



Discovering Pathogens-in-Foods: resources and applications of a database on occurrence data of foodborne pathogens in European-marketed foods

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Background

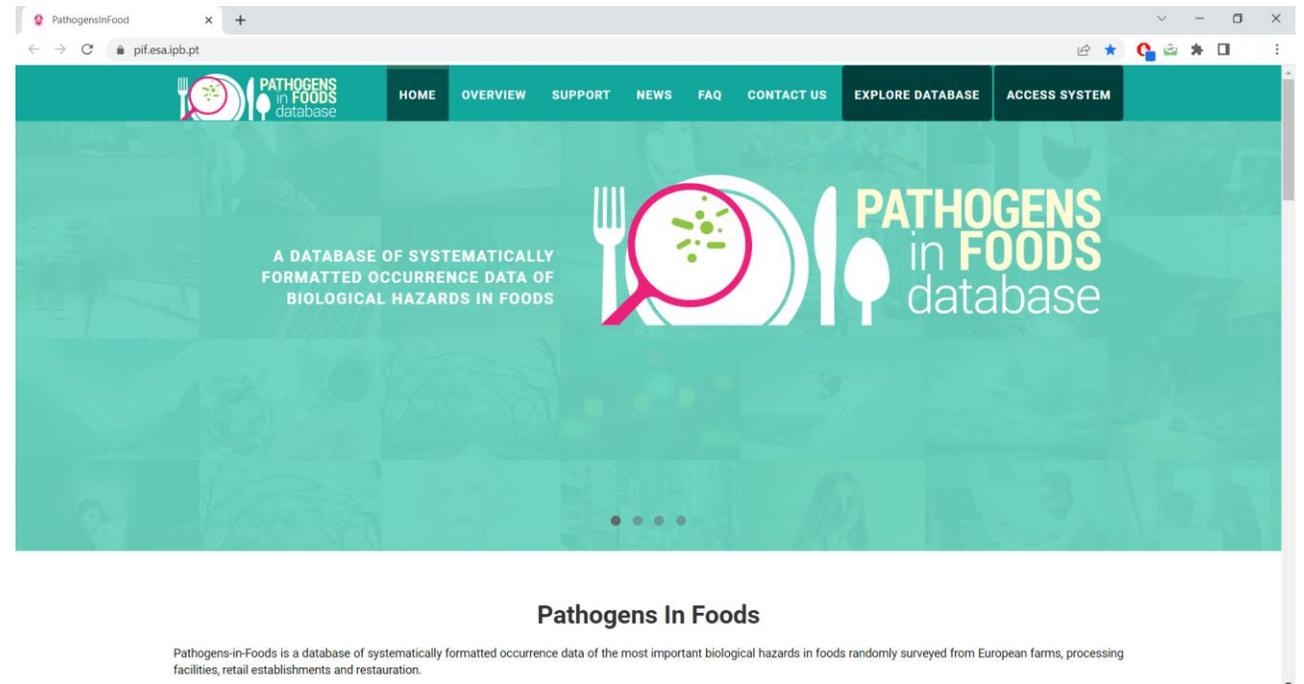
- ▶ Studies addressing the occurrence of pathogens in foods surveyed in the farm-to-fork chain
 - ▶ vital in the development of pathogens' risk assessment models
 - ▶ risk management tools
 - ▶ risk ranking
- ▶ Yet, the existing data is mostly dispersed, disharmonized or not easily accessible

How to solve this issue?



PIF - Pathogens In Foods

- ▶ PIF is a database of systematically formatted occurrence data
 - ▶ prevalence and enumeration
 - ▶ most important biological hazards in foods randomly surveyed
 - ▶ European farms,
 - ▶ processing facilities,
 - ▶ retail establishments
 - ▶ restauration



