

JOINT ECDC/EFSA RAPID OUTBREAK ASSESSMENT

Multi-country outbreak of *Salmonella* Mbandaka ST413 linked to consumption of chicken meat products in the EU/EEA and the UK – first update

21 March 2024

Abstract

A cross-border outbreak of *Salmonella* Mbandaka ST413 has been ongoing in the European Union/European Economic Area (EU/EEA) and the United Kingdom (UK) for over two years since September 2021. By 30 November 2022, 196 cases had been recorded and published in a joint European Centre for Disease Prevention and Control (ECDC) and European Food Safety Authority (EFSA) Rapid Outbreak Assessment. By 15 March 2024, 300 cases (an increase of 104 cases) had been reported in Estonia (n=3), Finland (n=98), France (n=16), Germany (n=2), Ireland (n=7), the Netherlands (n=1), and the United Kingdom (n=173), according to the European case definition. Twenty-three cases were hospitalised, six cases had septicaemia and one case died in the UK.

In November 2022, when the first assessment was published, ready-to-eat chicken products and/or fresh chicken meat were identified as probable vehicles of infection based on case interviews in Finland and the UK. Subsequent investigations by the food safety authorities in Estonia, Finland and the Netherlands and the sharing of genomic food information with EFSA in 2024 identified frozen steam-cooked chicken breast, produced in Ukraine, as the vehicle of infections. The contaminated batches had been imported by non-EU operators and distributed in the EU/EEA and UK markets.

The shelf lives of contaminated frozen chicken meat products expired in November and December 2023. The most recent cases were detected in Finland in October 2023 and in the UK in February 2024. Assuming that the identified contaminated batches are no longer on the market, and given the expiration dates and control measures implemented, the likelihood of new infections occurring with the outbreak strain from these batches is low. However, despite the implementation of control measures, cases continued to occur throughout 2023 in the EU/EEA and in early 2024 in the UK, suggesting undetected routes of exposure which require further investigation and pose a continued, albeit reduced, risk for new infections.

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Event background

On 20 May 2022, the UK reported a cluster of 31 *Salmonella* Mbandaka ST413 cases from England (25 cases), Scotland (three cases) and Wales (three cases) with sample dates between 24 September 2021 and 23 April 2022 (EpiPulse ID 2022-FWD-00033). Of the 13 cases where information was available, four (31%) were admitted to hospital and one case died. The UK shared the sequence data of two representative outbreak strains with countries for comparison with the sequence data in the national databases.

On 16 June 2022, Finland reported a cluster of nine *S. Mbandaka* cases from different regions between 19 April and 24 May 2022 (EpiPulse ID 2022-FWD-00042). Subsequent analysis on 20 June confirmed that the cluster of nine Finnish cases was genetically close to the representative isolates of the UK outbreak strains.

As new cases continued to be reported in Finland and the UK in September 2022, indicating that the outbreak was ongoing, ECDC and EFSA decided to investigate further and produce a Rapid Outbreak Assessment (ROA). The ROA was published on 30 November 2022 [1]. During 2023, while investigations were performed in countries, new cases continued to be reported. As new information has become available about the vehicle of infection following successful investigations in countries, ECDC and EFSA agreed to update the ROA.

Information on reported human *S. Mbandaka* infections in the EU/EEA is presented in the ROA published on 30 November 2022 [1].

Outbreak strain characterisation

The two representative outbreak strains from the UK are characterised as follows:

- *Salmonella* Mbandaka, sequence type (ST) 413, EBG (e-BURST group) 62, UKHSA (United Kingdom Health Security Agency) 5-SNP (single nucleotide polymorphism) single linkage cluster address designation: 1.148.273.438.602.665.% [2].
- Predicted antimicrobial resistance determinants were detected against the following classes of antibiotics: aminoglycosides (*aac(6')-Iaa*) and fluoroquinolones (single mutation of the gene *parC*[57:T-S], which does not necessarily confer resistance). In France, phenotypic testing of one isolate did not express resistance to aminoglycosides or to quinolones. In Germany, two isolates were susceptible to all tested antimicrobials: ampicillin, azithromycin, chloramphenicol, ceftazidime, ciprofloxacin, colistin, cefotaxime, ceftazidime, gentamicin, kanamycin, meropenem, nalidixic acid, cotrimoxazole, tetracycline, and trimethoprim. In the UK, a selection of isolates was tested for resistance, and all isolates were sensitive to the antimicrobials in the panel.

The Enterobase cgMLST hierarchical cluster designation for the outbreak isolates is HC5_286156 [3,4].

There are **four representative strains** available in the European Nucleotide Archive (ENA):

- From the UK: the sequence accession codes for the two outbreak strains are SRR16920742 (October 2021) and SRR19087024 (April 2022)
- Finland: the sequence accession codes for the two outbreak strains are ERR10225555 and ERR10225556.

EU/EEA outbreak case definition

A confirmed outbreak case:

- A laboratory-confirmed *Salmonella* Mbandaka case with symptom onset on or after 1 September 2021 (date of sampling or date of receipt by the reference laboratory if date of onset is not available).

AND

- Fulfilling at least one of the following laboratory criteria: a *S. Mbandaka* ST413 isolate by:
 - the national cgMLST pipeline within five cg-allelic differences (AD) from the representative UK or Finnish outbreak strains, OR
 - clustering in a centralised whole genome sequencing (WGS) analysis within five cg-allelic differences in a single linkage analysis, OR
 - belonging to the same cgMLST HC5_286156 cluster (Enterobase scheme), OR
 - belonging to a 5-SNP single linkage cluster with SNP designation 1.148.273.438.602.665.% (t5:665) according to the UKHSA pipeline in the UK.

A possible outbreak case:

- A laboratory-confirmed *S. Mbandaka* case with symptom onset on or after 1 September 2021 (date of sampling or date of receipt by the reference laboratory if date of onset is not available) without molecular typing/sequencing data.

AND

- An epidemiological link to a confirmed case.

