Retail Surveillance Sampling Programme during Covid-19 pandemic

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Executive Summary

This project was commissioned to carry out targeted surveillance sampling on food products across Food Standards Agency (FSA) competent areas in order to help to identify emerging food safety risks and increase the FSA's intelligence on the food system during the Covid-19 pandemic.

The targeted surveillance programme was delivered in partnership by the three Local Authority Food and Feed Official Laboratories (OLs) and the two private OLs in England and Wales. The programme consisted of six sub projects each focussing on commodities and hazards where intelligence suggested that the impact of Covid-19 on the global food chain could potentially impact product safety or authenticity.

- Mince and Processed Meat Composition and Speciation
- Fish and Fish Product Speciation
- Spice and Herb Authenticity
- Basmati Rice and Durum Wheat Authenticity
- Undeclared Milk
- Undeclared Gluten

Samples were purchased across England and Wales from large Food Business Operators (FBOs) such as national supermarkets, smaller FBOs such as independent retailers and internet sites.

In total 1010 surveillance samples were analysed by OLs for authenticity, adulteration and contamination and 829 (82%) were reported as compliant by the Public Analysts with regards to the analysis undertaken. Samples can be deemed non-compliant for a variety of reasons, and the nature and severity of these varies widely. The majority of non-compliant samples within his survey were due to the composition of the product. Sampling was targeted at products and Food Business Operators (FBOs) of highest risk, and the non-compliance rate is not necessarily reflective of the UK market. It should be noted that the compliance rate for large FBOs was higher (92.8%).

Samples were recorded as non-compliant in the following circumstances:

- meat and fish samples tested for speciation were non-compliant if they contained DNA from a non-stated species. (A 1% threshold was used for meat samples).
- meat samples tested for composition were non-compliant if they did not have a qualitative meat declaration, had a low meat content, excess fat or other labelling irregularities.
- herbs and spices tested for adulteration were reported as unsatisfactory if they contained extraneous material such as damaged or unwanted plant parts, dirt or foreign substances.
- Basmati rice samples were reported as unsatisfactory if non-basmati rice varieties were detected or if the marked variety was not at least 97% of the product.
- any undeclared milk protein detected in dairy free products was reported as unsatisfactory.

A total of 300 minced and processed meat products were tested for speciation and composition. No horsemeat was detected in any of the samples suggesting that the measures put in place to increase food security following the horsemeat scandal in 2013 are preventing undeclared infiltration of horsemeat into the food chain.

Of the meat samples tested, 20% contained meat species that the consumer would not expect to find, with beef products having the lowest level of contamination and goat having the highest proportion of adulterated products.
Fewer fish samples than meat samples tested for speciation were found to have been adulterated with 96 out of 100 products reported as satisfactory. The four non-compliant samples were all sold as haddock.

A total of 375 samples of herbs and spices were analysed using microscopy to check for authenticity. Four of the samples had missing or substituted ingredients and approximately 10% were reported as non-compliant due to high proportions of extraneous plant matter being present which rendered the quality of the product as unacceptable.

Milk-free products (140) and gluten-free flours (30) were tested for the presence of the respective allergens. All of the dairy alternative products and gluten-free flours were satisfactory. Milk was detected in six dark chocolate samples, one chocolate truffle sample and one popcorn sample.

One third of samples bought via the internet were reported as not meeting regulatory standards, whereas one fifth of samples bought from smaller retailers and fewer than one in eight from large FBOs were reported as unsatisfactory.

The outcomes from this surveillance programme provide intelligence and evidence on the safety and authenticity of food as well as reassurance that food is safe. Any foods with significant findings were reported immediately to the FSA so that effective action could be taken. The FSA also reviewed all of the results to identify areas of emerging risk and used this to inform post-Covid-19 priorities.

Collaborative working on this project has increased the flow of information between the OLs and the FSA and has bolstered the enforcement network, making stronger connections between national and local knowledge of the food supply chain. Encouraging joined up working between the OLs was recommend by Professor Elliott in his review into the integrity and assurance of food

supply networks (1) and this project has facilitated this. Outputs from the project also supported the FSA in acquiring and using data from food sampling as a source of intelligence and to test hypotheses, which was a benefit recognised in the National Audit Office report into ensuring food safety and standards (2). This style of working is demonstrably aligned to the FSA future approach to sampling as endorsed by the FSA Board in November 2020 (3).

Retail Surveillance Sampling Programme during Covid-19 pandemic - Introduction

Project Aim

To carry out targeted surveillance sampling on food products across England, Wales and Northern Ireland to help identify emerging food safety risks during the Covid-19 pandemic as a result of pressures on the global food chain and increase the FSA's intelligence on the food system.

Background

The aim of the Food Standards Agency, as laid out in its Strategic Plan 2015–2020 (4), is to protect public health from risks which may arise in connection with the consumption of food both in terms of how it is produced and supplied, while making sure that "food is safe and what it says it is".

The Covid-19 pandemic led to a reduction in the amount of sampling undertaken by Local Authorities (LAs) as they minimised the footfall in food and feed business establishments and focussed resources on urgent priority reactive work.