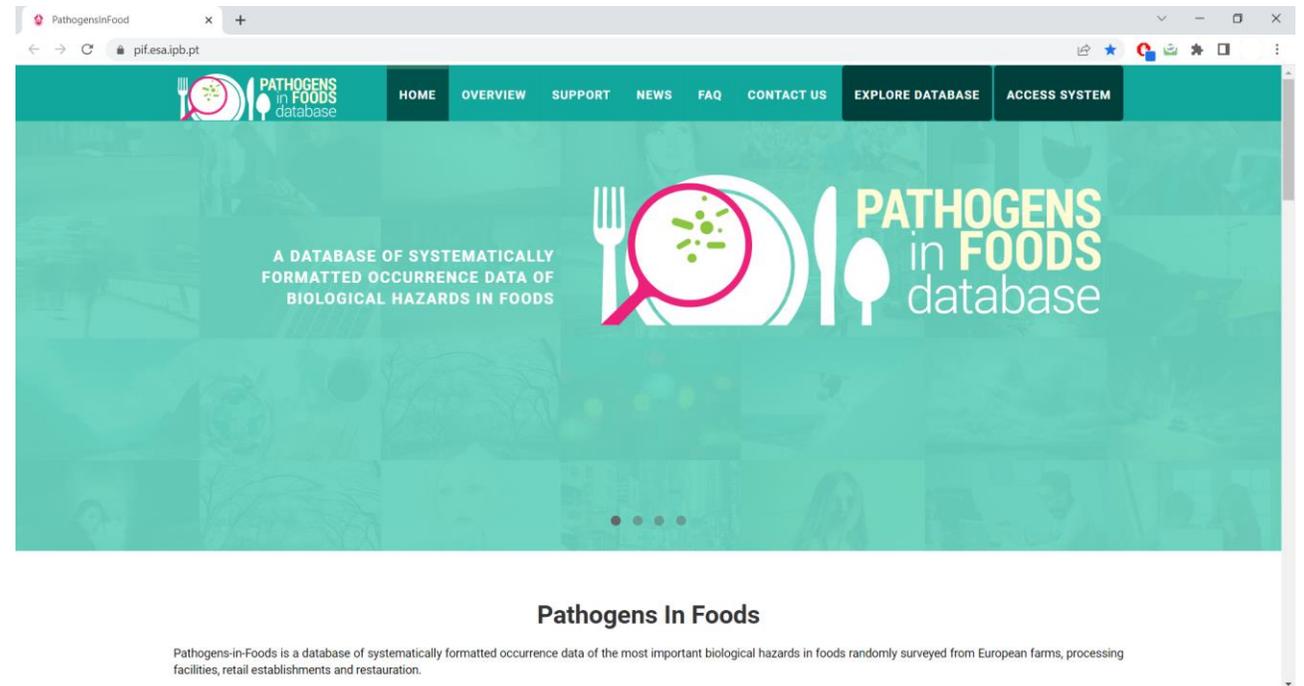
Accessible through the website

<https://pif.esa.ipb.pt/>

PIF - Pathogens In Foods

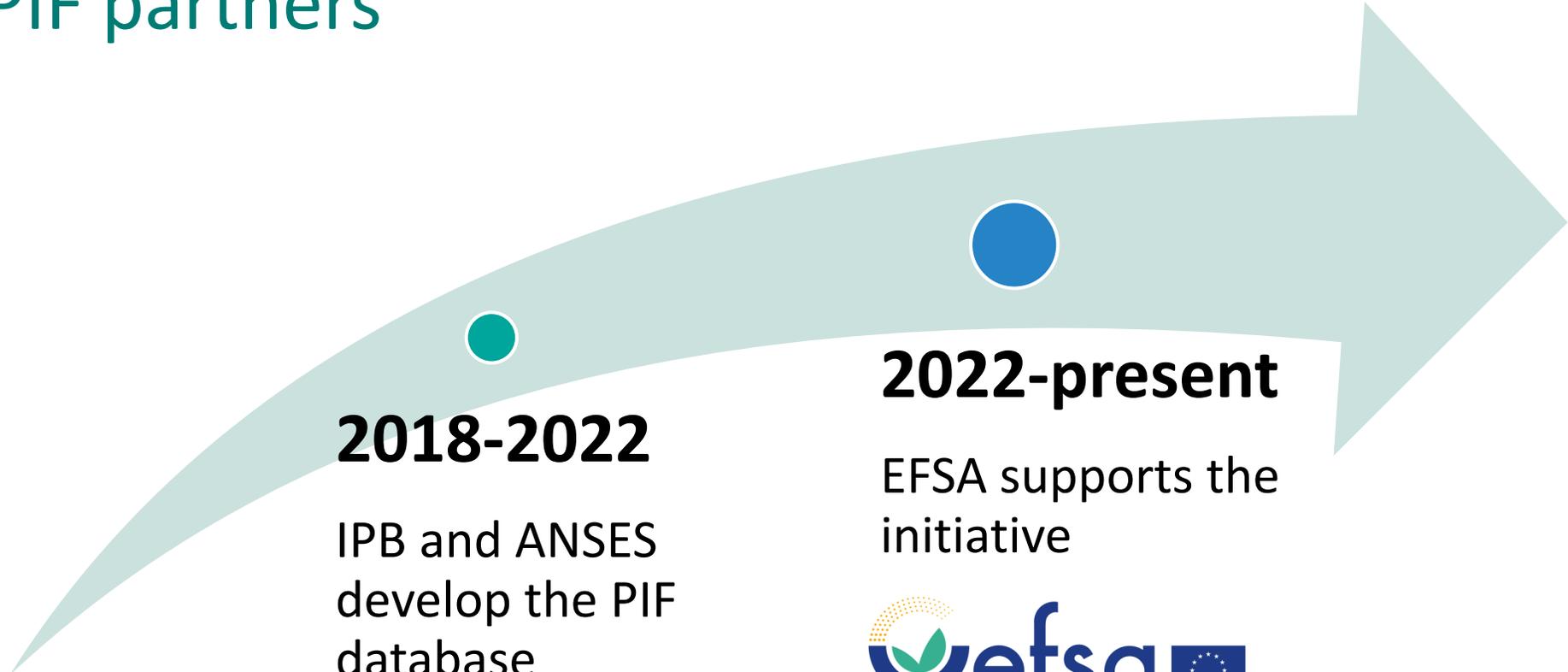
- ▶ Contains data extracted from
 - ▶ peer-reviewed articles
 - ▶ retrieved through systematic literature searches
 - ▶ using a publicly available protocol describing the search and screening process

(<https://doi.org/10.5281/zenodo.7850017>)



Accessible through the website
<https://pif.esa.ipb.pt/>

PIF partners



2018-2022

IPB and ANSES
develop the PIF
database



anses

2022-present

EFSA supports the
initiative



Conceptualization



Selecting the data - Review Question

“What is the occurrence (i.e., prevalence and/or concentration) of the most important biological hazards in the various foods and food products produced and/or commercialised in Europe?”