Epidemiological and microbiological investigations of human cases

By 11 March 2024, 300 cases (251 confirmed and 49 possible) had been reported in six EU/EEA countries (Estonia, Finland, France, Germany, Ireland, and the Netherlands) and the UK (Table 1). This represents an increase of 104 cases (53.1%) since 30 November 2022 (n=196). The first case was identified in the UK with a sample date on 24 September 2021 and the most recent case was reported in the UK on 15 February 2024 (Table 1). Overall, the cases are reported across all age groups and there is a predominance of females among the cases in the EU/EEA (chi-square test, $p < 0.05$, Table 1).

Hospitalisation was required for 23 cases (10 in Finland, two in France, two in Ireland, and nine in the UK). Six cases in Finland had septicaemia and one case died in the UK.

Travel histories during the incubation period were reported for seven cases: one case in the Netherlands reported travel to Ukraine, two cases in the UK reported travel to Nigeria and United Arab Emirates, one case in Ireland reported travel to the USA and another to Italy, and one case in Estonia had travelled to Finland.

Table 1. Demographic and background information for 300 human *S. Mbandaka* cases in six EU/EEA countries and the UK, as of 15 March 2024

Country	Total	Confirmed cases	Possible cases	Time range	Age range (median)	Gender		Comments
						M	F	
Estonia	3	3	0	1 January - 17 October 2022	16 - 58 years (47)	1	2	One case had travel history to Finland.
Finland	98	49	49	19 April 2022 - 23 October 2023	<1 - 75 years (28)	39	59	10 cases were hospitalised and six cases had septicaemia. Cases are reported nationwide.
France	16	16	0	February 2022 - August 2023	13 - 95 years (64)	6	10	Two cases from different regions were interviewed: both were hospitalised and reported no travel
Germany	2	2	0	November 2021, May 2022	24 and 65 years	1	1	
Ireland	7	7	0	24 June 2022 – 7 May 2023	27 – 64 years (36)	2	5	Two cases were hospitalised. Two cases reported international travel in the 3 days prior to onset (one to the United States and one to Italy). Six cases had dates of diagnosis before 03/03/2023 and one case had onset in May 2023 but is believed to be a secondary case.
Netherlands	1	1	0	March 2022	> 50 years	1	0	Travel history to Ukraine
Total EU/EEA	127	78	49			50	77	
United Kingdom	173	173	0	24 September 2021 - 15 February 2024	<1 - 100 years (42)	85	88	Nine cases were hospitalised and one case has died. Two cases with travel histories to Nigeria and United Arab Emirates.
Total	300	251	49			135	165	

Information from patient interviews

In the UK, 18/26 (69.2%) cases reported consumption of ready-to-eat (RTE) chicken products within the week prior to the onset of symptoms. Most notably, the consumption of chicken products such as slices/pieces used in sandwiches and wraps was reported at a higher than expected rate compared to national dietary survey data. Ten of 26 cases (38.5%) indicated purchase of chicken products from local cafés and restaurants, including wraps, sandwiches/baguettes and kebabs. It is possible that the chicken products of interest were being distributed through the retail and the catering sector, however no clear food chain links have been identified in the UK to date. In addition, the majority of cases (17/26, 65.4%) indicated consumption of chicken bought fresh, including chicken breast, thighs, and whole chickens.

In Finland, 64 of 67 cases interviewed (95.5%) had eaten or possibly eaten various chicken products before becoming ill. Based on detailed patient interviews and purchase information available, 15 cases had consumed or purchased certain RTE of three brands. The products were sold in at least two of the largest grocery chains in Finland, whose grocery market shares are 36% and 46% respectively. One possible case, an asymptomatic staff member of a food company in Finland who tested positive for *S. Mbandaka* in September, handled raw material for salad products in transport carts at the company's plant, without it coming into contact with their hands. The case had regularly consumed RTE wraps, such as those reported by the 15 Finnish cases. Several cases had also eaten out in restaurants.

Microbiological and environmental investigations of food and control measures

On 29 July 2022, EFSA created a Rapid Alert System for Food and Feed (RASFF) notification (News **2022.4440**, 16 follow up, *fup* as of 15 February 2024) to inform the food safety authorities of a multi-country outbreak of *S. Mbandaka* ST413.

At the time of the publication of the ECDC/EFSA ROA related to this multi-country outbreak (30 November 2022), the food safety authority in Finland had linked six investigated RTE products (reported as consumed by the cases interviewed in Finland) to the Estonian Company A [1]. These six RTE products were:

- chicken wrap **Product A** Brand A batch unknown,
- chicken baguette **Product B** Brand A batch unknown,
- chicken wrap **Product C** Brand B batch unknown,
- chicken sandwich **Product D** Brand B batch unknown,
- chicken ciabatta **Product E** Brand C batch unknown, and
- smoked salmon sandwich **Product F** Brand C batch unknown.

The link to the Estonian Company A, that was based on case interviews and purchase data, was not supplemented by the identification of the batch numbers and/or expiry dates of the six investigated RTE products or by any microbiological evidence (2022.4440).

Following the publication of the ROA, Finland, Estonia, and the Netherlands shared the outcome of subsequent food investigations related to this multi-country outbreak in the RASFF Alert **2022.7654** (created by Finland on 30 December 2022; 11 *fup* as of 19 April 2023) and in RASFF Alert **2023.0365** (created by Estonia on 16 January 2023; 16 *fup* as of 4 March 2024).

The latest food investigations identified one positive RTE chicken product and two positive frozen chicken meat products:

- chicken Caesar ciabatta (chilled) **Product E Brand C of Batch C** produced by the Estonian Company A, sampled in Finland in 2022, and reported as *S. Mbandaka*-positive based on WGS analyses with the national pipeline (2022.7654);
- steam cooked chicken breast (frozen) **Meat A Batch A** produced by the Ukrainian Processing plant A, sampled at the Estonian Company A in 2022 (*fup4*, 2022.7654), and matching the representative outbreak strain in the centralised WGS analysis (one isolate);
- steam cooked chicken breast (frozen) **Meat B Batch B** produced by the Ukrainian Processing plant A, sampled in 2023 at the Estonian Wholesaler A (*fup4*, 2023) (one isolate) and at the Dutch Company C (*fup9*, 2023.0365) (two isolates), and matching the representative outbreak strain in the centralised WGS analysis.

