A safety assessment of Microbial Food Cultures (MFC) endorsed by the International Dairy Federation (IDF)

Food fermentations: Micro-organisms with technological beneficial use
http://www.fil-idf.org/Files/media/Articles/IDF-IDJ-Food-Fermentations.pdf
IDF Bulletin 455/2012

23rd International ICFMH Symposium
François BOURDICHON – IDF/SCMH
05.09.2012

Outline

- Definition of MFC and fermented foods
- Safety concerns on MFC in fermented foods?
- A Process under scrutiny
- IDF Proposed approach
- Next Steps

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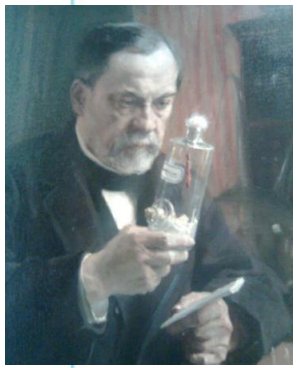
Microbial Food Cultures (MFCs)

- European Food and Feed Cultures Association (EFFCA) has proposed the following definition:
  - "Microbial food cultures are live bacteria, yeasts or molds used in food production."
  - MFC preparations range from defined single-strain starter culture to undefined multiple-species starter culture.
- ISO 27205: 2010 (IDF 149: 2010)
  - Fermented milk products - Bacterial starter cultures - Standard of identity.
- MFCs have not been defined legally.

Fermentation ? Fermented Foods ? What's behind ?

- Louis Jacques Thénard (1824):
  - "There are four types of fermentations: saccharine, alcoholic, acetic and putrid."
    - *Il y a quatre sortes de fermentations : la fermentation saccharine, la fermentation vineuse, spiritueuse ou alcoolique, la fermentation acétique, la fermentation putride.*



- Louis Pasteur (1856) – First description of role of Microbes:
  - Life (respiration) without air (although fermentation occurs in aerobic conditions).

- Major roles considered further were:
  - Preservation of food through formation of inhibitory metabolites., Improving food safety through inhibition of pathogens,
  - Improving the nutritional value and
  - Organoleptic quality of the food.

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Safety concerns on MFC in fermented foods?

Problems related to the safety assessment of lactic acid bacteria starter cultures and probiotics*

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LAB associated with human infections, and safety considerations

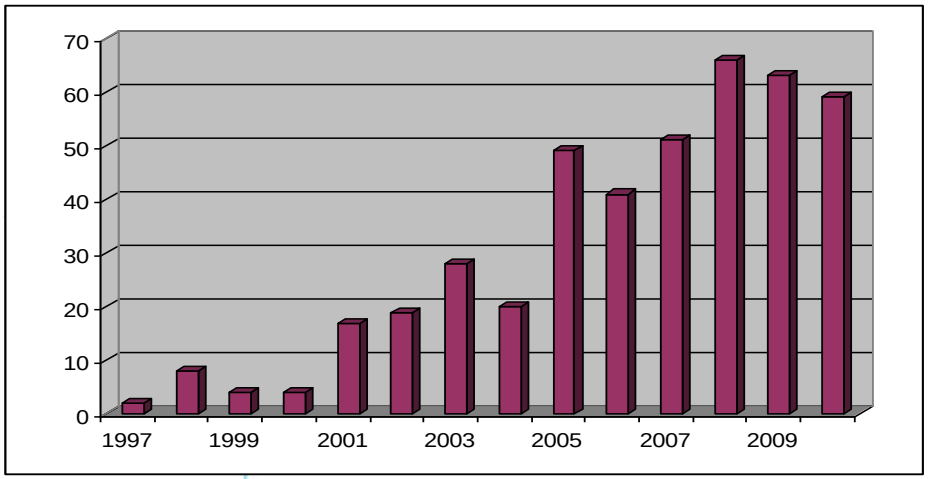
Cases of infection due to lactobacilli and bifidobacteria are rare and estimated to represent about 0.05 % to 0.4 % of cases of infective endocarditis or bacteremia (12, 24, 25, 26). Leuconostocs have been reported to cause <0.01 % of bacteremia cases,