Additionally, it also increased the pressure on the global food supply chain and there were enforcement flexibilities in order to maintain food stocks, and changes to exports and trade flows from exporter countries worldwide.

This targeted programme of surveillance sampling on food products across England, Wales and Northern Ireland has been developed in response to the challenges arising from Covid-19 to deliver useful intelligence on the safety of the food system and provide support to the OLs to ensure that the FSA continues to meet its legislative requirements.

Food and Feed Official Laboratories (OLs)

The FSA are the Central Competent Authority responsible for designating food and feed official laboratories in the UK according to the Multi-Annual National Control Plan (5), as required by the retained Official Feed and Food Control Regulations 2017/625 (6). It has the responsibility for ensuring the United Kingdom has sufficient laboratory capacity and capability to deliver official controls on feed and food safety and standards in order to protect public health. The Official Laboratories (OLs) are not owned or operated by the FSA.

There are currently 5 Public Analyst OLs in England and Wales:

- Hampshire Scientific Service
- Kent Scientific Services
- Lancashire County Scientific Services

- Minton Treharne and Davies Ltd
- Public Analyst Scientific Services

All OLs are accredited to ISO17025 by The United Kingdom Accreditation Service (UKAS) and employ suitably qualified staff including Public Analysts, Agricultural Analysts and Food Examiners for enforcement purposes.

Retail Surveillance Sampling Programme during Covid-19 pandemic - Project Outline

Purpose and Scope

Based on FSA and OL intelligence a number of key sampling areas of interest were identified and developed into sampling and analysis sub projects. A range of means were used to identify commodities for sampling including FSA surveillance tools, horizon scanning and policy and scientific expertise. High priority was given to commodities and hazards where intelligence suggested that Covid-19 could impact product safety or authenticity. The laboratory results will be used to provide additional intelligence but do not provide the full picture with regards to the source or level of the issues.

Sampling and analysis protocols were created for each sub project, which were approved by the FSA prior to the commencement of the work.

Six sub projects are included in this report

- P1 Mince and Processed Meat Compliance and Speciation
- P2 Fish and Fish Product Speciation
- P3 Spice and Herb Authenticity
- P4 Basmati Rice and Durum Wheat Authenticity
- P5 Undeclared Milk
- 6 Undeclared Gluten

The project aimed to provide representative surveillance across England and Wales. A small number of samples were also taken within Northern Ireland. All samples were purchased by the OLs from businesses selling to the general public either in store or online.

The samples were divided between the OLs for analysis according to the analytical capabilities of each laboratory. Each OL used analytical methods that are routinely employed for enforcement purposes and reported the samples against appropriate legislation for the food product and the tests undertaken.

The Hampshire Scientific Service project team worked in partnership with the FSA throughout the project to respond to any emerging issues and allow the project scope to be reviewed as the wider food sampling landscape evolved.

Sub Project Rationales

P1 Minced and Processed Meat Compliance and Speciation

There are compositional and labelling criteria prescribed in legislation for minced meat and meat products to ensure that consumers are informed about the quality of the products they purchase.

Retained regulation (EU) No 1169/2011 on the provision of food information to consumers has specific compositional and labelling criteria for minced meat and also quantitative ingredient requirements for prepacked meat products, whilst The Products Containing Meat etc. (England) Regulations 2014 prescribes compositional requirements for certain meat products such as sausages, burgers and pies.

During processing, meat products can be accidentally or deliberately adulterated with other meat species. This could be local or widespread adulteration such as the horsemeat scandal in 2013 where foods advertised as containing beef were found to contain undeclared or improperly declared horsemeat. There is a 1% threshold level set by the FSA for the DNA of other species in meat products.

In order to determine the quality of minced and other meat products this sub project analysed:

- Minced meat to evaluate the level of fat and collagen:meat ratio.
- Uncooked meat products such as burgers, sausages and pies for meat content.
- Ready meals for meat content.
- All samples for the presence of cow, pig, sheep, chicken, turkey, horse and goat DNA.

All results and food labels were assessed against the legislative criteria for the product type.

P2 Fish and Fish Product Speciation

Fish consumption has increased in recent years. High demand and low stock volumes of fish can lead to inflated costs and, as a consequence, be an attractive commodity for fraudsters. Fish products made from pieces of fish rather than whole fillets provide additional opportunities for fraudulent substitution.

This sub project focussed on premium fish and fish products (cod, haddock, plaice) from fishmongers / fish counters and catering establishments including fish and chip shops.

All samples were analysed for the presence of the named fish species DNA to determine whether any substitution had taken place.

P3 Spice and Herb Authenticity and Contamination

Global supply of herbs and spices is not expected to keep up with future demand, leading to a rise in prices and an increased threat of fraud and adulteration of the products. Oregano, turmeric, thyme, black pepper, ginger, sage, mixed herbs and mixed spices were particular targets identified by the FSA.

Herbs and spices are produced by a broad range of countries and may be subjected to chemical contamination at one or more stages of the supply chain mainly through environmental pollution. Common contaminants include heavy metals and aflatoxins.
All samples were visually inspected and examined under the microscope to detect adulteration. Turmeric, black pepper and ginger samples were analysed for the presence of lead and cadmium. Spice mixes were analysed for the presence of Aflatoxins B1, B2, G1 and G2.