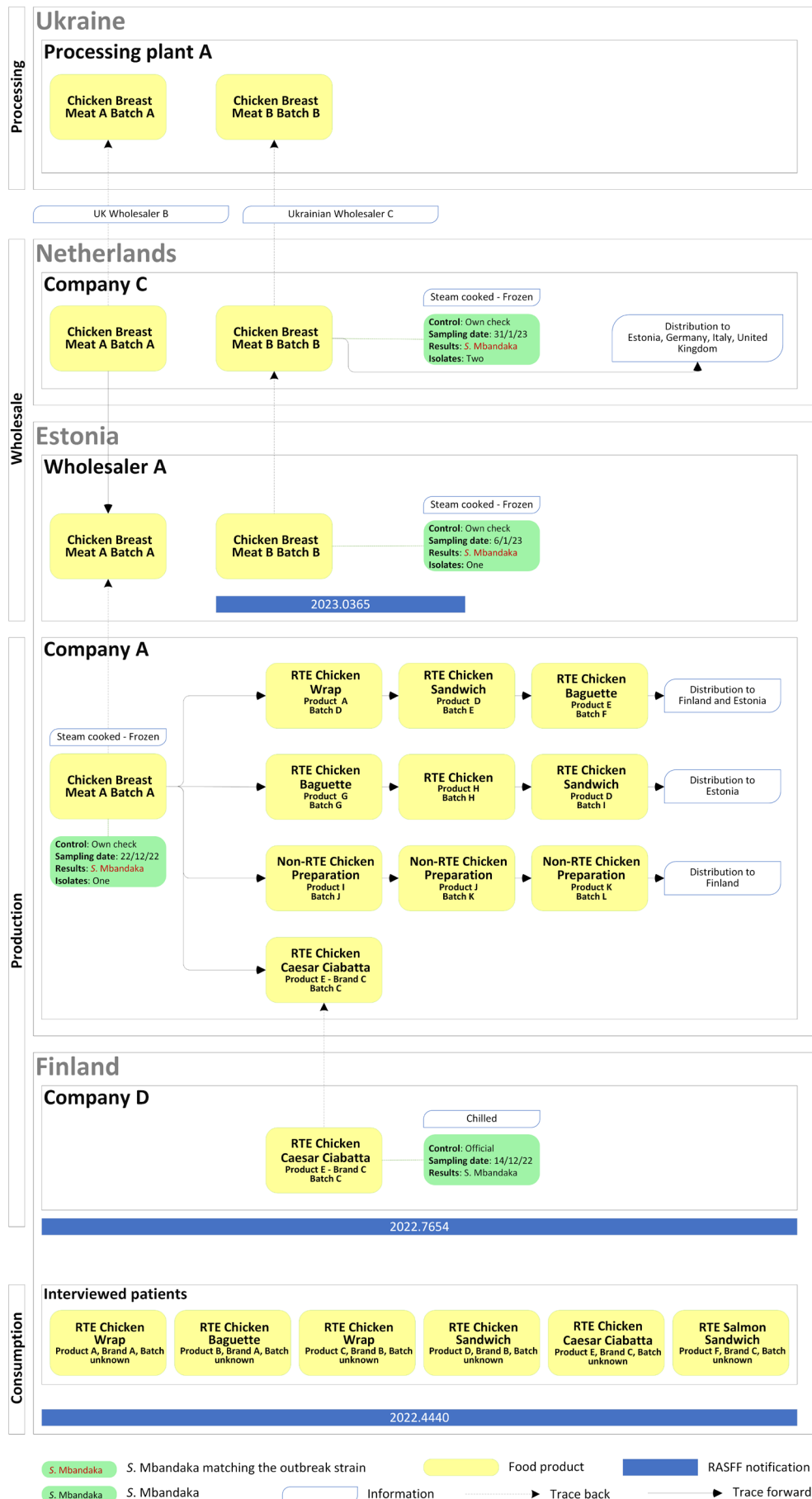
The food safety authority in Estonia reported that the Estonian Company A had not used chicken meat originating from Ukraine since December 2022, as communicated on 18 December 2023 (*fup15*, 2022.4440).

In January and April 2023, the European Commission, on behalf of Ukraine, communicated in RASFF that corrective measures were reported to have been implemented at the Ukrainian Processing plant A (e.g. microbiological testing of each batch intended to be exported to Europe, increased *Salmonella* testing of raw materials coming from the slaughterhouse, revision of the food safety and hygiene procedures).

Further food investigations and control measures, including inspections, trace forwards, withdrawals, and destructions, were reported by the food safety authorities of the countries involved: Italy (*fup6-7-8*, 2023.0365), the Netherlands (*fup9-10-11*, 2023.0365), Ireland (*fup12*, 2023.0365), and the United Kingdom (in respect of Northern Ireland) (*fup3*, 2023.0365).

A visual representation of their traceability is displayed in Figure 1. A detailed description of their traceability is provided in Annex 1.

Figure 1. Graphical representation of the traceability and microbiological analyses of the *S. Mbandaka* outbreak strain-positive steam-cooked chicken breast fillet products and *S. Mbandaka*-positive RTE chicken product, as reported by countries involved under RASFF notifications 2022.4440, 2022.7654 and 2023.0365



European whole genome sequencing analysis of human and non-human isolates

WGS data collection and cross-sectoral analysis

On 16 February 2024, EFSA launched a call for data, inviting Member States to submit to the EFSA One Health WGS System genomic information regarding food isolates of *S. Mbandaka* ST413 collected between January 2022 and February 2024, focusing on those isolates collected from chicken meat and chicken products. By 23 February 2024, a total of 58 profiles of *S. Mbandaka* non-human isolates had been shared in the EFSA One Health WGS system by 12 EU/EEA countries (Austria: n=1; Belgium: n=8; Estonia: n=2, Finland: n=3; France: n=11; Germany: n=19; Ireland: n=1; Luxembourg: n=1; Netherlands: n=5; Norway: n=4; Spain: n=1 and Sweden: n=2). Of the 58 profiles, 14 isolates derived from chicken meat, chicken products, and related environments sampled between 2022 and 2024. In addition, 236 profiles of *S. Mbandaka* ST413 non-human isolates were generated from sequences retrieved from the European Nucleotide Archive (ENA).