* Lecture presented at the 37th Symposium of the Swiss Society of Food Hygiene, Zurich 29 September 2004

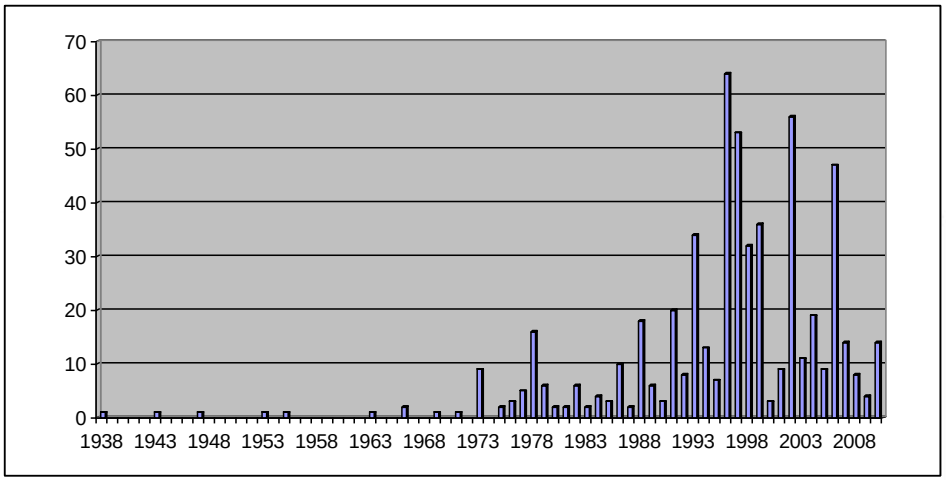
Mitt. Lebensm. Hyg. 96, 39–65 (2005)

Safety concerns – focus on *Lactobacillus spp.*

Timeline and number of publications



Safety – Probiotics (Bibliometry on GoPubMed)



Lactobacillus Case Report 1938-2010

1994: Gasser
Pasteur Institute
CNRS

1995: LABIP
Workshop
and Proceedings

1997-1999:
BgVV (GER)
"Probiotische
Mikroorganismenkulturen
in Lebensmitteln"

2001 – 2002 :
FAO / WHO
Guidelines for Probiotic
Food Product

2002: IDF Inventory
Microorganisms

2003: Borriello
Safety of Probiotics
Danone, Yakult, Nestlé, Valio

2005:
EFSA QPS
Colloquium
FEEDAP
ATB- R

2007: QPS

2008: QPS

2008: FEEDAP
Update

2008: RESOMIL
IJFM Special Issue

2009: QPS

2010: QPS

2011: QPS

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Use of microbial food cultures, a process under the eyes of regulators….

E.U. Novel Food Regulation 258/1997

IDF Bulletin 377/2002

Initially produced by EFFCA
Endorsed by IDF
Avoid Trade Barriers

12/2004 – EFSA Scientific Colloquium QPS
12/2007 – First Publication of EFSA QPS List

EFSA internal assessment tool for BIOHAZARD Panel
QPS List used by some Food Safety Authorities as positive list for food cultures (India, China, Thailand…)
IDF Bulletin outdated
taxonomic changes
new isolated species & food matrices
higher scientific expectation of demonstration of food usage

History of Use

- Health Canada, 2003:
  - ‘‘significant human consumption of food over several generations and in a large, genetically diverse population for which there exist adequate toxicological and allergenicity data to provide **reasonable certainty that no harm** will result from consumption of the food’’.
- History of safe use of a microorganism:
  - occurrence of a microorganism in a fermented food product,
  - evidence whether the presence of the microorganism is beneficial, fortuitous, or undesired.

European Approach: (EFSA Biohazard Panel)
Qualified Presumption of Safety

- Qualified Presumption of Safety (QPS) was introduced as a generic risk assessment approach for harmonising the assessment of notified biological agents across EFSA's different scientific panels and units.

