UK Health Security Agency

An update on recent UKHSA FW&E studies

UKHSA annual programme of food and environmental studies

- National studies
  - All Local Authorities requested to participate
  - Pre-planned topics of interest and reactive studies
  - Questionnaires used to gather details relating to samples
  - Aim to publish results wherever possible

- Consultation on short-list of suggestions – circulated to stakeholders in November / December each year
- Top two options selected, plus a reactive study dependent on current issues

- Regional studies may be organised by each lab based on local concerns – may be useful for local understanding or as pilot studies for future national focus

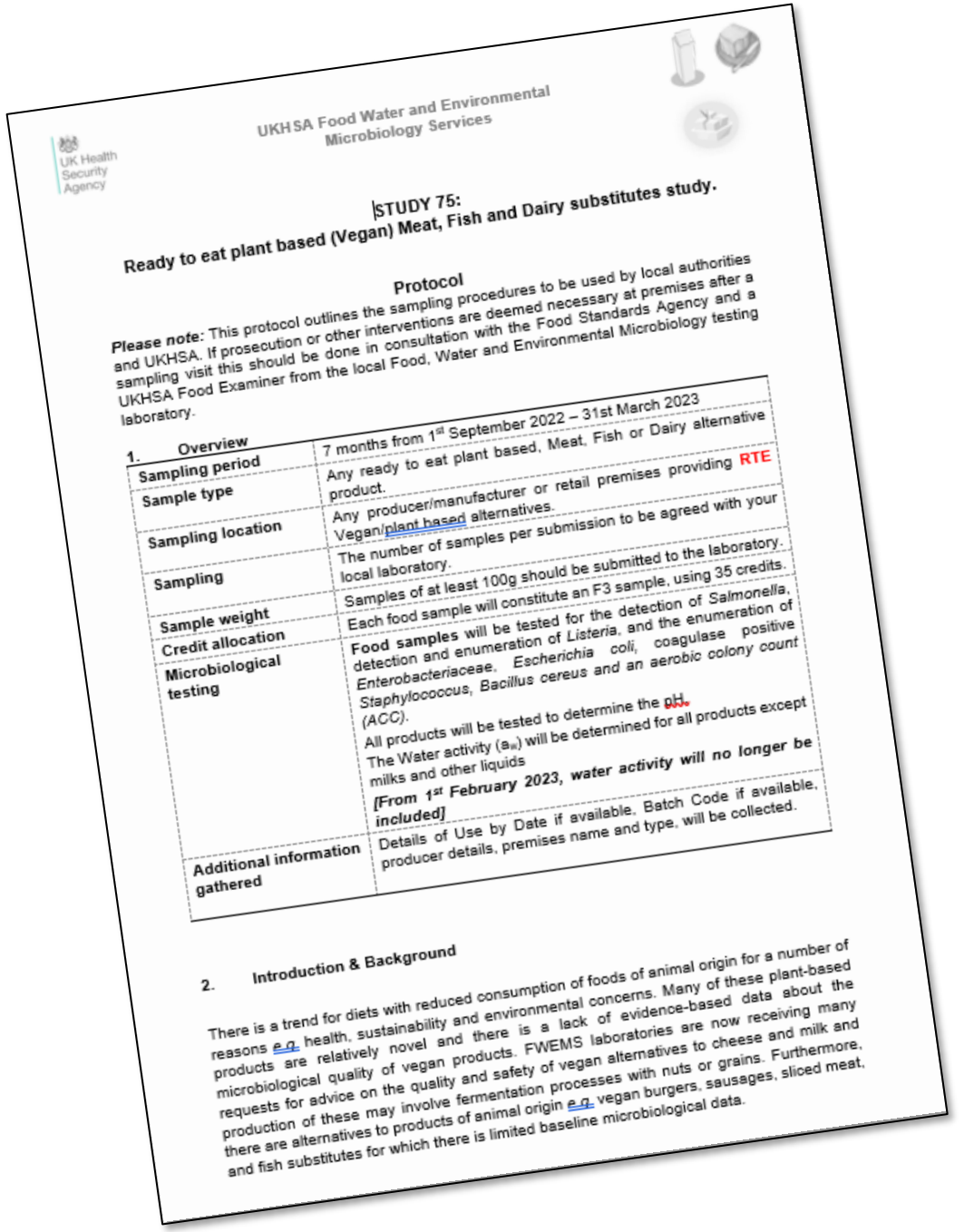
Annual survey timetable

Year	2024-2025											
Months of sampling	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	J	F	M
Study 80- Cheese												
Study 81- Tattoo/piercing												
Study 82– Reactive study- Eggs												

Protocol shared

- Specifies time period, types of premises
- Sample types included and excluded
- Tests to be performed
- Interpretation of results

- Does not prescribe numbers of samples of each type (i.e. not based on market share etc)
- We accept that our surveys will tend to focus more on higher risk products



UK Health Security Agency

UKHSA Food Water and Environmental Microbiology Services

STUDY 75:
Ready to eat plant based (Vegan) Meat, Fish and Dairy substitutes study.

Protocol

Please note: This protocol outlines the sampling procedures to be used by local authorities and UKHSA. If prosecution or other interventions are deemed necessary at premises after a sampling visit this should be done in consultation with the Food Standards Agency and a UKHSA Food Examiner from the local Food, Water and Environmental Microbiology testing laboratory.