The representative human sequences from countries were analysed by ECDC using BioNumerics version 7.6.3 (Applied-Maths, Sint-Martens-Latem, Belgium), which included raw sequence trimming using the default settings; de novo assembly including mismatch correction using SPAdes v.3.7.1. Allele calling was performed on assemblies using Enterobase core genome scheme and isolates were excluded from further analysis if less than 2 702 (90%) of the 3 002 core loci were detected.

For cross-sectoral analysis, the cgMLST analysis was performed at both ECDC and EFSA, as previously described [5]. Briefly, genome profiles were calculated from assembled genomes using chewBBACA version 2.8.5 (<https://github.com/B-UMMI/chewBBACA>) using the schema described by Rossi et al. 2018 [6] for *Salmonella enterica*, made available by chewie [Nomenclature Server](#) [7]. Isolates with more than 10% of missing loci (325 from a total of 3 255 loci) were excluded from the analysis.

Results of cross-sectoral WGS analysis

ECDC queried EFSA One Health WGS System on 13 March 2024 using the entire cluster of 100 *S. Mbandaka* as reference genomes and 10 ADs as threshold. As a result of the query, four submitted profiles of *S. Mbandaka* ST413 non-human isolates clustered within five ADs in a single-linkage cluster analysis with the human isolates, giving a total of 104 *S. Mbandaka* ST413 in the joint isolate dataset. The four non-human isolates originated from frozen steam-cooked chicken breast fillets Meat A Batch A (one sequence) and Meat B Batch B (three sequences). Countries sharing non-human data matching the outbreak strains (Estonia and the Netherlands) and included in the centralised analysis were consulted on 28 February 2024 for genomic data validation.

Both the minimum spanning tree (MST) and the single-linkage cluster tree show the genetic closeness of human and chicken meat isolates, supporting the hypothesis of RTE chicken meat products as vehicles of infection (Figures 2 and 3). The temporal distribution of *S. Mbandaka* ST413 isolates in the cluster illustrates the highest level of exposure and risk for infections in 2022, but with continued circulation of the strain in 2023 (Figure 4).

Figure 2. Minimum spanning tree of *S. Mbandaka* ST413 sequences from 100 human and four chicken meat isolates, 2021–2023, as of 13 March 2024