- ▶ Descriptive question with a simple PO (*population* and *outcome*) structure with the following key elements

Review Question

Population – Foods

- Beverages
- Meat and meat products
- Eggs and egg products
- Milk and dairy products
- Seafood and fishery products
- Fruits
- Vegetables
- Legumes
- Grains and cereal products
- Oils and sugars
- Ready-to-eat, composite and multi-ingredient foods

Outcome – Biological Hazards

- *Bacillus cereus*
- *Campylobacter* spp.
- *Clostridium perfringens*
- *Listeria monocytogenes*
- *Salmonella* spp.
- Shiga toxin-producing *Escherichia coli*
- *Staphylococcus aureus*
- *Yersinia enterocolitica*
- *Cryptosporidium* spp.
- *Giardia* spp.
- *Toxoplasma gondii*
- Hepatitis A virus
- Hepatitis E virus
- Norovirus

Foodchain

- Primary production (ex. farm, fishery, etc.)
- Manufacturing (processing)
- Storage
- Retail
- Restauration

Countries

- All countries in Europe

Bibliographic search



e-bibliographic databases search (with adapted database syntax):

- ▶ PubMed
- ▶ Web of Science Core Collection
- ▶ Scopus
- ▶ SciELO

Entries filtered by:

- ▶ database insertion date
- ▶ type of publication (only primary research articles and reviews)
- ▶ language (English, Spanish, French and Portuguese)

Screening of studies

Reference Details

RefID: 85, Assessment of the microbiological quality and safety in takeaway sushi meals in Portugal
Alegria, Sandy J.C., Santos, Maria Isabel S., Furtado, Rosália M.S., Correia, Cristina Belo, Lima, Ana Isabel G., Pedroso, Laurentina R., Ramos, Sónia Catarina da Silva

Full Text Links
DOI.org

Reference Label(s):
Add Labels here

Abstract Being a food product that contains perishable ingredients and involves a significant degree of manual handling during preparation, sushi is regarded as a potentially hazardous food, which may lead to foodborne disease outbreaks. In Portugal, consumption of takeaway sushi meals has strongly increased throughout the past few years; however, there is limited information regarding its compliance with food quality standards. Under this context, the present study aimed to evaluate the microbiological quality and safety of takeaway ready-to-eat sushi meals in Lisbon, Portugal. Sixty-two samples were collected from different origins (restaurant and hypermarket), and each sample was tested for aerobic mesophilic microorganisms, Enterobacteriaceae, Escherichia coli, positive coagulase Staphylococci, presumptive Bacillus cereus count, as for detection of pathogenic microorganisms, such as Salmonella spp., Listeria monocytogenes and Vibrio parahaemolyticus, V. cholerae and V. vulnificus. Results revealed that 48.4% (30/62) were deemed unsatisfactory, 35.5% (22/62) were classified as borderline and only 16.1% (10/62) were considered satisfactory. Even though we did not detect the incidence of potentially pathogenic microorganisms in sushi, the presence of B. cereus and coagulase-positive Staphylococci was detected at unsatisfactory levels. Furthermore, significant differences between the place of origin (restaurant vs. hypermarket) and type of fish were also observed. Overall, the high number of samples classified with a level of microbiological quality "unsatisfactory" and "borderline" highlights the need to review good hygiene practices, as well as the quality of the raw materials used, to obtain a final product with a satisfactory quality and safety level.

Submit Form and go to This Form - Next Reference or Skip to Next

1. Is the article in English, Spanish, French, or Portuguese?

Yes No Not sure

2. What is the Publication type?

Primary research study Review or systematic review Other Not sure

3. Is occurrence data provided in the study for at least one of the following biological hazards,

- Salmonella spp., Campylobacter, Shigatoxin producing Escherichia coli (STEC), Listeria monocytogenes, Yersinia enterocolitica, Bacillus cereus, Clostridium perfringens, Staphylococcus aureus, Toxoplasma gondii, Cryptosporidium spp., Giardia duodenalis, Hepatitis A virus, Hepatitis E virus, Norovirus,
- in food products such as beverages, meat and meat products, eggs and egg products, milk and dairy products, seafood, produce – fruits and vegetables, cereals or composite products?

Yes No Not Sure

4. Do the occurrence data of any of the aforementioned pathogens in foods originate from observational studies?

(This could be cross-sectional or longitudinal where food units have been sampled by a randomized design, either simple or stratified. These designs are typically used in studies related to microbiological surveillance, microbiological characterisation of foods, and microbiological surveys on farms, in food factories, at retail, or in restaurant establishments)

Yes No Not sure

5. Were the foods in the study, as a finished product or during production/processing, sampled from a European country?

Yes No Not Sure

Reference proceed to next level

Yes No

After bibliographic search

- citations are uploaded to DistillerSR
- duplicate cleaning
- screening (Title/Abstract screening + Full Text screening)

Database insertion

- ▶ Studies that pass both stages of screening, are selected to proceed to data extraction into the database

PATHOGENS in FOODS database

REGISTER NEW

1. Study, Agent & Essay

Study Info

Select Study ID (required)

Select...