P4 Basmati Rice and Durum Wheat Authenticity

Basmati refers to premium rice, which has special eating characteristics, and is grown in specific regions of India and Pakistan. Approved basmati varieties sell at around twice to three times the price of ordinary long grain rice.

Durum wheat (Triticum durum) is traditionally used in the manufacture of dried pasta because it produces the correct eating qualities. Shortages in availability, due to recent poor global weather conditions, have increased the market price of durum wheat to around double that of common wheat. The increased prices for these premium products provide incentives for adulteration.
This sub project tested rice products sold as basmati and pasta claiming to be 100% durum wheat for authenticity.

P5 Undeclared Milk

Since January 2017 there have been 177 food alerts with respect to undeclared milk ingredients, of which 26 (15%) have been issued during the 8-month period 1st January 2020 – 25th August 2020. This averages approximately 3 products a month.
It is often not obvious from the appearance of a food that it contains an allergenic ingredient. Clear product labelling is mandatory and essential to alert individuals to the presence of allergenic ingredients within the food, thereby enabling consumers to make informed choices as to whether to consume a potentially allergenic food.
This sub project evaluated foods which claimed to be free of milk and/or dairy or had no milk allergens declared, to establish if such claims are true.

P6 Undeclared Gluten

Gluten is a protein found in some cereal grains, typically wheat, barley, rye, and is a regulated allergen. Up to 13% of the population may have a gluten sensitivity (7) and, according to Coeliac UK (8), coeliac disease affects at least 1 in 100 people in the UK.
Legislation provides a framework for gluten-free labelling and states that the term can only be used on packs of food or foods sold in catering which contain 20 ppm or less of gluten.

This sub project targeted flours which claimed to be gluten free or had no gluten allergens declared to establish if the claims were true and whether there was any inter-batch variation.

Retail Surveillance Sampling Programme during Covid-19 pandemic - Method

Sampling

The informal purchasing of samples was carried out by OL staff who were provided with a shopping list and an area of the country in which to shop. All products were purchased at full cost from businesses selling to the general public and the FBOs were not notified that samples were being taken for subsequent testing. The sampling plan focussed on the range of products identified for each sub project and did not target specific businesses.

Geographic Distribution

The surveillance sampling was undertaken in two phases in order to achieve a wide geographic spread. Sampling started in July during Covid-19 restrictions therefore half of the samples were bought from regions local to the laboratories. This was followed by a national sampling plan to cover all of England and Wales when restrictions allowed. A small number of samples were taken in Northern Ireland during regional sampling.

- Phase 1 Regional Sampling commenced July 2020: Sampling was undertaken in the local areas around the OL offices and laboratories including Hampshire, Kent, Lancashire, London, Midlands, Manchester and Northern Ireland providing good regional coverage, whilst remaining compliant with local and national Covid-19 travel restrictions.
- Phase 2 National Sampling (excluding Scotland) commenced August 2020: Areas not covered by the regional sampling were identified and subsequently targeted to ensure a good geographical spread. With Covid-19 restrictions still in place this phase of sampling consisted of both in store and online purchases.

Retail Types

Representative surveillance was also achieved through sampling across a mix of food business operators (FBOs). The project aim was to obtain approximately 25% of samples from large Food Business Operators (FBOs) and 75% from smaller FBOs.
Large FBOs included mainstream supermarkets with national coverage or at least across multiple counties, or large food distributors. Smaller retailers included FBOs smaller than this, such as independent retailers, farm stores, stores operating under franchise, and self-service wholesale stores.

Some samples were purchased via the internet to reflect the consumer move to on-line shopping and provide national coverage during periods of lockdown.

Duplication of Samples

Sampling was coordinated across all five OLs to minimise duplication. Each sampling protocol identified the types of products and these were allocated to the laboratories to purchase with an initial focus on regional or small FBOs. Once purchased samples were added to a central list which was used as a reference for future sampling.

Sample Integrity

In order to ensure that surveillance samples were of a suitable standard for testing sampling protocols were provided for each food commodity/ hazard to ensure that sufficient sample was obtained and that samples were collected, transported and stored under appropriate conditions so as not to adversely impact on the sample integrity or on the quality of the final analytical result. Project protocols are included in Appendix 1 of this report.

Analysis

Each OL holds ISO17025 accreditation and used the most appropriate method for each commodity / hazard analysed using accredited methods if available. All of the surveillance samples in this project were analysed using procedures used for official control samples and the integrity of the samples was maintained at all times with comprehensive records to demonstrate chain of custody.

Raw data for all samples including any replicate analysis, positive and negative controls and quality control materials were recorded and all records kept for a period of at least 12 months. The FSA were provided with photographs of packaging for all unsatisfactory samples as well as the final raw data.

In the event that a laboratory identified something that it considered to be indicate a serious authenticity concern or a significant hazard to human health then the FSA were informed immediately.