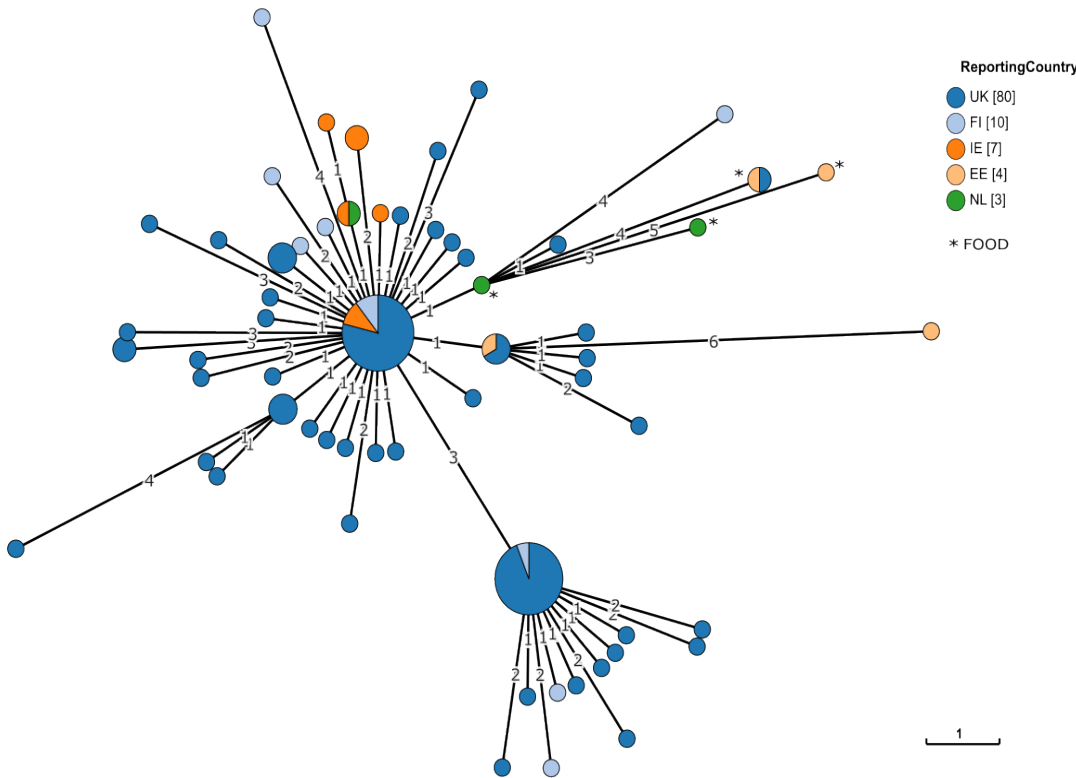
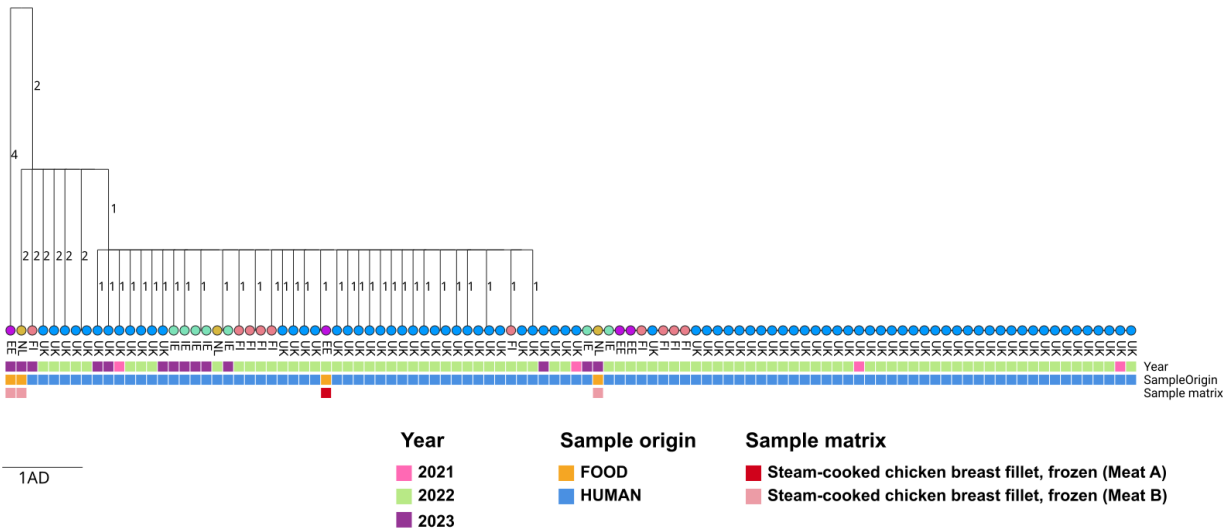
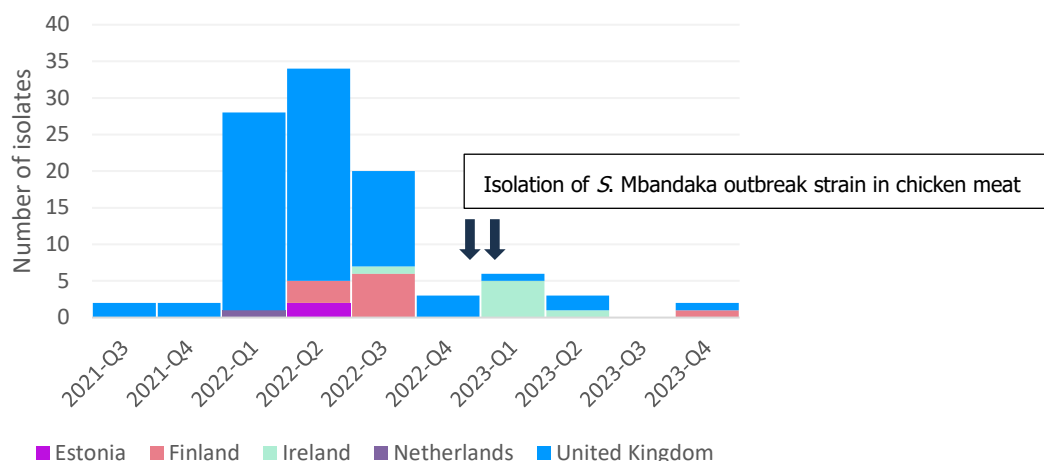


Figure 3. Single linkage cluster tree of 100 human and four *S. Mbandaka* ST413 outbreak isolates as of 15 March 2024



Source: [ROA *S. Mbandaka* chicken update 2024 \(microreact.org\)](#)

Figure 4. Temporal distribution of 100 human isolates of *S. Mbandaka* ST413 outbreak strain from 251 confirmed cases by quarter and year, September 2021 – December 2023, as of 15 March 2024



ECDC and EFSA risk assessment for the EU/EEA

A cross-border outbreak of *S. Mbandaka* ST413 has been ongoing in the EU/EEA and the UK for over two years since September 2021. By 30 November 2022, 196 cases had been recorded and published in a joint ECDC and EFSA Rapid Outbreak Assessment [1]. By 15 March 2024, 300 cases (an increase of 104 cases) had been reported (251 confirmed and 49 possible) according to the European case definition in six EU/EEA countries (Estonia, Finland, France, Germany, Ireland and the Netherlands) and the UK. This represents an increase of 104 cases since 30 November 2022 [1]. The most recent case was reported in the UK in February 2024, which indicates that the strain was still circulating in the chicken meat production chain recently. Twenty-three cases were hospitalised, six cases in Finland had septicaemia, and one case died in the UK, indicating that this salmonellosis outbreak is of moderate severity. Cases have occurred across all age groups and there is an overall predominance of females among cases in the EU/EEA (chi-square, $p < 0.05$).

Case interviews in Finland and the UK showed that consumption of various types of RTE chicken products was commonly reported among cases. The products mentioned were chicken wrap, chicken tortilla, chicken salad, prepacked chicken products including chicken breast/drumsticks, chicken sandwiches, and chicken pasta. Many cases had consumed these products at cafés and restaurants but some cases in the UK also reported consumption of chicken bought fresh (chicken breast, thighs, and whole chickens), suggesting that various contaminated chicken products and meat may have been distributed through retail and catering. Chicken meat appeared to be a common ingredient of the RTE products reported by cases in Finland and the UK.

Following the publication of the ROA on 30 November 2022, new microbiological and traceability evidence demonstrated the involvement of the Estonian Company A – i.e. the detection of *S. Mbandaka* ST413 at production level (Finnish Company D) in one RTE chicken product (chicken Caesar ciabatta Product E Batch C, produced by the Estonian Company A) and the detection of the outbreak strain at production level (Estonian Company A) in one of its ingredients (frozen steam-cooked chicken breast Meat A Batch A). Based on the available traceability information, the Estonian Company A cannot be linked to all countries reporting human cases. Other food business operators, including the importers, could have played a role in the distribution of the contaminated products.