STUDY INFO

Agent Info

Select Agent (required)

Select

Bacterium Label (leave blank for NA)

enter text...

Serotype/Serovar (leave blank for NA)

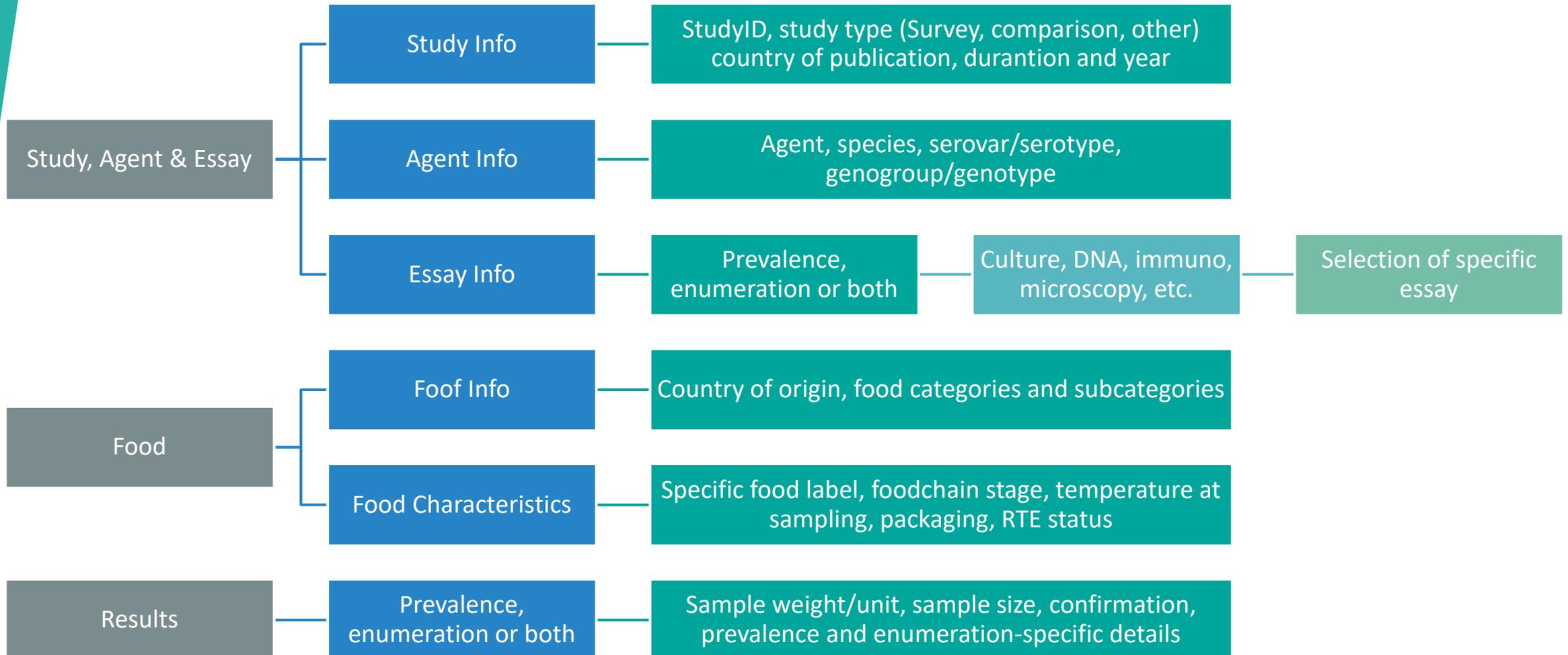
enter text...