- Microorganisms not considered suitable for QPS would remain subject to a full risk assessment, as would those failing a QPS qualification.

- The review of the list of biological agents recommended for QPS is carried out annually by EFSA's Biohazard Panel.
  - Review of new information concerning taxonomic units already assessed through the QPS assessment.
  - Identification and assessment of taxonomic units that have not been previously considered.

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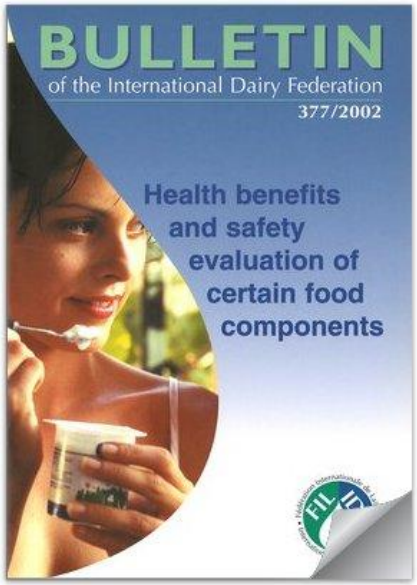
Bulletin 377-2002 of the IDF: Health benefits and safety evaluation of certain food components



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Food Microorganisms - Health Benefits, Safety Evaluation and Strains with Documented History of Use in Foods

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Action within the International Dairy Federation

Update of previous FIL 377-2002 publication

Dedicated Task Force “Update of Inventory of Microorganisms”

01/2010 – 11/2011

- *Chair:* Egon Bech Hansen (Denmark).
- *Deputy Chair:* François Bourdichon (France then Switzerland).

Food fermentations
Microorganisms with technological beneficial use

Safety demonstration

- Microbial Risk Assessment solely for contaminants.
- FAO/WHO Guidelines and review for probiotics.
- Qualified Presumption of Safety (EFSA) not intended for fermented foods.
- No existing guidelines for fermentation species.

Food Purpose

- Escaping from the “black box” level of demonstration.
- “Omics” application on historical fermentation process.
- New microbial techniques of isolation and metabolism characterization.

>> Based on the proposed demonstration, update the inventory

Update of IDF Bulletin 377/2002
Initial Considerations

- A scientific rationale of the criteria chosen for building the inventory must be defined and validated (peer review).
- Food fermentation processes only shall be considered:
  - Industrial Microbiology.
    - Ingredient production e.g. shall not be taken into consideration.
  - Strains incorporated in food matrices for a different purpose than the fermentation process will not be considered.
    - e.g. Probiotics.
- Following scientific evidence, the 2002 inventory shall be updated using the proposed scientific rationale under the endorsement of IDF.

Food Fermentations
Microorganisms with technological beneficial use

Contents

Inclusion & Exclusion Criteria

- Inclusion:
  - Microbial species with documented presence in fermented foods and evidence of technological role.
- Exclusion:
  - Lack of documentation for any desirable function in the fermentation process.
  - The species is a contaminant and / or does not harbor any relevant metabolic activity.
  - The species is undesirable in food for scientifically documented reasons .
- *Microorganisms conferring a health benefit to the host (FAO and WHO, 2002) are thus included if they are part of a culture used in a food fermentation process, whereas we have decided not to include microbial species of probiotic strains only used in supplements or over the counter (OTC) products.*

EFSA's QPS approach *vs.* IDF proposed demonstration of use of MFCs

- What is QPS ?
  - Internal safety assessment tool for BIOHAZARD panel to evaluate the safety of submitted **strains** voluntarily added for food / feed use.
- What is the process ?
  - Describe the scientific rationale:
    - 2004 Colloquium.
    - Peer Review Publications.
    - EFSA Website in 2007.
  - Yearly update of the QPS List of **species** since 2008.