Further investigations at wholesale level in Estonia and the Netherlands identified a second batch of frozen steam-cooked chicken breast (Meat B Batch B) positive for the outbreak strain. The chicken meat was produced by the Ukrainian Processing Plant A, the same company that had produced the Meat A Batch A. This suggests that the Ukrainian Processing Plant A was the origin of the contaminated chicken meat. The contaminated meat entered the market in the EU/EEA via non-EU operators.

Among the control measures implemented by the countries involved, the Estonian Company A reported that it had interrupted its commercial relationship with the Ukrainian Processing plant A since December 2022. In addition, mitigation and control measures were also reported for the Ukrainian Processing plant A.

Based on available information from case interviews, microbiological analyses (human and food), and traceability analysis, the conclusion is that RTE products containing contaminated chicken meat were the vehicles of infection, with freshly sold chicken as another possible vehicle. The genomic profile of this outbreak strain is different to other *S. Mbandaka* strains reported to the EFSA WGS System by several Member States and different to described strains circulating for many years in poultry, feeds and foods, according to a study in Poland [8].

The shelf lives of contaminated chicken meat products expired in November and December 2023. The most recent cases with the outbreak strain were detected in Finland in October 2023 and in the UK in February 2024. Assuming that the contaminated batches identified are no longer on the market, and given the expiration dates and the control measures implemented, the likelihood of new infections occurring with the outbreak strain from these batches is low. However, despite the implementation of control measures, cases continued to occur throughout 2023 in the EU/EEA and in early 2024 in the UK, suggesting undetected routes of exposure, which require further investigation and pose a continued, albeit reduced, risk for new infections.

Recommendations

ECDC encourages Member States to sequence *S. Mbandaka* isolates from human cases and interview cases with *S. Mbandaka* ST413 infection, focusing on the consumption of various chicken/poultry meat and related products. Further investigations are recommended in cooperation with food safety authorities. Should new cases be detected linked to this outbreak, ECDC encourages countries to update their country's case information in EpiPulse event [2022-FWD-00033](#) or [2022-FWD-00042](#).

EFSA encourages Member States to perform sequencing of *S. Mbandaka* ST 413 food isolates linked to the present cluster either microbiologically (serotype or ST) or epidemiologically (e.g. reported consumption of RTE chicken products by human cases) and to submit genomic and epidemiological data of *S. Mbandaka* ST 413 isolates from any kind of food, feed, animal or related environment to the EFSA One Health WGS System and the corresponding traceability data to the iRASFF platform.

Source and date of request

ECDC sent a request to EFSA on 14 February 2024 to produce an update of the Joint Rapid Outbreak Assessment (ROA). EFSA accepted the request on 15 February 2024.

Consulted experts and national contact points

ECDC experts (in alphabetical order): Áine Collins, Cecilia Jernberg, Johanna Takkinen.

Public health experts consulted for data and facts validation:

Estonia: Jelena Rjabina (Health Board);

Finland: Ruska Rimhanen-Finne, Saara Salmenlinna, and Anni Vainio (Finnish Institute for Health and Welfare);

France: Maria Pardos de la Gandara (Institut Pasteur, Centre National de Référence des *E. coli*, *Shigella* et *Salmonella*) and Nathalie Jourdan-Da Silva (Santé publique France);

Germany: Michael Pietsch and Sandra Simon (National Reference Centre for *Salmonella* and other bacterial enteric pathogens, Robert Koch Institute);

Ireland: Niall De Lappe (National *Salmonella*, *Shigella* and *Listeria* Reference Laboratory, University Hospital Galway); Aoife Colgan and Patricia Garvey (Health Protection Surveillance Centre);

The Netherlands: Roan Pijnacker (National Institute for Public Health and the Environment);

The United Kingdom: Amy Douglas, Lesley Larkin, Thomas Thackray, Anaïs Painset (United Kingdom Health Security Agency), Lynda Browning (Public Health Scotland), Derek Brown (Scottish Microbiology Reference Laboratories).

EFSA staff (in alphabetical order): Sofia Fusco, Valentina Rizzi, Mirko Rossi, Eleonora Sarno, Frank Verdonck.

RASFF contact points: Estonia, Finland, France, Germany, Ireland, Italy, the Netherlands

National experts consulted by the RASFF contact points:

Estonia: Jelena Sögel, Kairi Sisask, Elle Männisalu, Food Department, Agriculture and Food Board

Finland: Elina Leinonen and Annika Pihlajasaari, Finnish Food Authority

Ireland: Karen McCullagh, The Food Safety Authority of Ireland.

National experts consulted by the Country Officer of the EFSA One Health WGS system:

(List of consulted countries: Estonia, Finland, The Netherlands)

Estonia: Brita Smitt (Food Department, Agriculture and Food Board)

The Netherlands: Ife Slegers – Fitz-James (Netherlands Food and Consumer Product Safety Authority (NVWA)).

Disclaimer

ECDC issued this outbreak assessment document in accordance with Article 10 of Decision No 1082/13/EC and Article 7(1) of Regulation (EC) No 853/2004 establishing a European Centre for Disease Prevention and Control (ECDC), and with the contribution of EFSA in accordance with Article 31 of Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002, laying down the general principles and requirements of food law, establishing the European Food Safety Authority (EFSA) and laying down procedures in matters of food safety.

In the framework of ECDC's mandate, the specific purpose of an ECDC-EFSA outbreak assessment is to present different options on a certain matter. The responsibility on the choice of which option to pursue and which actions to take, including the adoption of mandatory rules or guidelines, lies exclusively with EU/EEA Member States. In its activities, ECDC strives to ensure its independence, high scientific quality, transparency and efficiency.

This report was written under the coordination of an internal response team at ECDC, with contributions from EFSA, at the behest of the European Commission based on a mandate requesting scientific assistance from EFSA in the investigation of multinational food-borne outbreaks (Ares (2013) 2576387, Mandate M-2013-0119, 7 July 2013).

All data published in this rapid outbreak assessment are correct to the best of ECDC's and EFSA's knowledge. Maps and figures published do not represent a statement on the part of ECDC, EFSA or its partners on the legal or border status of the countries and territories shown.