NEXT

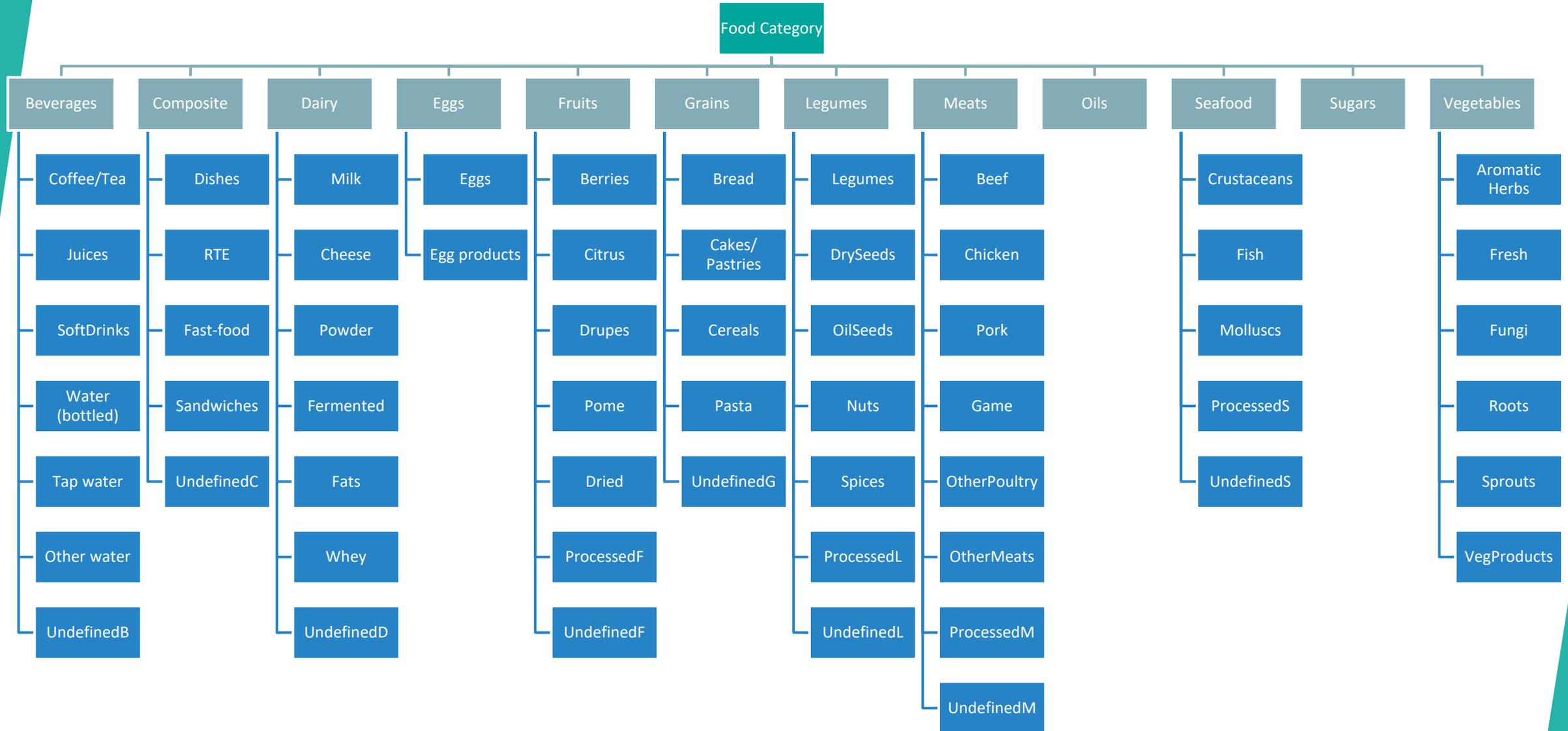
Main Menu

- Dashboard
- Database Management**
- Study
- Bacteria
- Search
- Search By Label
- Register New**
- Curate Data
- Virus
- Parasite
- System Management**
- Users

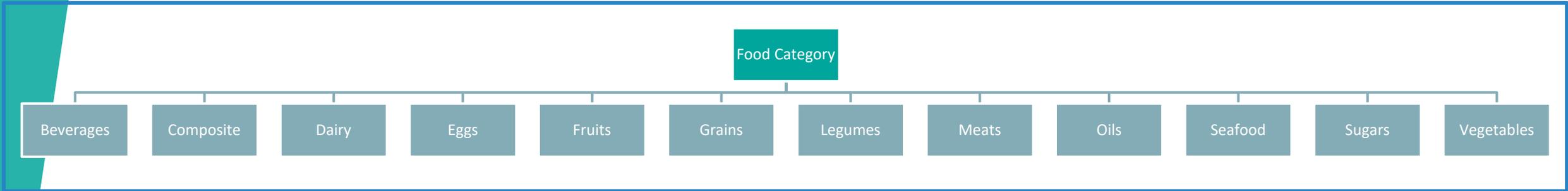
Extracted Information



PIF Food Info - Before



PIF Food Info - Now



Food categories and subcategories are currently being harmonized according to EFSA's FoodEx2 Matrix

EFSA Catalogue Browser 1.2.12 (Connected as catalogue viewer)
File View Tools About Proxy Account

14.3 MTX (FoodEx2 Matrix)

Select: Hierarchies Facets Hierarchy: Zoonoses hierarchy Hide: Deprecated terms Terms not in use Terms code

Search: Write the term's name here Exact Match
 Current hierarchy All hierarchies Go