P1 Minced and Processed Meat Composition and Speciation

A total of 300 minced and processed meat products were analysed for compositional and speciation compliance. The number of each product type is in the table below.

Table 1: P1 Sample Numbers by product type

Product Type	Number of samples submitted
Beef Mince	29
Beef Ready Meal	30
Beef Burger	30
Beef Pie	34
Lamb Mince	34
Lamb Ready Meal	30
Lamb Curry / Kebab	37
Pork Sausages	31
Pork Mince	35
Goat Meat / Products	10

Analysis of meat samples for composition was carried out by five OLs. Proximate analysis was used to measure the amounts of nitrogen, moisture, ash, fat, hydroxyproline and soya protein in the product. Calculations based on the CLITRAVI (Liaison Centre for the Meat Processing Industry in the EU) method for calculation of meat content (9) were used for reporting results. Analysis of meat samples for speciation was carried out by four OLs. Real-time Polymerase Chain R assays for seven meat species were used to detect and measure (semi-quantitatively) the amount of animal species present. All samples were analysed for the presence of the following meat species:

- Cow (Beef)
- Pig (Pork)
- Sheep (Lamb)
- Goat
- Horse
- Chicken
- Turkey

P2 Fish and Fish Product Speciation

A total of 100 fish and fish product samples were analysed for speciation compliance. The number of each product type is in the table below.

Table 2: P2 Sample Numbers by product type

Product Type	Number of samples submitted
Cod fillets	20
Haddock fillets	20
Plaice fillets	11
Cod or Haddock fish fingers	12
Cod or Haddock fishcakes	11
Named species fish products	26

Speciation analysis was carried out by three OLs using two different DNA techniques.

- PCR-RFLP (using Agilent 2100 Bioanalyzer) of the mitochondrial cytochrome b gene using lab-on-a-chip capillary electrophoresis for end-point analysis enabling accurate sizing of DNA fragments and identification of fish species in raw and cooked foods from reference database.
- DNA extraction and subsequent PCR and sequencing of various, variable mitochondrial DNA regions. Sequences were compared to entries in the public databases NCBI (National Center for Biotechnology Information, USA) and BOLD (Barcode of Life Database).

P3 Spice and Herb Authenticity and Contamination

A total of 375 spice and herb samples were analysed for authenticity. Of the spice samples, 150 were additionally analysed for lead and cadmium levels and 50 were analysed for aflatoxins B1, B2, G1 and G2. The number of each product type is in the table below.

Table 3: P3 Sample Numbers by product type

Product Type	Number of samples submitted	Metals	Aflatoxins
Turmeric	50	50	-
Oregano	49	-	-
Thyme	50	-	-
Black Pepper	50	50	-
Ginger	50	50	-
Mixed Herbs	51	-	-
Spice Mix	50	-	50
Sage	25	-	-

Samples of spices were analysed for authenticity using microscopy by five OLs and one OL tested for metals and aflatoxins. All samples were analysed using light microscopy at both macroscopic and microscopical levels. Observed features were compared with reference literature and reference control authenticated herbs and spices.

Black pepper, ginger and turmeric samples were analysed for cadmium using Flame Atomic Absorption Spectroscopy (AAS) and for lead using a Graphite Furnace AAS.

Spice mixes were analysed for aflatoxins using solvent extraction followed by filtration Immuno Affinity Column clean up (IAC) and HPLC with Kobra cell post column derivatisation.

P4 Basmati Rice and Durum Wheat Authenticity

Samples of basmati rice (40) and durum wheat pasta (25) were analysed for authenticity. The number of each product type is in the table below.

Table 4: P4 Sample Numbers by product type

Product Type	Number of samples taken
Prepacked Basmati	20
Cooked Basmati	20
Prepacked Pasta	15
Cooked Pasta	10

All basmati rice samples were analysed by one OL and all durum wheat samples were analysed by a different OL. Basmati rice speciation was analysed using PCR & Microsatellite-based DNA analysis using 10 marker microsatellite alleles. The allele pattern was then compared with those of authentic varieties of basmati rice.

Durum wheat speciation was analysed using R-Biopharm DUROTEST SQ Elisa Membrane Kit which uses a monoclonal antibody specific for the protein friabilin which is only present in non-durum wheats.

P5 Undeclared Milk

A total of 140 products which claimed to be free of milk were analysed to establish if the claims were true. The number of each product type is in the table below:

Table 5: P5 Sample Numbers by product type

Product Type	Number of samples taken
Dark Chocolate	39
'Free From Milk/Dairy' Chocolate Products	21
'Free From Milk/Dairy' Confectionary	20
Dairy Alternatives: Ice-cream	10
Dairy Alternatives: Butter	10
Dairy Alternatives: Milk	15
Dairy Alternatives: Cheese	15
Dairy Alternatives: Yogurt	10

The products were analysed for the presence of milk by three OLs using two different ELISA kits.