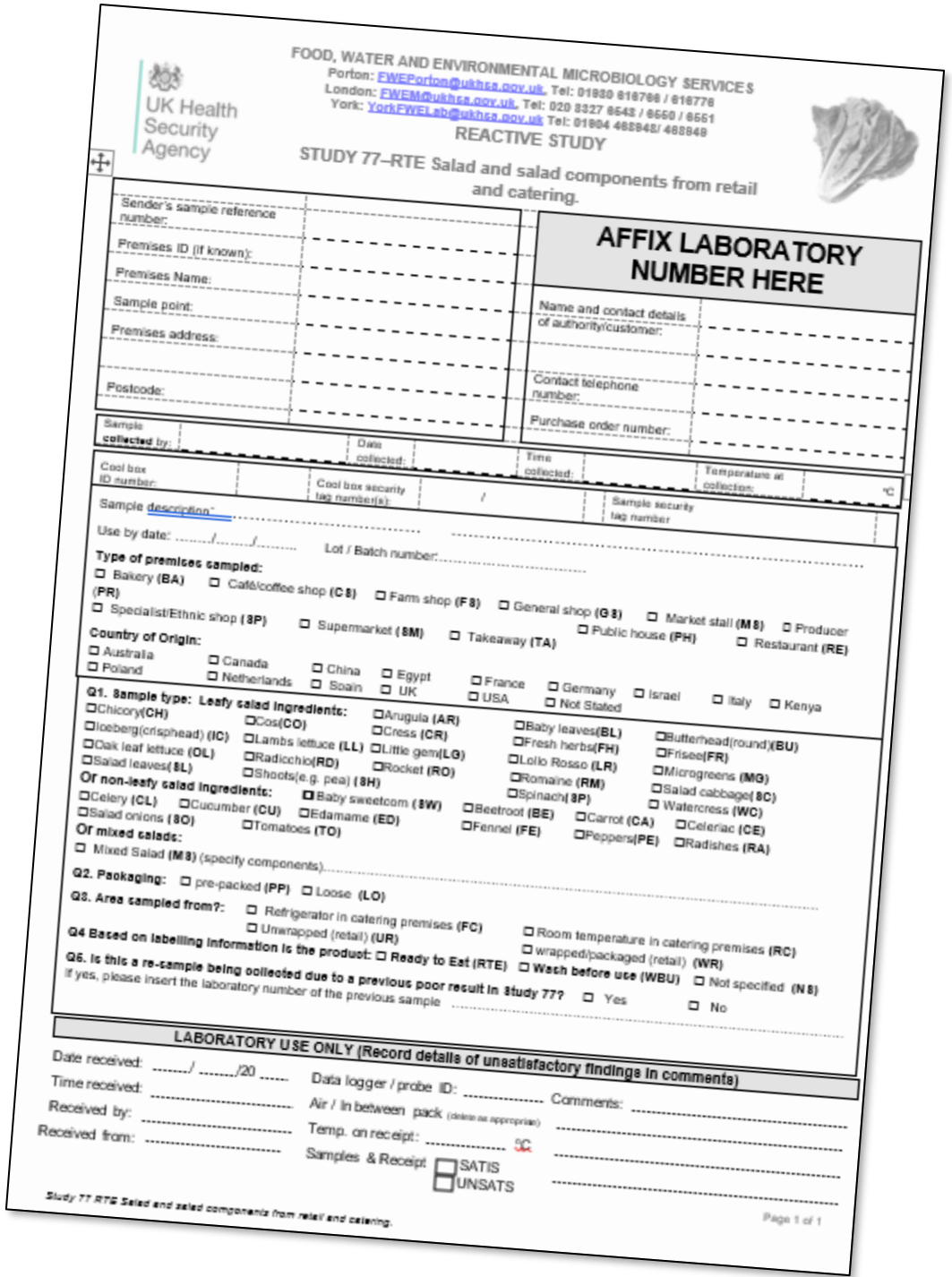
1. Overview	
Sampling period	7 months from 1st September 2022 – 31st March 2023
Sample type	Any ready to eat plant based, Meat, Fish or Dairy alternative product.
Sampling location	Any producer/manufacturer or retail premises providing RTE Vegan/plant based alternatives.
Sampling	The number of samples per submission to be agreed with your local laboratory.
Sample weight	Samples of at least 100g should be submitted to the laboratory.
Credit allocation	Each food sample will constitute an F3 sample, using 35 credits.
Microbiological testing	**Food samples** will be tested for the detection of *Salmonella*, detection and enumeration of *Listeria*, and the enumeration of *Enterobacteriaceae*, *Escherichia coli*, coagulase positive *Staphylococcus*, *Bacillus cereus* and an aerobic colony count (ACC). All products will be tested to determine the ~~ph.~~ The Water activity (a_w) will be determined for all products except milks and other liquids ***[From 1st February 2023, water activity will no longer be included]***
Additional information gathered	Details of Use by Date if available, Batch Code if available, producer details, premises name and type, will be collected.

2. Introduction & Background

There is a trend for diets with reduced consumption of foods of animal origin for a number of reasons e.g. health, sustainability and environmental concerns. Many of these plant-based products are relatively novel and there is a lack of evidence-based data about the microbiological quality of vegan products. FWEMS laboratories are now receiving many requests for advice on the quality and safety of vegan alternatives to cheese and milk and production of these may involve fermentation processes with nuts or grains. Furthermore, there are alternatives to products of animal origin e.g. vegan burgers, sausages, sliced meat, and fish substitutes for which there is limited baseline microbiological data.

Questionnaire

- Standard information on premises, sample description, use by date etc
- Up to 10 additional questions, dependent on study aims
  - FHRS score
  - Cooking instructions
  - Storage instructions
  - Packed or open / loose
  - Country of origin
  - Cleaning procedures



FOOD, WATER AND ENVIRONMENTAL MICROBIOLOGY SERVICES

UK Health Security Agency

REACTIVE STUDY

STUDY 77–RTE Salad and salad components from retail and catering.

AFFIX LABORATORY NUMBER HERE

Sender's sample reference number:
Premises ID (if known):
Premises Name:
Sample point:
Premises address:
Postcode:
Name and contact details of authority/customer:
Contact telephone number:
Purchase order number:
Sample collected by:
Date collected:
Time collected:
Temperature at collection: °C
Cool box ID number:
Cool box security tag number(s):
Sample security tag number
Sample description:
Use by date: ...../...../.....
Lot / Batch number:

Type of premises sampled:
☐ Bakery (BA) ☐ Café/coffee shop (CS) ☐ Farm shop (FS) ☐ General shop (GS) ☐ Market stall (MS) ☐ Producer (PR)
☐ Specialist/Ethnic shop (SP) ☐ Supermarket (SM) ☐ Takeaway (TA) ☐ Public house (PH) ☐ Restaurant (RE)

Country of Origin:
☐ Australia ☐ Canada ☐ China ☐ Egypt ☐ France ☐ Germany ☐ Israel ☐ Italy ☐ Kenya
☐ Poland ☐ Netherlands ☐ Spain ☐ UK ☐ USA ☐ Not Stated

Q1. Sample type: Leafy salad ingredients:
☐ Chicory (CH) ☐ Cos (CO) ☐ Arugula (AR) ☐ Baby leaves (BL) ☐ Butterhead (round) (BU)
☐ Iceberg (crisphead) (IC) ☐ Lambs lettuce (LL) ☐ Cress (CR) ☐ Fresh herbs (FH) ☐ Frisee (FR)
☐ Oak leaf lettuce (OL) ☐ Radicchio (RD) ☐ Little gem (LG) ☐ Lollo Rosso (LR) ☐ Microgreens (MG)
☐ Salad leaves (SL) ☐ Shoots (e.g. pea) (SH) ☐ Rocket (RO) ☐ Romaine (RM) ☐ Salad cabbage (SC)
Or non-leafy salad ingredients: ☐ Baby sweetcorn (SW) ☐ Spinach (SP) ☐ Watercress (WC)
☐ Celery (CL) ☐ Cucumber (CU) ☐ Edamame (ED) ☐ Beetroot (BE) ☐ Carrot (CA) ☐ Celeriac (CE)
☐ Salad onions (SO) ☐ Tomatoes (TO) ☐ Fennel (FE) ☐ Peppers (PE) ☐ Radishes (RA)
Or mixed salads:
☐ Mixed Salad (MS) (specify components)

Q2. Packaging: ☐ pre-packed (PP) ☐ Loose (LO)
Q3. Area sampled from?: ☐ Refrigerator in catering premises (FC) ☐ Room temperature in catering premises (RC)
☐ Unwrapped (retail) (UR) ☐ wrapped/packaged (retail) (WR)
Q4 Based on labelling information is the product: ☐ Ready to Eat (RTE) ☐ Wash before use (WBU) ☐ Not specified (NS)
Q5. Is this a re-sample being collected due to a previous poor result in Study 77? ☐ Yes ☐ No
If yes, please insert the laboratory number of the previous sample

LABORATORY USE ONLY (Record details of unsatisfactory findings in comments)

Date received: ...../...../20.....
Time received:
Received by:
Received from:
Data logger / probe ID:
Air / In between pack (delete as appropriate)
Temp. on receipt: °C
Samples & Receipt ☐ SATIS ☐ UNSATS
Comments:

Study 77 RTE Salad and salad components from retail and catering.
Page 1 of 1

Journal of Food Protection, Vol. 85, No. 12, 2022, Pages 1680–1689
https://doi.org/10.4315/JFP-22-116
Published 2022 by the International Association for Food Protection

Research Paper

Microbiological Quality of Ready-to-Eat Salad Products Collected from Retail and Catering Settings in England during 2020 to 2021

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MS 22-116: Received 12 April 2022/Accepted 25 June 2022/Published Online 30 June 2022