- > Meat and meat products [A01QR]
- > Fish meat and products thereof [A0EZR]
- > Seafood and products thereof [A0EZQ]
 - > Crustaceans [A02FD]
 - > Molluscs [A02GM]
 - > Seafood offal [A16FR]
 - > Sea-squirts and other tunicates [A02GN]
 - > Sea urchins and other echinoderms [A02GP]
 - > Jellyfishes and similar [A02GY]
 - > Processed or preserved seafood [A0BZ4]
 - > Marinated / pickled seafood [A0EZA]
 - > Salted seafood [A0EYX]
 - > Dried seafood [A0EYY]
 - > Canned seafood [A0BZ5]
 - > Smoked seafood [A0EYZ]
- > Terrestrial animals other than mammals and birds [A0EZT]
- > Milk and milk products (dairy) [A0BXZ]
- > Eggs and egg products [A031E]
- > Meat and dairy imitates [A03TD]
- > Cereal grains and similar and primary derivatives thereof [A0EZF]
- > Cereal dough-based products [A0EZV]
- > Garden vegetables and primary derivatives thereof [A07XJ]
- > Legume seeds and primary derivatives thereof [A0EZG]
- > Fruit and primary derivatives thereof [A0EZN]
- > Nuts and primary derivatives thereof [A0EZH]
- > Oilseeds and oilfruits [A015E]
- > Starchy roots and tubers and primary derivatives thereof [A16RE]
- > Sugar plants [A01OR]
- > Herbs, spices and similar [A0EZM]
- > Fruit/vegetables/plant drinks, spreads and related products [A0EZF]
- > Water, water-based beverages and related ingredients [A0FO]
- > Ingredients for hot drinks and infusions [A0F0K]
- > Hot drinks and similar (coffee, cocoa, tea and herbal infusions) [A03JZ]
- > Alcoholic beverages [A03LZ]
- > Confectionery including chocolate [A04PE]
- > Food products for young population [A03PV]
- > Food for particular diets [A03RR]

Term naming and definition | Implicit facets | Reportability

Type of term: [] Level of detail: []

Term code: []

Term extended code: []

Term name: []

Term extended name: []

Scope notes and links: []

Implicit attributes:

Label	Value

Pathogen

Select Agent

- All
- Bacillus cereus
- Campylobacter
- Clostridium perfringens
- Listeria monocytogenes
- Salmonella
- Staphylococcus aureus
- Shiga toxin-producing Escherichia coli
- Yersinia enterocolitica

Selected Items: 1

Essay Type

Select Essay

All

Food Info

Category

Fruits

SubCategory

All

Search Results

Show Search Results as:

Table

Fill Empty Cells with:

Blank Field

Show Advanced Filters

DOWNLOAD BIB

SEARCH

Results Found: 26

StudyID	Year	DurationSurvey	Bacterium	Serotype_Serovar	PhageType	BacteriumLabel	CountrySampling	CountryOrigin	Category
Badosa_JSciFoodAgric_2008	2006	8	Listeria monocytogenes				Spain		Fruits
Abadias_UJFM_2008	2005	12	Listeria monocytogenes				Spain		Fruits
Althaus_JFP_2012	2011	2	Listeria monocytogenes				Switzerland		Fruits
Badosa_JSciFoodAgric_2008	2006	8	Listeria monocytogenes				Spain		Fruits
Badosa_JSciFoodAgric_2008	2006	8	Listeria monocytogenes				Spain		Fruits
Gelbicova_CJFS_2009	2004	48	Listeria monocytogenes				Czech Republic		Fruits
Cavaiuolo_JFAE_2014	2014		Listeria monocytogenes				Portugal		Fruits
Francis_JFP_2006	2001	24	Listeria monocytogenes				Ireland		Fruits
Badosa_JSciFoodAgric_2008	2006	8	Listeria monocytogenes				Spain		Fruits

Database Interface

▶ PIF allows data extraction according:

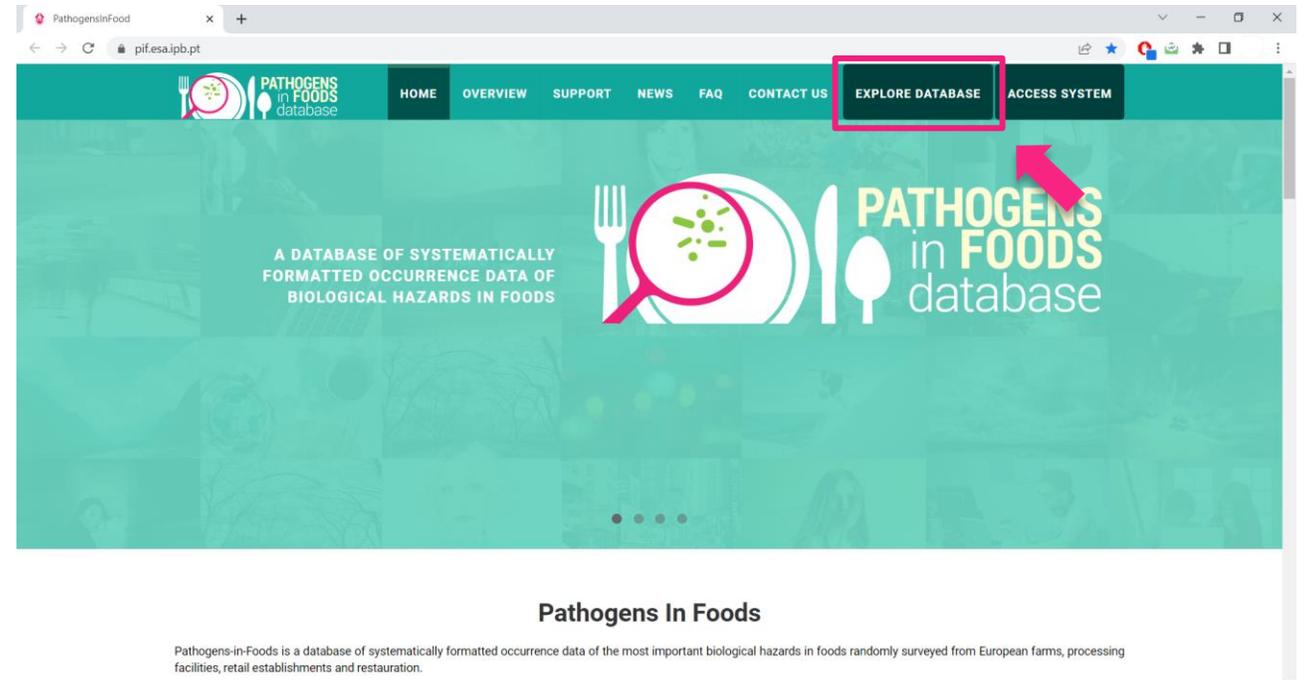
- ▶ pathogen,
- ▶ food type or country,
- ▶ Other metadata