- Neogen Veratox Casein Allergen Quantitative Sandwich Enzyme-Linked Immunosorbent Assay Kit - this kit is used for the quantitative analysis of casein residue in food products and has a limit of detection of 1 ppm casein (NFDM scale).
- RIDASCREEN®FAST Milk - this is a sandwich enzyme immunoassay to quantify milk proteins (casein and ß-lactoglobulin) in food containing whey, milk or milk powder and has a limit of detection of 0.3 – 0.8 ppm milk protein (depending on matrix).

P6 Undeclared Gluten

A total of five samples of gluten-free flour (general all-purpose flour) and five samples of gluten-free flour alternatives (specialist flours such as buckwheat, coconut, gram flour) were selected. Of the ten flours selected, three samples of each were taken from different areas of the country to determine the presence of gluten and any potential variation between batches. The number of each product type is in the table below.

Table 6: P6 Sample Numbers by product type

Product Type	Number of samples taken
Free From Gluten Flour	15
Free From Gluten Flour Alternatives	15

Samples were analysed for the presence of gluten by five OLs using two different ELISA kits.

- RIDASCREEN®FAST Gliadin (Art. No. R7002) - A sandwich enzyme immunoassay for the quantitative analysis of contaminations by prolamins from wheat (gliadin), rye (secalin), and barley (hordein) in raw products like flours (buckwheat, rice, corn, oats, teff)

- SENSISpec INgezim Gluten R5 ELISA The assay is based on the R5 Monoclonal Antibody, which is specific for proteins from wheat, rye and barley.

Retail Surveillance Sampling Programme during Covid-19 pandemic - Results

Table 7: Sample numbers and compliance by sub project

Number of samples

Project	Purchased	Compliant	Non-Compliant	Inconclusive	%Compliance
P1 Meat Composition and Speciation	300	179		121	59.7%
P2 Fish Speciation	100	96	4		96.0%
P3 Spices Adulteration and contamination	375	336	38	1	89.6%
P4 Rice/Pasta Authenticity	65	56	6	3	86.2%
P5 Undeclared Milk	140	132	8		94.3%
P6 Undeclared Gluten	30	30	0		100.0%
Total	1010	829	177	4	82.1%

Results are presented in Figures 1 to 7 (Project Overview and each of the sub projects P1 to P6) and highlight the following key areas.

Project Headlines Table:

- number of samples.
- number of compliant samples reported as satisfactory.
- number of non-compliant samples reported as unsatisfactory.
- % Non-compliance (which will be explained further in the discussion).

Sample Numbers Graph:

- total number of samples by Project or Product Type.
- numbers of compliant, non-compliant and inconclusive samples.

Retail Outlet Type Table:

- numbers of samples purchased from the different retail outlet types.
- project summary – % Split of purchases across retail types.
- P1 to P6 - % Non-compliance by retail type.

Surveillance Sampling Locations Map:

- purchase location of samples.

Figure 1: Project Overview

Figure 2: P1 Mince and Processed Meat Composition and Speciation

Figure 3: P2 Fish and Fish Product Speciation

Figure 4: P3 Spice and Herb Authenticity and Contamination

Figure 5: P4 Rice and Pasta Authenticity

Figure 6: P5 Undeclared Milk

Figure 7: P6 Undeclared Gluten

Retail Surveillance Sampling Programme during Covid-19 pandemic - Discussion

Project Overview

Of the 1010 samples analysed, 829 were compliant with regard to the analyses undertaken. The overall project compliance rate was 82.1%.

The types of non-compliances detected include:

- meat and fish samples tested for speciation were non-compliant if they contained DNA from a non-stated species. For meat products the threshold used was >1% and in some cases multiple species were detected.
- meat samples tested for composition were non-compliant if they did not have a qualitative meat declaration, had a low meat content, excess fat or other labelling irregularities.
- herbs and spices tested for adulteration were reported as unsatisfactory if they contained extraneous material such as damaged or unwanted plant parts, dirt or foreign substances.
- Basmati rice samples were reported as unsatisfactory if non-basmati rice varieties were detected or if the marked variety was not at least 97% of the product.
- any milk proteins detected in dairy free products were reported as unsatisfactory.

The sampling for this project took place during national and local lockdowns and sampling plans were adjusted to include more focus on web sales and deliveries as well as shop purchases.

- 15% of samples were purchased from large FBOs
- 75% from smaller FBOs
- 10% as online purchases

Table 8: Compliance by Retail Outlet Type

Retail Outlet Type	Number of Compliant samples	Number of Non- Compliant samples	% of Compliant samples	% of Non-Compliant samples
Internet	67	35	65.7%	34.3%
Retail - independent	419	108	79.5%	20.5%
Retail - large	272	21	92.8%	7.2%
Takeaway	43	10	81.1%	18.9%
Wholesale	27	4	87.1%	12.9%
Grand Total	828	178	82.3%	17.7%

Samples purchased via the internet had the highest rate of non-compliance with around one third of the 102 samples ordered online not meeting all the legislative requirements. Approximately one fifth of samples bought from independent retailers including takeaways were deemed by Public Analysts to be non-compliant. Samples bought from large retailers had the lowest level of non-compliance although around one in eight samples were still reported as unsatisfactory.

The maps for geographical distribution show that there was a wide spread of samples for sub projects P1 to P5. The locations of non-compliant samples in each sub project were reviewed for local or regional hotspots. No geographical distribution patterns were identified.