ABSTRACT

Salad and other fresh produce were collected in England from retail and catering businesses during 2020 tested for *Salmonella*, Shiga toxin–producing *Escherichia coli* (STEC), *Listeria*, *Bacillus cereus*, and *E. coli*. C collected, 57% were from retail settings and 43% were from catering settings; 61% were either salad leave mixed with other products. Equal numbers of samples were prepacked or loose, and 50% were refrigerat sampling. Combining results for all microbiological parameters, 84% were interpreted as satisfactory, 12% w borderline, and 4% were interpreted as unsatisfactory. One sample (prepacked leaves, cucumber, and tomato fr categorized as unacceptable and potentially injurious because of detection of STEC O76; no STEC from huma United Kingdom matched this isolate. No *Salmonella enterica* was detected, but *Listeria monocytogenes* was r samples: 1 at 20 CFU/g and the remainder at <20 CFU/g. *B. cereus* was detected at borderline levels (10^3 to ≤ of samples and at an unsatisfactory level (>10^5 CFU/g) in one sample. *E. coli* was detected in 3% of samples a (20 to ≤10^2 CFU/g) and in 4% at unsatisfactory levels (>10^2 CFU/g). There was a significant association bet *L. monocytogenes* and borderline or unsatisfactory levels of *E. coli*. There were no specific risk profiles associa with the higher levels of *B. cereus*, STEC, or *Listeria*, but elevated levels of *E. coli* were predominantly products from the United Kingdom collected from caterers in summer or autumn 2021 and may have resulted COVID-19 restrictions. Among the *L. monocytogenes* isolates, only one matched those from human cases a from a prepacked mixed salad from a catering business in 2021. This isolate was the same strain as that multicountry outbreak (2015 to 2018) associated with Hungarian-produced frozen sweet corn; no link to the ou was established.

Journal of Food Protection, Vol. 85, No. 2, 2022, Pages 278–286
https://doi.org/10.4315/JFP-21-247
Published 2022 by the International Association for Food Protection

Research Paper

Assessment of the Microbiological Quality and Safety of Unpasteurized Milk Cheese for Sale in England between 2019 and 2020

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MS 21-247: Received 17 June 2021/Accepted 18 October 2021/Published Online 20 October 2021

ABSTRACT

teurized milk has been associated with outbreaks of illness. However, there are limited data on the oducing *Escherichia coli* (STEC) in these products and a lack of clarity over the significance of *E.* hygiene in raw milk cheeses. The aim of this study was to provide further data to address both of sing the overall microbiological quality of raw milk cheeses available to consumers in England. A se were collected from retailers, catering premises, and manufacturers throughout England. The sing cow's milk, with 14% made from sheep's milk and 5% from goat's milk. Samples were from in, with the majority originating from either the United Kingdom (40%) or France (35%). When Union microbiological criteria and United Kingdom guidance, 82% were considered to be of quality, 5% were borderline, and 12% were unsatisfactory. Four samples (0.6%) were potentially isolation of STEC from one, >10^4 CFU/g of coagulase-positive staphylococci in two, and >100 *enes* in the fourth sample. Indicator *E. coli* and *Listeria* species were detected more frequently in ese. Higher levels of indicator *E. coli* were significantly associated with a greater likelihood of *stx*$_1$ and/or *stx*$_2$).

HIGHLIGHTS

mined, 82% were of satisfactory microbiological quality.
ined potentially harmful levels of bacteria.
l/or *stx*$_2$) were detected in 10 samples.

Occurrence of Listeria and Escherichia coli in frozen fruit and vegetables collected from retail and catering premises in England 2018–2019

Caroline Willis [1], Jim McLauchlin [2], Heather Aird [3], Corinne Amar [4], Clare Barker [4], Timothy Dallman [4], Nicola Elviss [2], Sandra Lai [2], Lorraine Sadler-Reeves [5]

Affiliations + expand

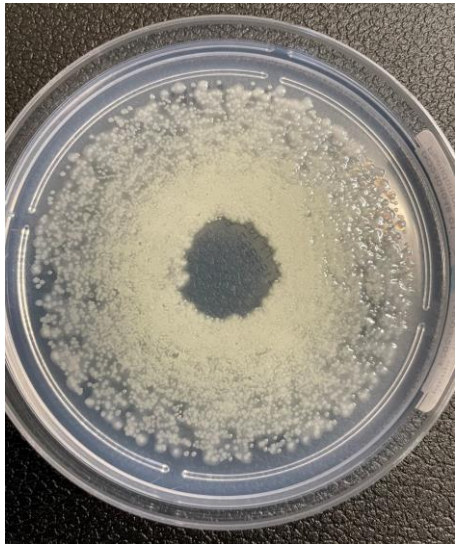
PMID: 32906080 DOI: 10.1016/j.ijfoodmicro.2020.108849
Free article

Abstract

Frozen vegetables have previously been associated with outbreaks of listeriosis in both the USA and Europe. An outbreak of Listeria monocytogenes serogroup 4 caused 53 cases in five European countries between 2015 and 2018. Whole genome sequencing (WGS) indicated that frozen sweet corn from a producer in Hungary was the source of illness. However, limited data is available on the prevalence of Listeria in frozen produce. A study of frozen fruit and vegetables from catering and retail premises in England was therefore carried out to assess their microbiological quality with respect to Listeria and Escherichia coli. Between December 2018 and April 2019, 1050 frozen fruit and vegetable samples were collected. Of these, 99% were of a satisfactory or borderline microbiological quality. Eleven samples (1%) contained ≥100 cfu/g of Escherichia coli (considered unsatisfactory in products labelled as ready-to-eat). Listeria monocytogenes or other Listeria species were detected in six samples (2%) of fruit compared to 167 samples (24%) of vegetables and six samples (26%) of fruit and vegetable mixes, but none at a level of ≥100 cfu/g. Characterisation by WGS of 74 L. monocytogenes isolates identified ten genetic clusters indicating a common source. For 8 of the 10 clusters, the isolates came from homogenous food types: four were sweet corn, and there was one cluster each for beans, peas, peppers and broccoli. There were five genetic associations between

Plant-based alternatives to meat and dairy products: potential risks

- Plant-based diets increasingly popular
- Contamination of plant-based ingredients
  - dried pulses / nuts / grains likely to contain spores – *Bacillus cereus*
  - *Salmonella* previously associated with nuts
  - Yeasts and moulds likely on dried ingredients
- Soaking process may allow growth of bacteria
- Soaking of kidney beans overnight – *Bacillus* shown to grow at ambient temperature but not if soaked in fridge
- Relatively few controls in final products to minimise microbial growth during shelf-life