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Annex 1. Description of the traceability, food investigations, and control measures by country

Finland

- According to the WGS analyses performed at national level, one *S. Mbandaka* food isolate was identified in a chilled RTE chicken Caesar ciabatta (**Product E Brand C of Batch C**) sampled in Finland in 2022.

In December 2022, the food safety authority in Finland reported that *S. Mbandaka* was detected from an official sample of a chilled RTE chicken Caesar ciabatta (Product E Brand C of Batch C) collected on 14 December 2022 at the Finnish Company D. The national clustering analysis (cgMLST-based MST, Ridom SeqSphere+, 1295 target alleles) revealed that there were six allelic differences between this RTE chicken Caesar ciabatta and the 46 human isolates from Finland with which it was compared (*fup10*, 2022.7654).

Product E Brand C of Batch C was produced by the Estonian Company A for the Finnish Company D (*fup2*, *fup4*, 2022.7654) (Figure 1). Product E Brand C (belonging to a different batch to Batch C), is one of the six RTE products reported as consumed by the cases interviewed in Finland and described in the Rapid Outbreak Assessment published in 2022 [1].

Estonia

- According to the centralised WGS analysis, two *S. Mbandaka* food isolates matching the representative outbreak strains were identified in two frozen chicken meat products (**Meat A Batch A** and **Meat B Batch B**) sampled in Estonia in 2022 and 2023, respectively.

Having been informed of the detection of *S. Mbandaka* from the chicken Caesar ciabatta (Product E Brand C from Batch C) by the Finnish Company D, the Estonian Company A tested all the ingredients used for its preparation.

S. Mbandaka matching the representative outbreak strain was detected from an own check sample of the frozen chicken meat ingredient (Meat A Batch A, steam cooked chicken breast fillet) on 22 December 2022. The frozen chicken meat was produced by the Ukrainian Processing plant A (*fup4*, 2022.7654).

The food investigation revealed that the Estonian Company A purchased this frozen chicken meat ingredient (between 2 November 2022 and 19 December 2022) from the Estonian Wholesaler A, which had bought it from the Dutch Company C in October 2022. The Dutch Company C had received the meat from the UK Wholesaler B (*fup4*, 2022.7654) (Figure 1).

The food safety authority also reported that Meat A Batch A had been used for the preparation of other six RTE chicken products already expired in 2022 (Product A Batch D, Product D Batch E, Product E Batch F, Product G Batch G, Product H Batch H, and Product D Batch I). The Estonian Company A had distributed Product A Batch D, Product D Batch E, Product E Batch F to Finland and within Estonia, and Product G Batch G, Product H Batch H, Product D Batch I only within Estonia (*fup4*, 2022.7654) (Figure 1).

Product A Batch D, Product D Batch E, Product D Batch I, Product E Batch F have the same composition as some of the previously investigated RTE products, reported as consumed by the cases interviewed in Finland (i.e. Product A Brand A batch unknown; chicken sandwich Product D Brand B batch unknown, chicken ciabatta Product E Brand C batch unknown) but with slightly different weight.

In addition, Meat A Batch A was used in three frozen chicken meat preparations intended to be cooked (Product I Batch J, Product J Batch K, Product K Batch L) with expiry dates in 2023 (Figure 1). The Estonian Company A informed its recipient in Finland (Finnish Company E) of the presence of *Salmonella* and initiated the withdrawals (*fup4*, 2022.7654) of the products from these three batches and from other batches (latest expiry dates in June 2023) (*fup7*, 2022.7654).

On 16 January 2023 the food safety authority in Estonia created a new RASFF notification (2023.0365) to report that a second sample of frozen chicken meat (Meat B Batch B, steam cooked chicken breast) tested positive for *S. Mbandaka* matching the representative outbreak strain (*fup4*, 2023.0365). Meat B Batch B was sampled on 6 January 2023 at wholesale level (the Estonian Wholesaler A) from an own check. It was wholesaled from the Dutch Company C and was produced by the Ukrainian Processing plant A (2023.0365) (Figure 1).

Following the occurrence in the 2023 Finnish case reporting consumption of a chicken Caesar baguette from Brand A (*fup14*, 2022.4440), on 18 December 2023 the food safety authority in Estonia reported that the Estonian Company A had not used chicken meat originating from Ukraine since December 2022 (*fup15*, 2022.4440). In addition, samples (such as raw materials, food and environmental samples) taken at the company (dates of sampling not available in RASFF) tested *Salmonella* negative (*fup15*, 2022.4440).

Ukraine

In January and April 2023, the European Commission reported in RASFF on behalf of Ukraine that the Ukrainian Processing plant A had distributed Meat A Batch A (*fup11*, 2022.7654) and Meat B Batch B (*fup13*, 2023.0365) only

to the Netherlands (the Dutch Company C) (Figure 1). In addition, corrective measures were reported as having been implemented at the Ukrainian Processing plant A (e.g. microbiological testing of each batch intended to be exported to Europe, increased *Salmonella* testing of raw materials coming from the slaughterhouse, revision of the food safety and hygiene procedures).

The Netherlands

- According to the centralised WGS analysis, two *S. Mbandaka* food isolates matching the representative outbreak strains were identified in one frozen steam cooked chicken breast fillet, (**Meat B Batch B**) sampled in the Netherlands in 2023 (product unopened and withdrawn).

In January 2023, the food safety authority in the Netherlands reported that the Dutch Company C had delivered to the Estonian Wholesaler A Meat A Batch A in October 2022 (*fup6*, 2022.7654), and Meat B Batch B in September 2022 (*fup1*, 2023.0365).

The Dutch Company C bought Meat A Batch A and Meat B Batch B from the Ukrainian Processing plant A via the UK Wholesaler B (*fup4*, 2022.7654) and via the Ukrainian Wholesaler C (*fup1*, *fup10*, 2023.0365), respectively.