Sampling for P6 was undertaken during national lockdown and the products identified for this sub project were all available from large FBOs and were purchased from outlets local to the OLs in order to comply with Covid-19 restrictions.

P1 Mince and Processed Meat Composition and Speciation

Of the 300 meat samples analysed for both compositional/labelling compliance and meat species, 179 were compliant with regards to all of the analyses.

No horsemeat was detected in any of the 300 samples which were all analysed for the presence of seven meat species (cow, pig, sheep, chicken, turkey, horse and goat). Table 9 summarises the compliance status by product type. The overall compliance rate for the 300 meat samples analysed was 59.7%.

Table 9: Compliance by Product Type (composition and speciation)

Product	Number of Compliant samples	Number of non-compliant samples	Total
Beef Burger	21	9	30
Beef Mince	21	8	29
Beef Pie	22	12	34
Beef Ready Meal	24	6	30
Goat	2	8	10
Lamb Curry / Kebab	24	13	37
Lamb Mince	10	24	34
Lamb Ready Meal	20	10	30
Pork Mince	16	19	35
Pork Sausages	19	12	31
Total	179	121	300

Meat Speciation

Speciation non-compliance was found in 62 samples with either additional or alternative meat species to those on the label being detected.

Table 10 shows the number of samples adulterated with other meat species by product type. The compliance rates by meat types for speciation across the products tested are as follows: Beef 95.1%, Pork 72.7%, Lamb 69.3% and Goat 30%.

Table 10: Meat Speciation Non-Compliance by Product Type

Product	Total number of samples	Non-compliant species	% of species
Beef Burger	30	0	0.0%
Beef Mince	29	4	13.8%
Beef Pie	34	2	5.9%
Beef Ready Meal	30	0	0.0%
Goat Meat / Products	10	7	70.0%
Lamb Curry / Kebab	37	9	24.3%
Lamb Mince	34	20	58.8%
Lamb Ready Meal	30	2	6.7%
Pork Mince	35	15	42.9%
Pork Sausages	31	3	9.7%
Total	300	62	20.7%

Beef Speciation

Speciation non-compliance was found in 6 out of 123 beef products. All the beefburgers and all the beef ready meals only contained beef. Non-compliant minced beef samples consisted mainly of bovine (beef) DNA but small amounts of sheep and turkey, pork, sheep and pork, and sheep and chicken were also detected in the four samples respectively. The two non-compliant beef pie samples were both found to contain bovine and porcine (pig) DNA, one of which was 30% pork and 70% beef. The compliance rate for beef products for speciation was 95.1%.

Goat Speciation

Of the 10 goat meat samples analysed, four had no goat DNA detected and another three also contained significant amounts of other meats as shown in Table 11.

Table 11: Species Non-Compliances by Goat Product Type

Product	DNA detected in Goat	DNA detected in Sheep	DNA detected in Cow	DNA detected in Pig
Curry	Not Detected	>99%	-	-
Goat Meat	Not Detected	>99%	<1%	-
Mince	Not Detected	>90%	<1%	-
Burger	Not Detected	>80%	11%	-
Mince	>50%	-	5-10%	<1%
Burger	>50%	5-10%	1-5%	1-5%
Mince	>50%	10-50%	-	<1%

The main substitute ingredient for goat was lamb but beef and pork were also found in a number of the samples. The compliance rate for goat products for speciation was 30%.

Lamb Speciation

Out of 101 lamb products sampled for speciation, 31 were non-compliant with 9 out of 37 kebabs detecting undeclared meat DNA. Beef was detected in 8 of the samples ranging from 2% to 73% and chicken DNA was identified in 7 of the kebabs

ranging from trace amounts to 64%.

Out of a total of 34 minced lamb samples, 20 were found to contain DNA from other species ranging from trace amounts to > 50%. Beef was present in 18 samples and pork was found in 11 of the kebabs. Low levels of chicken DNA were also detected in two kebabs. The 2 lamb ready meals reported as unsatisfactory both contained 98% sheep DNA but one also had 2% beef and the other had 2% pork. The overall compliance rate for lamb products for speciation was 69.3%.

Pork Speciation

A total of 18 samples out of 66 pork products tested for speciation were non-compliant. 15 out of 35 pork minces had other meat DNA detected as well as pork. Beef DNA was detected in 13 minces ranging from 1% to 50% and 10 had sheep DNA detected ranging from <1% to 30%.

Three of the 31 pork sausages had pork as the main meat component but also contained beef and lamb, one of which had 30 – 60% beef. The overall compliance rate for pork products for speciation was 72.7%

Meat Composition and Labelling

Of the samples tested for composition and/or labelling, 69 were found to be non-compliant. Table 12 shows the number of unsatisfactory reports by product type.