Salmonella and vegan cheese

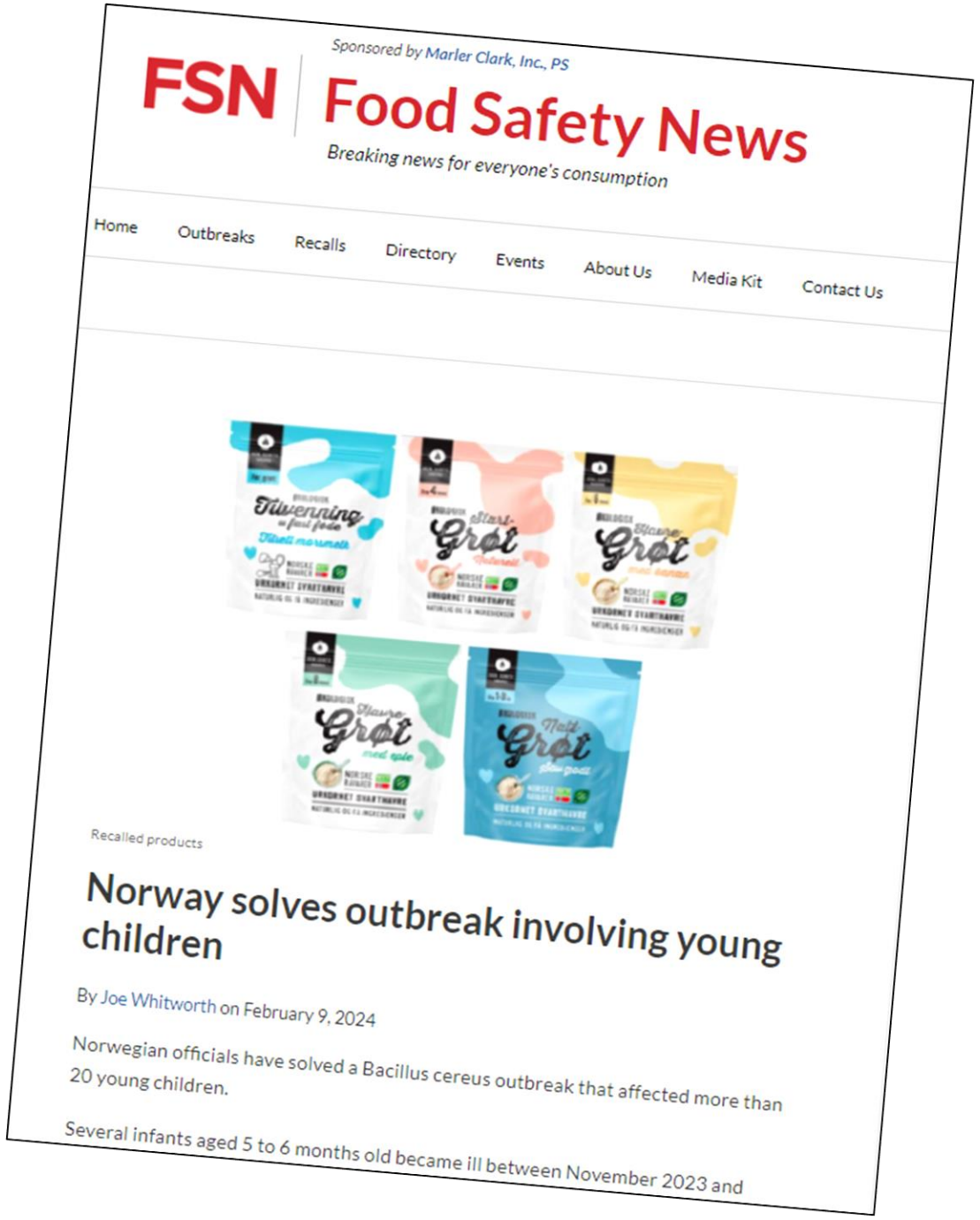
2020 / 2021:

- Salmonella outbreak linked to vegan cheese in US
- 20 cases – S. Chester, S. Urbana, S. Duisburg and S. Typhimurium!
- Outbreak strains (S. Chester and S. Urbana) found in production environment and in raw cashew nuts used in cheese production
- No pasteurisation step included in processing

2013 / 2014:

- 17 cases of salmonellosis (S. Stanley) linked to cashew cheese in California
- S. Weltevreden also isolated from fermenting cashew nuts at production premises

Bacillus in oats



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FSN Food Safety News

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Recalled products

Norway solves outbreak involving young children

By Joe Whitworth on February 9, 2024

Norwegian officials have solved a Bacillus cereus outbreak that affected more than 20 young children.

Several infants aged 5 to 6 months old became ill between November 2023 and

Study 75: Ready to eat plant based meat, fish and dairy substitutes - September 2022 to March 2023

- 937 samples:
  - 44% meat substitutes
  - 26% vegan cheeses
  - 15% plant-based milks
  - 12% other dairy alternatives
  - 1% fish alternatives
  - 2% other (eg egg alternatives / vegan desserts)

- Packaging:
  - 80% pre-packed, unopened
  - 3% pre-packed but opened
  - 10% loose / not pre-packed

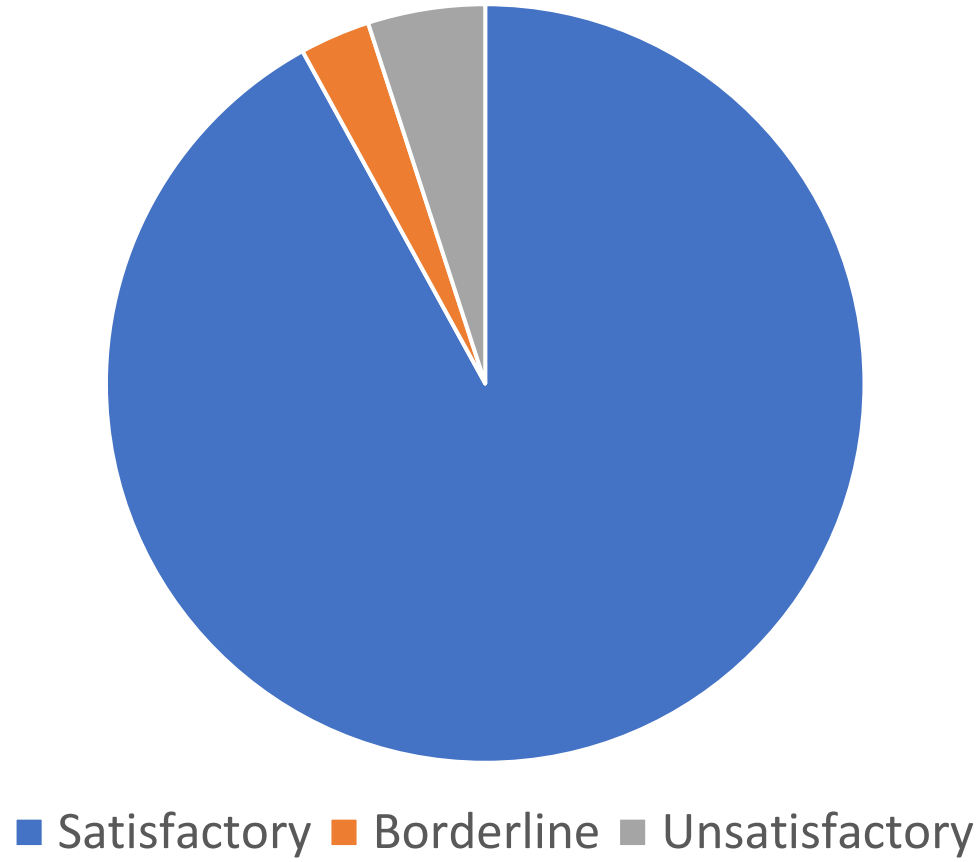
Sampling point:

- 90% retail
- 9% producers
- 1% catering

Results

- 92% satisfactory
- 3% borderline
- 5% unsatisfactory
  - due to Enterobacteriaceae and *E. coli*

- No Salmonella detected
- *Bacillus cereus* borderline in 2 samples
- *L. monocytogenes* in 5 samples
- Other *Listeria* species in 4 samples



Interpretation of Enterobacteriacae

- Are high Enterobacteriaceae levels expected in plant-based foods?
- Many products include a pasteurisation or cooking stage

- Borderline / unsatisfactory Enterobacteriaceae levels in:
  - 17% of unpackaged or open packs
  - 5% of unopened packs

- Considered that it is reasonable to interpret Entero levels according to HPA / UKHSA Ready-To-Eat Guidelines

  <100 cfu/g = satisfactory

  100 – 10,000 cfu/g = borderline

  >10,000 cfu/g = unsatisfactory

Listeria in vegan products

- *L. monocytogenes* detected in 5 tofu samples from same producer:

Sampling date	No. samples	Product	L. mono Result	Type
Jan 23	1	Organic natural tofu	Detected 20 cfu/g	Serotype 1/2a (ST37)
Feb 23 (early)	5	Organic natural tofu	3 x detected: 20, <20, <20 cfu/g	Serotype 1/2a (ST37) Serotype 4 (ST145)
Feb 23 (late)	5	Various tofu products	All negative	
Mar 23	5	Various tofu products	1 x detected 20 cfu/g	Serotype 1/2a (ST37)
Mar 23	1	Swab from producer	Detected	Serotype 1/2a (ST37)
May 23	1	Environmental sample – commercial lab		Serotype 4 (ST145)

- L. species in 4 meat substitutes (2 burgers / 2 ‘chicken’)

Study of sliced meats (Study 79)

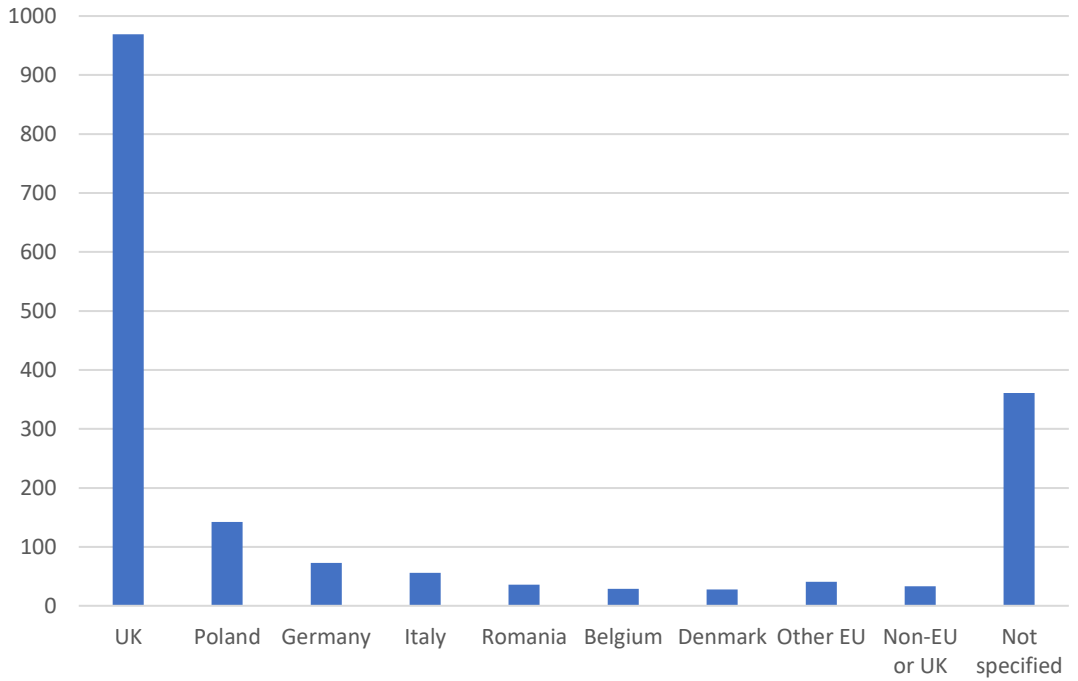
- October 2023 to April 2024
- Cooked sliced meats from retail and catering
- Examined for
  - Listeria – detection and enumeration
  - E. coli
  - Coagulase positive staphylococci
  - For pork / ham products, also Yersinia

Study of sliced meats - samples

- 1819 samples
  - 34% from supermarkets
  - 18% from butchers
  - 12% from delis
  - 8% from general stores
  - 12% from catering premises (pubs, restaurants, take aways, cafes)

- At least 27 countries of origin:

- Product type:
  - 24% ham, 15% chicken, 11% pork
  - 10% beef, 9% turkey
  - Others – chorizo, pastrami, haslet…



Study of sliced meats - results

- *L. monocytogenes* detected in 33 (1.8%)
  - Of which 3 had *L. mono* >20 cfu/g (40, 40, 2900)
  - Most common Clonal Complex was CC121 (n=9), CC9 (n=7), CC8 (n=6)
  - Five isolates linked with 5 SNP clusters including human cases
- *E. coli* present in 14 samples (0.8%) at borderline / unsatisfactory levels (>20 cfu/g)
  - Of which 6 were unsatisfactory (200 - >3000 cfu/g)
- Coagulase positive staphylococci in 6 samples at borderline levels (>20 cfu/g)
- *Yersinia* detected in 30 samples
- Vast majority (~97%) satisfactory BUT interpretations do not include ACC or Enterobacteriaceae – so caution needed in comparing with previous studies

Comparison with previous studies

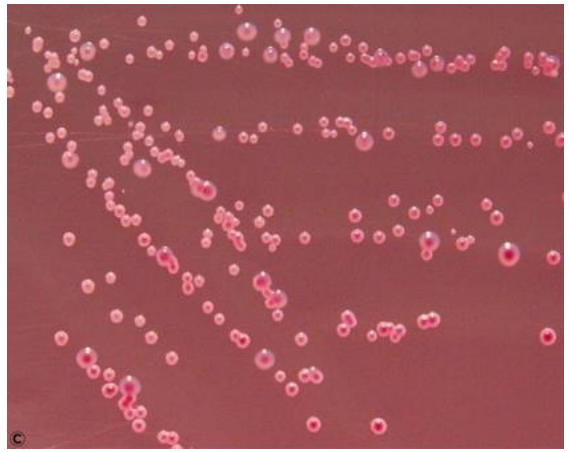
Study	No. of samples	L. monocytogenes >20 cfu/g (Detected in 25g)	E. coli >20 cfu/g	Reference
Cooked sliced meats – 2023/24	1819	0.2% (1.8%)	0.8%	UKHSA, 2024 – not yet published
Cooked chicken – 2013-2017	2721	0.4% (1.8%)	0.3%	McLauchlin et al, 2020
Speciality meats – 2008/9	2359	0.3% (2.3%)	0.9%	Gormley et al, 2010
Sliced meats - 2002	2894	0.03% (2.1%)	2.7%	Elson et al, 2004

Yersiniosis

- Yersinia species are part of the Enterobacteriaceae family
- Eighteen species including:
  - Y. pestis – the cause of the plague!
  - Y. pseudotuberculosis – scarlet-like fever
  - Y. enterocolitica – associated with food poisoning

- Y. enterocolitica can cause vomiting, bloody diarrhoea, fever ; 4-7 days after exposure
- Third most reported foodborne zoonosis in Europe – but considered to be rare in UK until recently
- A recent increase in cases has been seen in UK
- Particularly associated with undercooked pork meat, but recently other foods also implicated (raw milk, root vegetables…)

Yersinia testing in food



- 614 samples tested in 12 months
  - 65 positive (11%)
  - 52 ham / pork / bacon – largely sliced meat study (Study 79)
  - 6 raw milk

Identification	No. of isolates	Sequence type
Y. enterocolitica	35	3, 4, 8, 14, 137, 147, 157, 178, 184, 192, 278, 313, 357, 365, 445, 557, 606, P126
Y. intermedia	15	
Y. kristensenii	3	
Y. canariae	2	
Y. alsatica	2	

- No matches with human cases so far

Interpretation of *Yersinia* in food

- *Y. enterocolitica* comprises six biotypes
- Biotype 1A generally regarded as non-pathogenic in humans
- Biotype 1B considered highly pathogenic
- Pathogenicity linked to particular serotypes - O:3, O:8, O:9 and O:5,27 most commonly associated with human illness
- Virulent strains carry virulence genes *yst*A, *inv*A and *ail*

Table 1j.ii Interpretation of results for detection of *Yersinia enterocolitica* or *Yersinia pseudotuberculosis* from ready-to-eat foods placed on the market

Result in 25 g[a,b]	Interpretation	Likely cause	Suggested actions (not exclusive)
Detected [c]	UNSATISFACTORY: Potentially injurious to health and/or unfit for human consumption	Inadequate processing Cross contamination Poor temperature control	Immediate investigation of the food origin, production process and environment; Consider the Enterobacteriaceae count obtained from the sample and virulence characteristics; take investigative food samples and consider environmental monitoring.
Not detected	SATISFACTORY	N/A	N/A

[a] Testing of more or less food may be indicated during outbreak investigations.
[b] Perform risk assessment before any further action
[c] Levels of Yersinia that are likely to cause harm are not fully understood, but investigation should be undertaken where it is detected in ready-to-eat food.