- What is the objective of IDF?
  - Establish a rationale of the safety evidence of microbial **species** of fermented foods.
- What is the level of evidence ?
  - No authoritative guidelines.
  - No specific regulation.
- Alignment with QPS Process
  - Publication of safety demonstration.
  - Publication of inventory of microbial **species.**
  - Continuous update process endorsed by IDF – SCMH.

Same process, different objective, different classification keys
➔ Different list, complementary approach.

Updated Inventory:

from 113 to 264 species (62 genera)

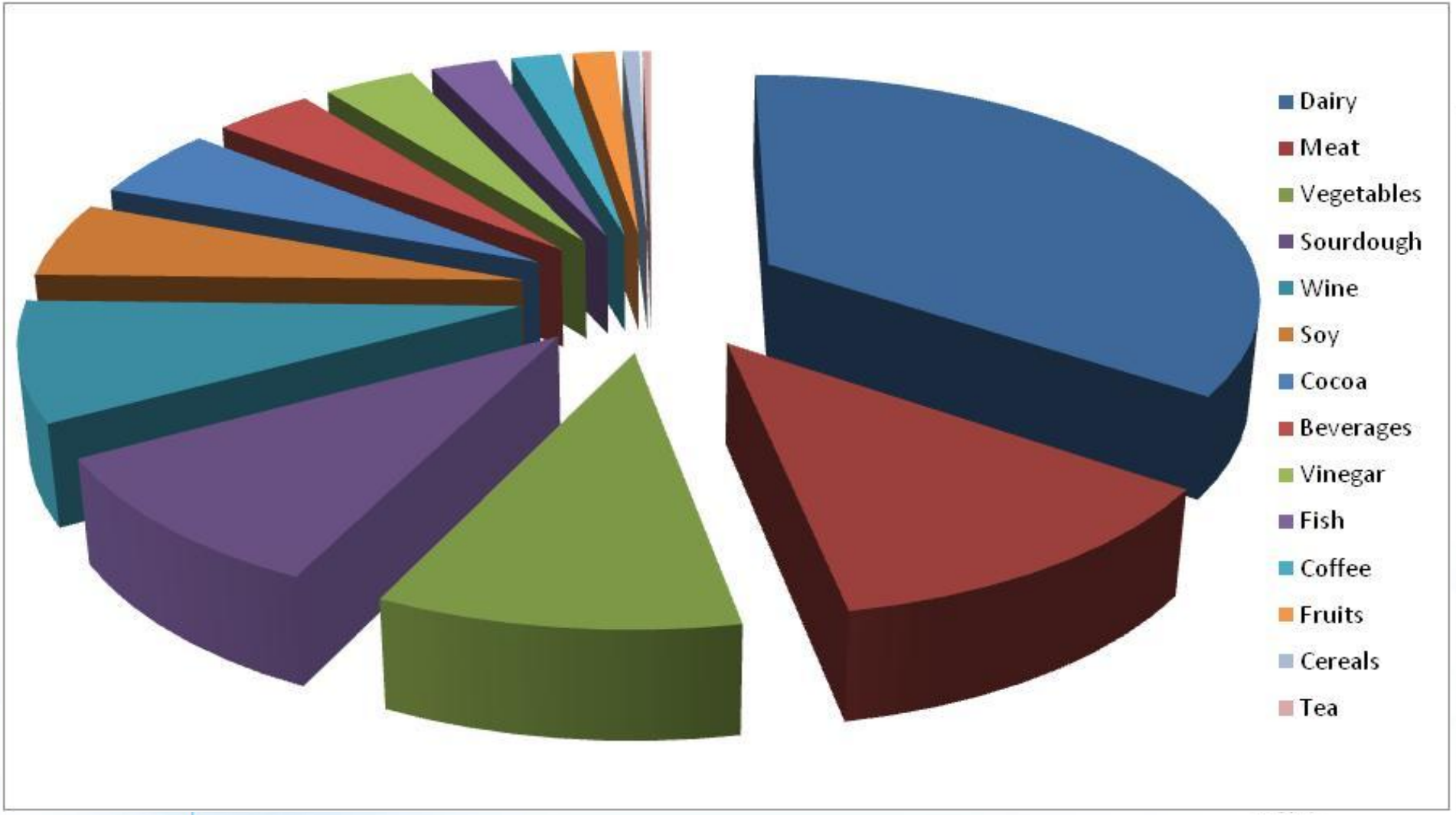
Bacterial diversity in the 2011 update of microorganisms with beneficial use.

