

Introduction:
- Short analysis of the chemical characteristics and physiological functions of lactoferrin & lactoperoxidase
- Extraction processes of lactoferrin & lactoperoxidase: technology and raw materials.

Supply analysis (2020, 2024e and 2028f):
- Volume and five-year forecast **growth**, globally and by geographical area (EU, US, Oceania)
- Short **profiles** of the main producers of lactoferrin
- Special chapter about lactoferrin produced by precision fermentation, cell-based and plant molecular farming.

Demand analysis (2020, 2024e and 2028f):
- Volume and five-year forecast growth by **geographical area** (Europe, North America, Oceania, China, Japan, South Korea, South-East Asia)

Main applications (2024e and 2028f):
- Volume and five-year forecast growth by **application** (baby food, mainstream food, functional food, supplements, pet products, personal care)
- Analysis of **new product developments**

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

Conclusion:
- SWOT analysis of the global lactoferrin and lactoperoxidase market
- Key factors to success

NEW: Special focus on Precision Fermentation

Characteristics of LF produced by precision fermentation, producers' profiles, market perspectives (price, scalability), main challenges (technical, regulatory), potential applications

Products recently launched with lactoferrin

Infant formula: the core sector


Pet food: a dynamic segment in Asia

Supplements


Milk powders for adults and seniors

Dairy products

Source: Mintel GNPD

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Deliverables: Results of the study are delivered through a written report and a webinar

Written Report:

- The report is published in English, in a PowerPoint "report format" (similar to the style of this proposal).

Webinar:

- Each client company receives an individual webinar during which Gira presents the key findings of this study, followed by a Q&A session
- The webinar will last around one hour and will be carried out remotely via MS Teams.

Methodology: We use our tried and tested combination of three primary research approaches to obtain the broadest possible coverage across the key aspects to help identify the market drivers to be analysed and forecasted:

1. Internal database on the dairy sector compiled from 14 years of Gira Dairy Club data, the 2nd edition of the Technical Ingredients study (2020) and the first edition of the Lactoferrin and Lactoperoxidase global market study (2022).

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 ingredients' production, trade and consumption databases built up over 30 years of sector experience.

3. A program of 15 interviews:
   - With lactoferrin producers
   - With players and experts in the field of Precision Fermentation
   - With end-users of the different application fields of lactoferrin and lactoperoxidase
   - Associations, authorities and experts.

Our Company

Over the last **30 years** Gira has built up a major reputation and client base in the **international dairy sector**. Over the last three years, Gira is also **active in the "alternative to dairy" sector**, through several presentations and webinars, as well as two editions of the Gira Ingredients Club.

- We are recognised for our **worldwide expertise**, **strategy consulting** and **market research** in ingredients, meat, dairy, bakery and foodservice, with specialist experience in all other food and drink areas (more details are available on www.girafood.com).
- In recent years, we carried out many assignments for worldwide ingredients companies.
- Gira has produced two editions of the multiclient study on **Technical Dairy Ingredients** in 2017/2018 and 2020/2021, and we regularly produce individual and multiclient studies in the **dairy, plant and bioengineered ingredients sectors**.
- Gira's extensive **network of international experts, contacts and clients** in most dairy sectors means that it is qualified to carry out this 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**.**

The Gira Team

Christophe Lafougere is **CEO of Gira, and directly responsible for all Gira's assignments in the worldwide dairy sector**. He has been directing Gira's consulting and research activities in the dairy sector for over 30 years, covering all aspects of production, collecting, processing and marketing, in major dairy-producing and consuming regions of the world.

Mylène Potier is Director of Ingredients at Gira. She has a PhD in Human Nutrition with particular reference to milk proteins. She is responsible for all studies and research on technical ingredients at Gira. She supervises a team of consultants with experience gained over many years, from individual and multiclient studies in the dairy and ingredients sectors.

Laurène Bajard, consultant within Gira for the last five years, has a strong understanding of the food industry, from production to marketing. She is specialised in dairy and plant-based products trends, as well as South American markets. Currently working on the evolution of dairy and meat alternatives markets, she focuses on innovations, strategies and investments in this sector.

Guy Kientz, is a Senior Advisor with Gira. He has held several senior management positions in the food ingredients industry, including dairy, in various companies in Europe, the United States and Asia Pacific (Singapore and Japan). He brings his expertise in strategic consulting, project management and M&A.

A subscription to the **2nd edition of Lactoferrin and Lactoperoxidase Global Market** study costs **EUR 10,000** (before any applicable taxes).

- Members of the Gira Dairy Club and the Gira Ingredients Club have access to **a special 15 % discounted price**.

A **special price** of **EUR 6,000** is offered to clients for the **1st edition of Lactoferrin and Lactoperoxidase Global Market** study in **2022**

What's new in the 2024 edition:

- all market data updated for production, consumption and applications of lactoferrin (2023 and 2028f)
- updated profiles of producers
- special focus on lactoferrin produced by precision fermentation

Note: the update on lactoperoxidase is minor given the absence of evolution of this market

Gira's dairy-sector clients

Dairy-Sector Clients

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

Gira Dairy Club Members 2024

Agropur	FIT
AHDB	Fonterra
Arla Foods	Inalpi
Bel	Lactalis
BordBia	Land'Olakes
Comital	Meggle
Danone	Novonesis
DMK Group	Sodiaal
dsm-firmenich	Tirlán
Eurial	USDEC
Eurosérum	Valio
EU Commission	Virbac
Ferrero	

Gira's ingredients-sector clients

Ingredients-Sector Clients

Agropur	Lactalis Ingredients
Alpavit	Laiterie des Ardennes
Corman	Mercurius Production
DMK	Neste
Eurial	Olam
Eurosérum	Saputo Dairy UK
GEA	Standing Ovation
IFF	USDEC
Inalpi	Volac
Isigny Ste-Mère	

Gira Ingredients Club 2024 Participants

Agropur	Lever VC
Bon Vivant	Mercurius Production
Bord Bia	Nuritas
Clasado	Saputo Dairy UK
Depthfield GmbH	Standing Ovation
dsm-firmenich	Turtle Tree
DMK	USDEC
Eurial	
Eurosérum	
Lactalis Ingredients	

Contacts

Christophe Lafougere

+33 4 50 40 24 04

c.lafougere@girafood.com

Mylène Potier

mpotier@girafood.com

Guy Kientz

gkientz@girafood.com