Salad incidents

- Observations of STEC cases at similar time each year and epidemiological association with salad consumption

An outbreak of Shiga toxin-producing *Escherichia coli* O157:H7 associated with contaminated salad leaves: epidemiological, genomic and food trace back investigations

Published online by Cambridge University Press: **18 December 2017**

A. F. W. MIKHAIL, C. JENKINS, T. J. DALLMAN, T. INNS, A. D
P. CLEARY, R. ELSON and J. HAWKER

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Summary

In August 2015, Public Health England detect
Escherichia coli (STEC) serotype O157:H7 caus
prepacked salad product from a national reta
different farms and the zoonotic source of th

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Home / Eurosurveillance / Volume 23, Issue 18, 03/May/201

Surveillance and outbreak report

National outbreak of Shiga toxin-
O157:H7 linked to mixed salad le
2016 | Check for updates

Maya Gobin[1], Jeremy Hawker[1,2], Paul Cleary[1,2], Thomas Inns[1,2], Daniel Gardiner[1,2], Amy Mikhail[1], Jacquelyn McC
[2,4], Derren Ready[4], Tim Dallman[2,4], Iain Roddick[1], Ian Hall[5], Caroline Willis[6], Paul Crook[1], Gauri Godbole[3], Drazenk
Isabel Oliver[1,8]

**Epidemiological investigations identifie
Shiga toxin-producing *Escherichia coli* se
associated with pre-packed sandwiches**

Published online by Cambridge University Press: **10 August 2021**

Saira Butt, Lesley Allison, Bhavita Vishram, David R. Greig, Heather Aird, Eisin McDon
Genna Drennan, Claire Jenkins, Lisa Byrne and Kirsty Licence ...Show all auth

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Abstract

In October 2019, public health surveillance systems in Scotland ide
number of reported infections of Shiga toxin-producing *Escherichi*
involving bloody diarrhoea. Ultimately, across the United Kingdom
O26:H11 *stx1a* were identified, with the median age of 27 years an
were hospitalised. Among food exposures there was an associatio
packed sandwiches purchased at outlets belonging to a national f
outlet A) [odds ratio (OR) = 183.89, $P < 0.001$]. The common ingred
component of the majority of the sandwiches sold at food outlet A

More than 250 ill in UK E. coli outbreak linked to salad

By News Desk on December 7, 2022

More than 250 people are sick in an E. coli O157 outbreak in the United Kingdom that may have been caused by salad.

There have been 259 confirmed cases in the UK with sample dates ranging from late August to the end of October, although most people fell ill in August and early September.

Study of ready-to-eat salad (Study 77)

- Reactive study – April 2023 to March 2024
- Interest in any seasonal differences, or differences related to UK-grown versus imported products
- Study to include any RTE salad and salad components
- From producers, retailers and caterers

- Detection of *Salmonella*, STEC, *Listeria*
- Enumeration of *E. coli*, coagulase positive staphylococci, *Bacillus cereus*

Study of ready-to-eat salad - results

- 2296 samples
  - 44% from supermarkets, remainder from other retailers or catering
  - 37% mixed salad, 15% iceberg, also tomatoes, cucumber etc

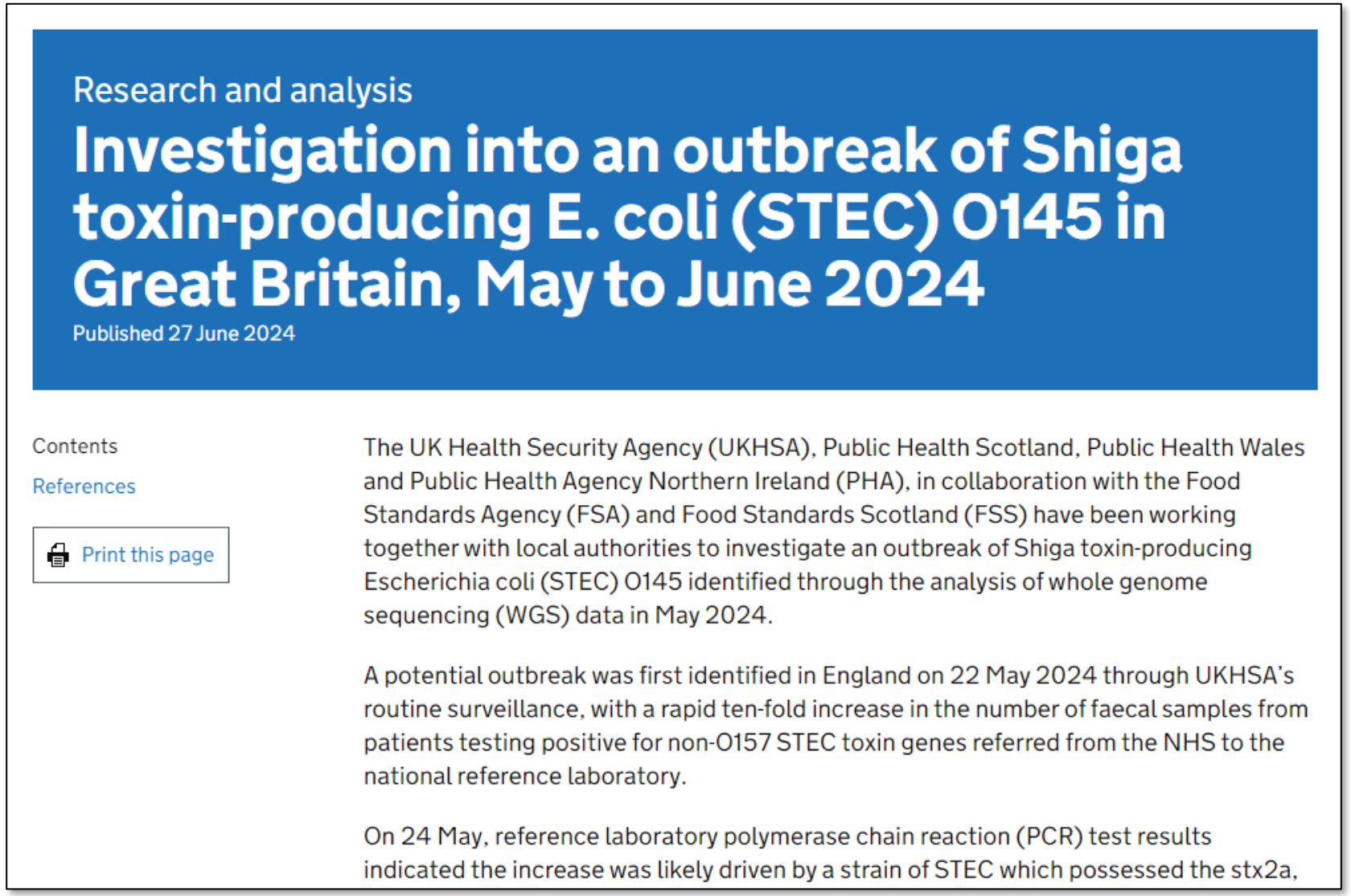
- Presumptive STEC (PCR positive) – in 23 samples (1%)
- Confirmed STEC (culture positive) – in 3 samples (0.1%)
  - ➢One fell within 10 SNP cluster with human case
- No clear differences in STEC between seasons