Phylum	Family	Genus	Species
Actinobacteria	*Bifidobacteriaceae*	*Bifidobacterium*	8
	Brevibacteriaceae	*Brevibacterium*	3
	Corynebacteriaceae	*Corynebacterium*	4
	Dermabacteraceae	*Brachybacterium*	2
	Microbacteriaceae	*Microbacterium*	1
	Micrococcaceae	*Arthrobacter*	4
		Kocuria	2
		Micrococcus	2
	Propionibacteriaceae	*Propionibacterium*	5
	Streptomycetaceae	*Streptomyces*	1
Actinobacteria—species			32
Firmicutes	*Bacillaceae*	*Bacillus*	3
	Carnobacteriaceae	*Carnobacterium*	3
	Enterococcaceae	*Enterococcus*	3
		Tetragenococcus	2
	Lactobacillaceae	*Lactobacillus*	84
		Pediococcus	3
	Leuconostocaceae	*Leuconostoc*	12
		Oenococcus	1
		Weissella	9
	Staphylococcaceae	*Macrococcus*	1
		Staphylococcus	15
	Streptococacceae	*Lactococcus*	3
		Streptococcus	3
Firmicutes—species			142
Proteobacteria	*Acetobacteraceae*	*Acetobacter*	9
		Gluconacetobacter	9
	Enterobacteriaceae	*Hafnia*	1
		Halomonas	1
	Sphingomonadaceae	*Zymomonas*	1
Proteobacteria—species			21
Total number of species			195

Fungal diversity in the 2011 update of microorganisms with beneficial use.

Phylum	Family	Genus	Species
Ascomycota	*Cordycipitaceae*	*Lecanicillium*	1
	Dipodascaceae	*Geotrichum*	1
		Yarrowia	1
		Galactomyces	1
	Microascaceae	*Scopulariopsis*	1
	Nectriaceae	*Fusarium*	2
	Saccharomycetaceae	*Candida*	10
		Cyberlindnera	2
		Debaryomyces	1
		Dekkera	1
		Hanseniaspora	3
		Kazachstania	2
		Kluyveromyces	1
		Lachancea	2
		Metschnikowia	1
		Pichia	4
		Saccharomyces	4
		Schwanniomyces	1
		Starmerella	1
		Trigonopsis	1
		Wickerhamomyces	1
		Zygosaccharomyces	1
		Zygotorulaspora	1
		Kluyveromyces	1
	Sarcosomataceae	*Torulaspora*	1
	Schizosaccharomycetaceae	*Schizosaccharomyces*	1
	Sordariaceae	*Neurospora*	1
	Trichocomaceae	*Aspergillus*	4
		Penicillium	7
Ascomycota—species			59
Basidiomycota	*Cystofilobasidiaceae*	*Cystofilobasidium*	1
		Guehomyces	1
Basidiomycota—species			2
Zygomycota	*Mucoraceae*	*Mucor*	4
		Rhizopus	4
Zygomycota—species			8
Total number of species			69

Updated Inventory: Food Usages



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Continuous Update Process: Action Team within Standing Committee on Microbiological Hygiene

- Evolution of taxonomy,
- Growing evidence of food usage of microbial species,
- Newly identified species on (newly identified) indigenous fermented foods,
- New fermentation techniques and
- Emerging issue questioning the relevance of one present species

"**The inventory can never be completed as such**, owing to the evolving taxonomy, the identification of new microorganisms, and new descriptions of roles of microorganisms in fermented foods. The same issue is valid for any list (of microorganisms) with a defined purpose."

Thank you
for your attention