Table 12: Meat Composition Non-Compliance by Product Type

Product	Total Number of Samples	Composition Non-Compliant	% of samples
Beef Burger	30	9	30.0%
Beef Mince	29	5	17.2%
Beef Pie	34	11	32.4%
Beef Ready Meal	30	6	20.0%
Goat Meat / Products	10	3	30.0%
Lamb Curry / Kebab	37	5	13.5%
Lamb Mince	34	6	17.6%
Lamb Ready Meal	30	8	26.7%
Pork Mince	35	4	11.4%
Pork Sausages	31	12	38.7%
Total	300	69	23.0%

The two main reasons for samples being reported as unsatisfactory was the absence of a quantitative ingredient declaration or QUID (which informs the customer the percentage of ingredients in the product) and low meat content where samples did not contain the amount of meat declared or required for the type of product (e.g. pork sausages are required to contain at least 42% pork). 23 of the samples fell into each of these failure categories.

Excess fat was also identified in 13 products, 12 of which were minces (6 lamb, 3 pork, 2 beef and 1 goat). The other product with excess fat was a lamb kebab.

Incorrect labelling was the reason for 9 of the unsatisfactory reports and these labels either did not include the required information or did not provide it in the correct format. One lamb ready meal was found to contain a piece of string (55 mm by 3 mm). Table 13 shows the composition failure reasons by product type.

Table 13: Meat composition failure reasons by product type

Product	No Quantitative Ingredient Declaration	Composition Failure Reasons: Low Meat Content	Excess Fat	Labelling	Foreign material
Beef Burger	5	2	-	2	-
Beef Mince	-	-	2	3	-
Beef Pie	7	3	-	1	-
Beef Ready Meal	2	4	-	-	-
Goat Meat / Products	2	-	1	-	-
Lamb Curry / Kebab	2	2	1	-	-
Lamb Mince	-	-	6	-	-
Lamb Ready Meal	1	6	-	-	-
Pork Mince	-	1	3	-	-
Pork Sausages	4	5	-	3	-
Total	23	23	13	9	1

The compliance rates by meat for composition and labelling across the product types tested are as follows: Lamb 81.2%, Pork 75.8%, Beef 74.8% and Goat 70%.

Beef Composition

The compliance rate for beef products for composition / labelling was 74.8%. Of those samples that were non-compliant for composition the majority, 14 out of 31 (45.2%), were missing a quantitative ingredient declaration. There were 2 beef samples, a mince and a pie, that were non-compliant for both composition and speciation.

Goat Composition

The compliance rate for goat products for composition / labelling was 70%. Of the ten goat samples, two were missing a quantitative ingredient declaration and a minced goat sample contained excess fat. There were 2 goat samples, a mince and a burger, that were non-compliant for both composition and species.

Lamb Composition

The compliance rate for lamb products for composition / labelling was 81.2%. Of the 19 non-compliant samples listed in Table 5.2, low meat content in lamb ready meals and excess fat in lamb mince were the most frequently reported issues. The foreign material found was a piece of string in a lamb ready meal. There were 3 lamb samples, 2 minces and a kebab, that were non-compliant for both composition and species.

Pork Composition

The compliance rate for pork products for composition / labelling was 75.8% with 5 pork sausage samples having a low meat content and another 4 pork sausages missing a quantitative ingredient declaration. There were 3 pork samples, all sausages, that were non-compliant for both composition and species.

Retail Type

Table 14 shows the overall breakdown of compliance, for both speciation and composition, by retail type. Large retailers and takeaways had the greatest rate of compliance for meat and meat products (73.7% and 72.7% respectively), when compared to other retail outlets.

Table 14: Meat Compliance by Retail Type Samples

Retail Outlet Type	Number of compliant samples	Number of non-compliant samples	Total
Internet	29	26	55
Retail - independent	86	70	156
Retail - large	42	15	57
Takeaway	16	6	22
Wholesale	6	4	10
Total	179	121	300

P2 Fish and Fish Product Speciation

The compliance rate for P2 Fish speciation was 96%.

Tables 15 and 16 summarise compliance by product type and retail type respectively. There were four non-compliant samples, and these were all foods sold as haddock. Two haddock fillets bought from takeaways and one haddock fillet from a fish seller were all identified as being cod. No haddock was detected in a smoked haddock and bacon gratin which was labelled as containing 10% haddock and 4% coley, all the fish was identified as coley. It was noted that this sample had a duplicate sample tested which did contain haddock which indicates that uneven distribution of fish in the product preparation may be the reason for this sample failure rather than substitution.

Table 15: Fish Speciation Compliance by Product Type

Product	Number of compliant samples	Number of non-compliant	Total
Cod fillets	20	-	20
Cod or Haddock fish fingers	12	-	12
Cod or Haddock fishcakes	11	-	11
Haddock fillets	17	3	20
Named species fish products	25	1	26
Plaice fillets	11	-	11
Total	96	4	100

Table 16: Fish Speciation Compliance by Retail Type

Retail Outlet Type	Number of Compliant samples	Number of non-Compliant samples	Total
Internet	1	-	1
Retail – Independent	32	2	34
Retail – Large	39	-	39
Takeaway	20	2	22
Wholesale	4	-	4
Total	96	4	100

P3 Spice and Herb Authenticity and Contamination

A total of 375 Spices and Herbs were examined for authenticity with a compliance rate of 89.6%.