- *E. coli* – borderline in 3% and unsatisfactory in 1%
- Presumptive *Bacillus cereus* – borderline in 6% of samples; unsatisfactory in 0.5%

Bacillus in salad crops

- *Bacillus thuringiensis* is used as a biopesticide on crops
- Over 400 B.t formulations available on market
- Appropriate interval between application and harvest should be applied, but B.t can persist in harvested product
- Indistinguishable from *B. cereus* in lab tests
  - all reported as 'presumptive *Bacillus cereus*'
- Similar range of potential virulence factors – enterotoxin can cause diarrhoea
- Therefore considered appropriate to interpret in the same way as *B. cereus* according to RTE Guidelines
- Some disagreement from producers who consider B.t to be low risk due to lack of emetic toxin gene and minimal growth during chilled storage

Concerns about salad continue…



Research and analysis

Investigation into an outbreak of Shiga toxin-producing E. coli (STEC) O145 in Great Britain, May to June 2024

Published 27 June 2024

Contents

References

Print this page

The UK Health Security Agency (UKHSA), Public Health Scotland, Public Health Wales and Public Health Agency Northern Ireland (PHA), in collaboration with the Food Standards Agency (FSA) and Food Standards Scotland (FSS) have been working together with local authorities to investigate an outbreak of Shiga toxin-producing Escherichia coli (STEC) O145 identified through the analysis of whole genome sequencing (WGS) data in May 2024.

A potential outbreak was first identified in England on 22 May 2024 through UKHSA's routine surveillance, with a rapid ten-fold increase in the number of faecal samples from patients testing positive for non-O157 STEC toxin genes referred from the NHS to the national reference laboratory.

On 24 May, reference laboratory polymerase chain reaction (PCR) test results indicated the increase was likely driven by a strain of STEC which possessed the stx2a,

Update on ongoing studies

Cheese:

- April 2024 – March 2025
- >1300 samples collected as of October 2024
- 74% pasteurised cheese so far
- *L. mono* detected in 0.8% of pasteurised and 1% of unpasteurised cheese
- Presumptive STEC in 0.5% of pasteurised and 2% of unpasteurised cheese
- STEC isolated from 2 samples: Manchego and Romanian sheeps milk cheese

More samples welcomed – especially unpasteurised (incl Eastern European!)

Eggs:

- July 2024 – March 2025
- ~200 samples to date
- 25% in Lion brand or Laid in Britain scheme

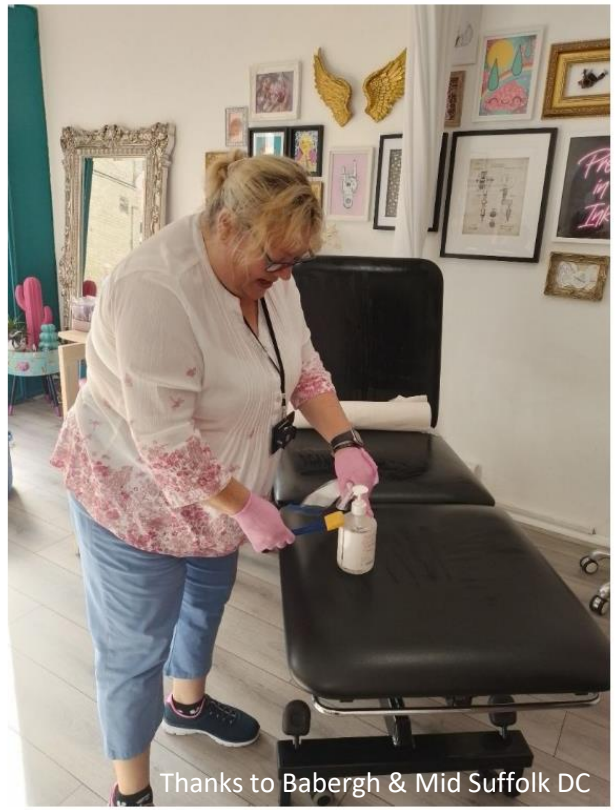
Larger numbers required to fully assess risk

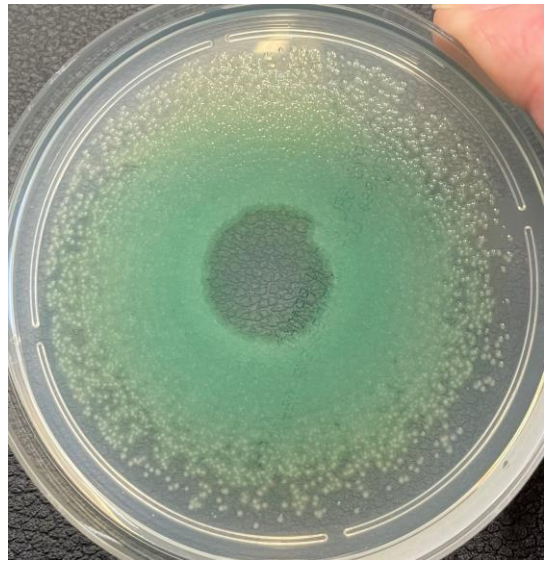
All negative for Salmonella!

Update on ongoing studies

Tattoo and ear-piercing premises:

- June 2024 – March 2025 (extended from November)
- So far, 1075 swabs, 350 waters, 340 green soap and other disinfectants
- Many findings of *Pseudomonas aeruginosa* in water and green soap
- Unsatisfactory Enterobacteriaceae and *S. aureus* in swabs
- Aim to contribute findings to update of CIEH Toolkit for tattooing and body piercing