▶ Presently contains:

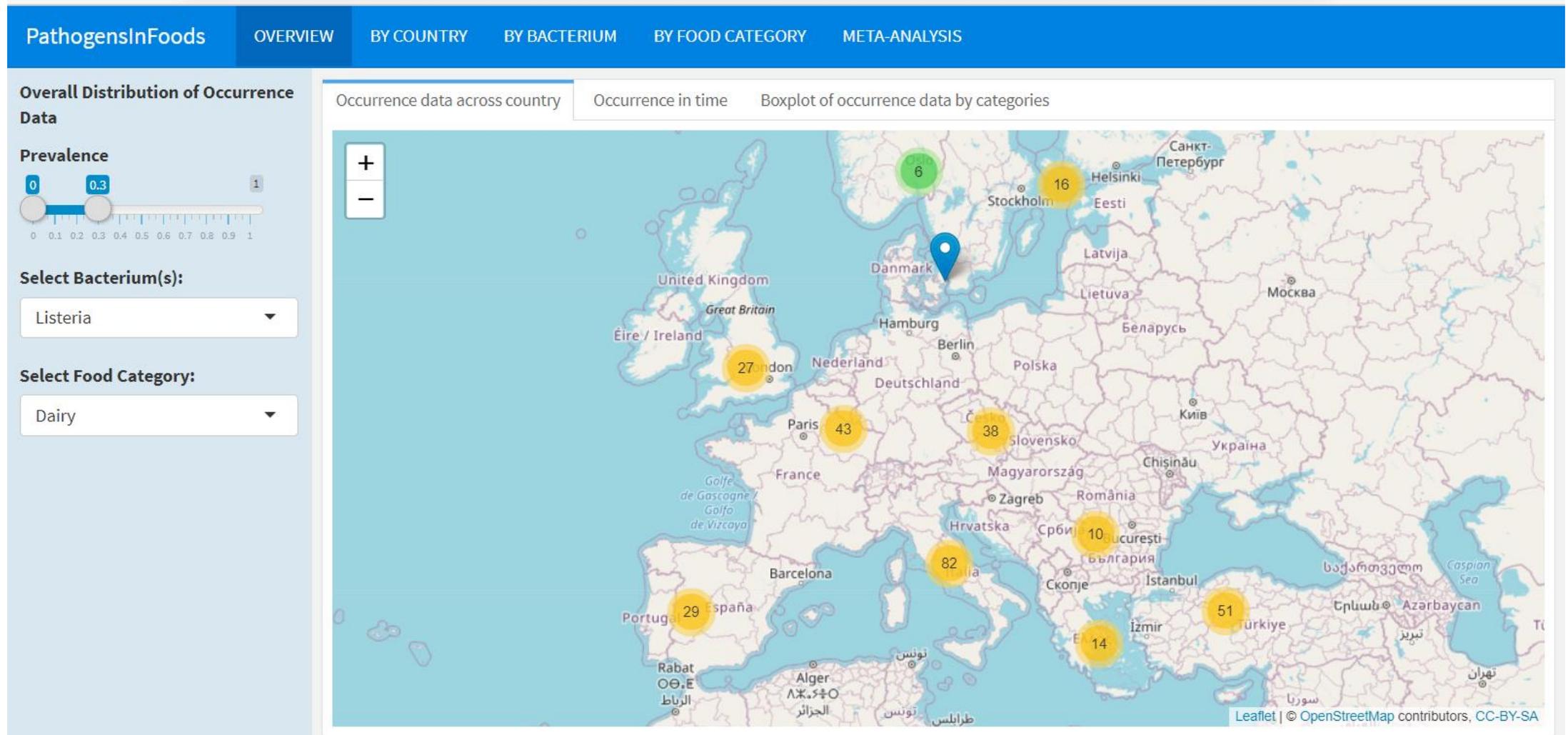
- ▶ > 1,100 primary studies
- ▶ ~ 6,000 entries of samples