In 2022, the Dutch Company C distributed Meat B Batch B to recipients in Estonia (Wholesaler A), Germany (manufacturer of feedstuffs for animals), Italy, and UK, (*fup1*, *fup2*, 2023.0365) (Figure 1).

On 31 January 2023, the Dutch Company C tested two batches (steam cooked chicken breast fillet, frozen) obtained from recipients (*fup9*, 2023.0365) and then destroyed them (*fup15*, 2023.0365). One of the two batches was the Meat B Batch B, (unopened) that tested positive for *S. Mbandaka* matching the representative outbreak strains (*fup15*, 2023.0365).

In February 2023, the food safety authority reported that the Dutch Company C had increased the frequency of *Salmonella* testing (*fup9*, 2023.0365).

Further food investigations and control measures, including inspections, trace forwards, withdrawals, and destructions, were reported by the food safety authority in Italy (*fup6-7-8*, 2023.0365), the Netherlands (*fup9-10-11*, 2023.0365), Ireland (*fup12*, 2023.0365), and the UK (in respect of Northern Ireland) (*fup3*, 2023.0365).

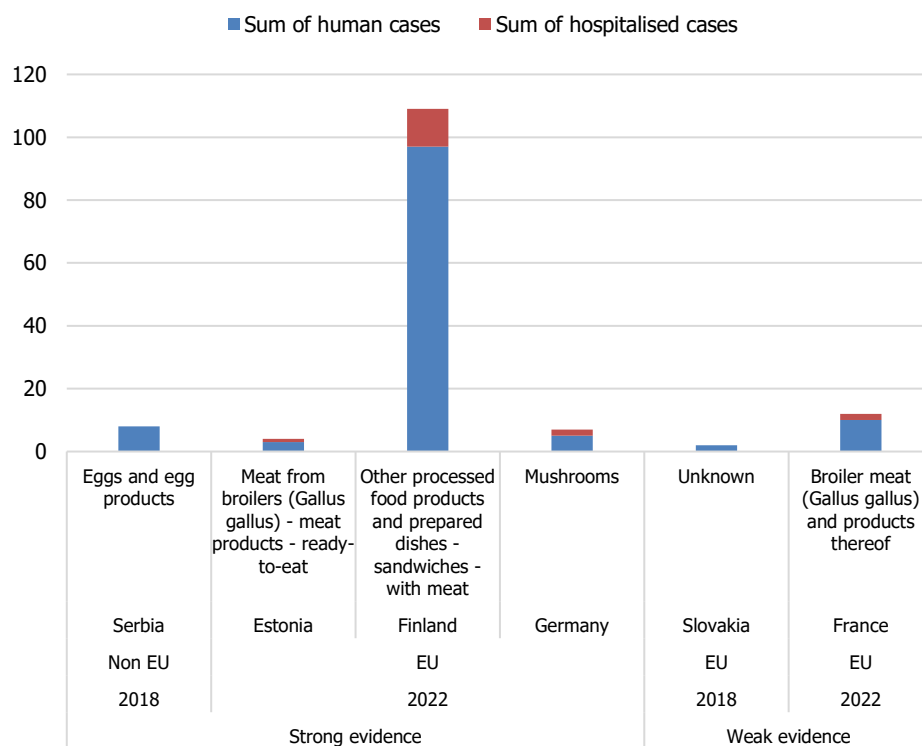
Annex 2. Background information of *S. Mbandaka* in food

Food-borne outbreaks caused by *S. Mbandaka*

This section summarises country-specific data on food-borne outbreaks associated with *S. Mbandaka*, as reported between 2018 and 2022 to EFSA by the EU and non-EU Member States in accordance with the Zoonoses Directive 2003/99/EC. Over the five years in question, six foodborne outbreaks were caused by *S. Mbandaka*, with 125 human cases overall, 17 hospitalisations, and no deaths reported.

Four strong-evidence foodborne outbreaks were reported by three EU Member States: Estonia (n=1), Finland (n=1), and Germany (n=1) in 2022; and one strong-evidence foodborne outbreak was reported by a non-EU Member State: Serbia in 2018. As a result of these four outbreaks, a total of 113 human cases and 15 hospitalisations were reported, the majority by Finland (97 human cases and 12 hospitalisations). The reported food vehicles included 'Meat and meat products', 'Composite foods, multi-ingredients foods and other foods', 'Foods of non-animal origin', and 'Eggs and egg products'. Two weak-evidence foodborne outbreaks were reported by Slovakia in 2018 and France in 2022. A total of 12 human cases and two hospitalisations were reported. The reported food vehicle was 'Meat and meat products', and 'Unknown' (Figure 5).

Figure 5. Distribution of six foodborne outbreaks caused by *S. Mbandaka* reported by EU Member States and non-EU Member States between 2018 and 2022



Occurrence of *S. Mbandaka* in food

This section summarises country-specific data on the occurrence of *S. Mbandaka* for the matrices 'Food RTE' and 'Food non-RTE', as reported to EFSA between 2018 and 2022 by the EU and non-EU Member States in accordance with the Zoonoses Directive 2003/99/EC.

For the food category poultry products, 21 EU and four non-EU Member States reported an amount of 1 096 881 total units tested for the matrix 'Food RTE' (n= 46 882) and for the matrix 'Food non-RTE' (n=1 049 999). Overall, 130 (0.27%) and 29 793 (2.83%) total units positive were reported for *Salmonella enterica*, respectively.

Over the five years in question, one EU Member State (Bulgaria) reported one unit positive for *S. Mbandaka* in 'Food RTE' for the category poultry products, out of 45 441 total units tested for *Salmonella enterica* in the same category. For the matrix 'Food non-RTE', 11 EU Member States (Austria, Belgium, Croatia, Czechia, France, Germany, Italy, Latvia, Netherlands, Poland, and Spain) reported 77 units positive for *S. Mbandaka* out of 1 024 663 total units tested for *Salmonella enterica*. The UK reported one unit positive for *S. Mbandaka* in poultry products out of 25 336 total units tested for *Salmonella enterica* for the same category.