Published studies

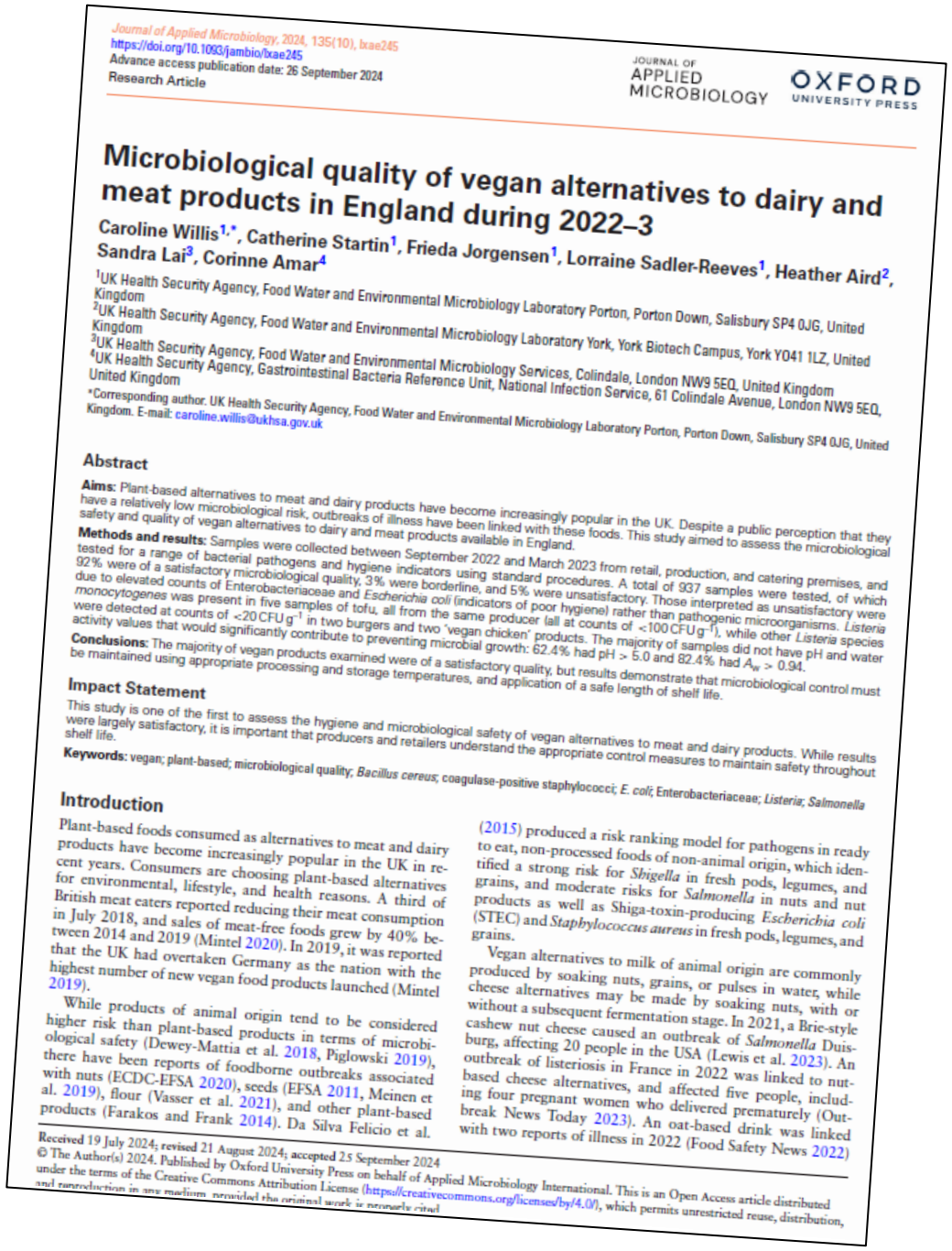
Vegan foods:

- Willis et al (2024)
  Journal of Applied Microbiology 135: lxae245

Flour:

- Kesby et al (2024)

  Journal of Applied Microbiology 135: lxae183



Journal of Applied Microbiology, 2024, 135(10), lxae245
https://doi.org/10.1093/jambio/lxae245
Advance access publication date: 26 September 2024
Research Article

JOURNAL OF APPLIED MICROBIOLOGY — OXFORD UNIVERSITY PRESS

Microbiological quality of vegan alternatives to dairy and meat products in England during 2022–3

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Abstract

Aims: Plant-based alternatives to meat and dairy products have become increasingly popular in the UK. Despite a public perception that they have a relatively low microbiological risk, outbreaks of illness have been linked with these foods. This study aimed to assess the microbiological safety and quality of vegan alternatives to dairy and meat products available in England.

Methods and results: Samples were collected between September 2022 and March 2023 from retail, production, and catering premises, and tested for a range of bacterial pathogens and hygiene indicators using standard procedures. A total of 937 samples were tested, of which 92% were of a satisfactory microbiological quality, 3% were borderline, and 5% were unsatisfactory. Those interpreted as unsatisfactory were due to elevated counts of Enterobacteriaceae and *Escherichia coli* (indicators of poor hygiene) rather than pathogenic microorganisms. *Listeria monocytogenes* was present in five samples of tofu, all from the same producer (all at counts of $<100\,CFU\,g^{-1}$), while other *Listeria* species were detected at counts of $<20\,CFU\,g^{-1}$ in two burgers and two 'vegan chicken' products. The majority of samples did not have pH and water activity values that would significantly contribute to preventing microbial growth: 62.4% had pH > 5.0 and 82.4% had A_w > 0.94.

Conclusions: The majority of vegan products examined were of a satisfactory quality, but results demonstrate that microbiological control must be maintained using appropriate processing and storage temperatures, and application of a safe length of shelf life.

Impact Statement

This study is one of the first to assess the hygiene and microbiological safety of vegan alternatives to meat and dairy products. While results were largely satisfactory, it is important that producers and retailers understand the appropriate control measures to maintain safety throughout shelf life.

Keywords: vegan; plant-based; microbiological quality; *Bacillus cereus*; coagulase-positive staphylococci; *E. coli*; Enterobacteriaceae; *Listeria*; *Salmonella*

Introduction

Plant-based foods consumed as alternatives to meat and dairy products have become increasingly popular in the UK in recent years. Consumers are choosing plant-based alternatives for environmental, lifestyle, and health reasons. A third of British meat eaters reported reducing their meat consumption in July 2018, and sales of meat-free foods grew by 40% between 2014 and 2019 (Mintel 2020). In 2019, it was reported that the UK had overtaken Germany as the nation with the highest number of new vegan food products launched (Mintel 2019).

While products of animal origin tend to be considered higher risk than plant-based products in terms of microbiological safety (Dewey-Mattia et al. 2018, Piglowski 2019), there have been reports of foodborne outbreaks associated with nuts (ECDC-EFSA 2020), seeds (EFSA 2011, Meinen et al. 2019), flour (Vasser et al. 2021), and other plant-based products (Farakos and Frank 2014). Da Silva Felicio et al. (2015) produced a risk ranking model for pathogens in ready to eat, non-processed foods of non-animal origin, which identified a strong risk for *Shigella* in fresh pods, legumes, and grains, and moderate risks for *Salmonella* in nuts and nut products as well as Shiga-toxin-producing *Escherichia coli* (STEC) and *Staphylococcus aureus* in fresh pods, legumes, and grains.

Vegan alternatives to milk of animal origin are commonly produced by soaking nuts, grains, or pulses in water, while cheese alternatives may be made by soaking nuts, with or without a subsequent fermentation stage. In 2021, a Brie-style cashew nut cheese caused an outbreak of *Salmonella* Duisburg, affecting 20 people in the USA (Lewis et al. 2023). An outbreak of listeriosis in France in 2022 was linked to nut-based cheese alternatives, and affected five people, including four pregnant women who delivered prematurely (Outbreak News Today 2023). An oat-based drink was linked with two reports of illness in 2022 (Food Safety News 2022)

Received 19 July 2024; revised 21 August 2024; accepted 25 September 2024

Planning studies for 2025-2026

- Hot off the press!

- Consultation for next year will include:
  - Nuts, seeds, dried fruit – particular interest in STEC / hygiene concerns
  - Fermented foods – general quality
  - Mushrooms – particular interest in Listeria
  - Root vegetables – particular interest in STEC/ Yersinia
  - Spa pools, hot tubs and pop-up pools – hygiene and Legionella
  - Dog chews / pet treats - Salmonella

Conclusions

- Programme of studies designed to investigate key areas of public health interest including food, water and environmental risks
- Findings from recent studies have supported outbreak investigation and led to updated guidance
- Success of the programme is based on strong working relationships with Local Authorities throughout England (and also participation from Northern Ireland)
- Important to identify study topics that EHDs are interested in, and can participate in

Please participate in the consultation exercise!

Acknowledgements

- Local Authority colleagues – sample and data collection
- FW&E teams at London, Porton and York
- GBRU reference laboratory
- Lorraine Sadler-Reeves – study coordination