Interactive Dashboards

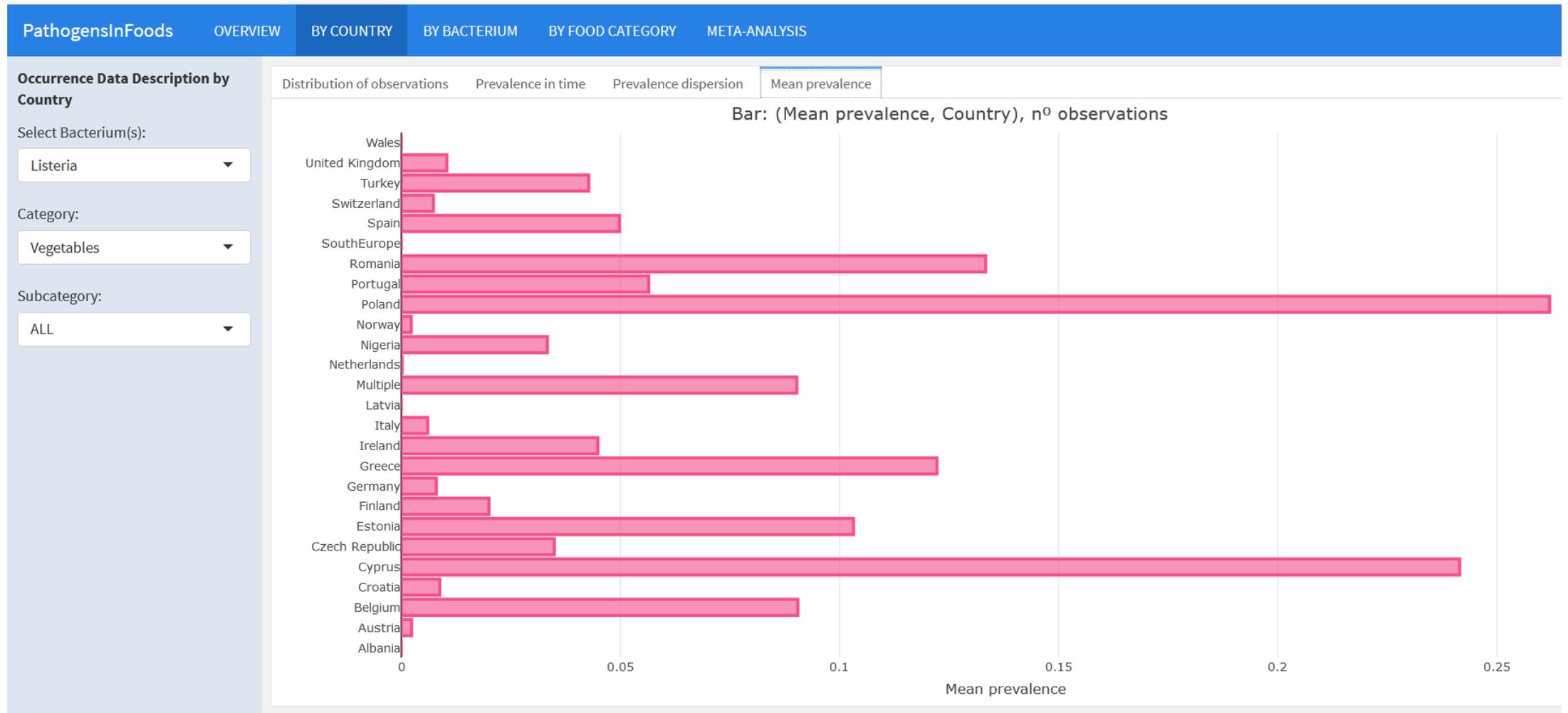
- ▶ PIF also generates interactive charts, summary statistics and meta-analysis, easily accessible through interactive dashboards
- ▶ Select:
- ▶ “Explore Database” on the website and navigating through the dashboards like:
 - ▶ “Overview”
 - ▶ “By Country”
 - ▶ summary of occurrence data across countries and in time
 - ▶ boxplots of occurrence data by food categories or country



Interactive Dashboards



Interactive Dashboards



Interactive Dashboards

- ▶ The “Meta-Analysis” dashboard provides synthesised statistical analysis for all the available entries on the selected pathogen and food categories
- ▶ For example, meta-analysis of *L. monocytogenes* incidence in fruits:
- ▶ Overall: 1.34% (95% CI 0.83-2.15)
- ▶ Berries: 1.40% (95% CI 0.56-3.49)
- ▶ Dried fruits: 2.25% (95% CI 0.44-10.58)
- ▶ Drupes: 0.86% (95% CI 0.05-12.33)
- ▶ Processed fruits: 1.14% (95% CI 0.28-4.44)

Final Considerations

- ▶ Pathogens-in-Foods has been constructed to facilitate the access, visualisation and assessment of microbiological occurrence data from different sources
- ▶ The database contains microbiological survey results extracted from over 1,100 peer-reviewed articles published since 1998 until the present day, and the systematic review protocol is periodically employed to retrieve current published studies and data
- ▶ PIF is a free tool for food safety researchers and policymakers, that gathers reliable and quality assessed data that can be used in microbiological risk assessment and help establish future food safety guidelines



Thank you!

Follow us at:

Website:

<https://pif.esa.ipb.pt/>

Zenodo: Resources of PIF

<https://doi.org/10.5281/zenodo.7850017>

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