A total of 150 black pepper, ginger and turmeric samples were tested for heavy metals and all were compliant. Of the 50 spice mixes tested for aflatoxins, one sample contained a level of aflatoxin B1 that exceeded the maximum limit. Table 17 summarises the compliance status by Product type.

Table 17: Spice and Herb Compliance by Product Type

Product	Number of Compliant Products	Number of Inconclusive products	Number of non-compliant products	Total
Black Pepper	50	-	-	50
Ginger	50	-	-	50
Mixed Herbs	42	-	8	50
Oregano	37	1	11	49
Sage	19	-	6	25
Spice Mix	48	-	3	51
Thyme	39	-	11	50
Turmeric	50	-	-	50
Total	335	1	39	375

There were 39 non-compliant samples and 1 inconclusive sample, giving an overall failure rate of 10.4%. Of the non-compliant samples 92% were herbs and only 8% (3 samples) were spices. The 35 non-compliant herbs samples all failed on microscopy. 25 of the samples were deemed to be not of the quality demanded due to the high proportion of extraneous plant matter present and 7 samples contained foreign matter (plastic, stones, snail shell). A further 2 samples, 1 x sage and 1 x oregano, were reported as not having plant material consistent with the named herb.

Upon evaluation by microscopy, two of the spice mixes were found to be unsatisfactory. A sample labelled as basil was found to contain only thyme and another sample was found to contain additional ingredients not declared on the label.

The inconclusive sample related to an oregano sample which showed noticeable macroscopical differences with the other oregano samples looked at. This sample coincidentally had a duplicate, which was reported as being non- compliant (not consistent with oregano). Table 18 shows that the greatest number of non-compliant samples were purchased from independent retailers.

Table 18: Spice and Herb Compliance by Retail Type

Retail Outlet Type	Number of Compliant products	Number of Inconclusive products	Number of non-compliant	Total
Internet	20	-	8	28
Retail - independent	223	1	27	251
Retail - Large	77	-	4	81
Wholesale	15	-	-	15
Total	335	1	39	375

P4 Basmati Rice and Durum Wheat Authenticity

The compliance rate for P4 Rice/Pasta was 77.5%. Of the 40 basmati rice samples, 31 contained basmati varieties and were reported as compliant and 3 cooked rice samples were reported as inconclusive as they were unsuitable for analysis due to degraded DNA, as shown in Table 19.

Table 19: Rice Compliance by Product Type

Product	Number of Compliant samples	Number of Non-Compliant samples	Number of Inconclusive samples	Total
Cooked Basmati	15	2	3	20
Prepacked Basmati	16	4	-	20
Total	31	6	3	40

Non-basmati rice varieties were detected in 3 out of 40 samples with the levels of adulteration ranging from 9% to 29%.

A further 3 samples were labelled with a specific variety of basmati rice and although they contained >95% of approved basmati rice varieties there is also a requirement to contain at least 97% of the marked variety and they did not comply with this requirement. As shown in Table 20, 5 out of the 6 non-compliant samples were obtained from independent retailers or takeaways.

Table 20: Rice Compliance by Retail Type

Retail Outlet Type	Number of Compliant samples	Number of Non-Compliant samples	Number of Inconclusive samples	Total
Internet	1	-	-	1
Retail - Independent	11	-	3	14
Retail - Large	11	1	3	15
Takeaway	7	2	-	9
Wholesale	1	-	-	1
Total	31	6	3	40

All 25 durum wheat pasta samples tested for authenticity were satisfactory.

Table 21: Pasta Compliance by Product Type

Product	Number of Compliant samples	Total
Cooked Pasta	10	10
Prepacked Pasta	15	15
Total	25	25

The samples were purchased from a range of retailers as shown in Table 22.

Table 22: Pasta Compliance by Retail Type

Retail Outlet Type	Number of Compliant samples	Total
Internet	1	1
Retail - Independent	12	12
Retail - Large	12	12
Total	25	25

P5 Undeclared Milk

A total of 140 samples were analysed for the presence of milk and 132 were deemed to be compliant. Table 23 summarises the compliance status by product type. The compliance rate for P5 Milk was 94.3%.

Table 23: Undeclared Milk Compliance by Product Type

Product	Number of Compliant samples	Number of Non-Compliant samples	Total
Dairy Alternatives: Butter	10	-	10
Dairy Alternatives: Cheese	15	-	15
Dairy Alternatives: Ice cream	10	-	10
Dairy Alternatives: Milk	15	-	15
Dairy Alternatives: Yoghurt	10	-	10
Dark Chocolate	33	6	39
Free from - Chocolate products	20	1	21
Free from - Flour Confectionery	19	1	20
Total	132	8	140

No milk proteins were detected in any of the ‘free from’ dairy alternative products. Undeclared milk was detected in 6 samples, milk, and in 1 case other allergens, may be present due to accidental cross-contact during production. The other 6 non-compliant samples either did not declare the presence of milk or milk derived ingredients or had a clear statement that the product was dairy free. 15% of the dark chocolate samples were reported as unsatisfactory with 6 out of 39 having milk protein present. A dairy free vegan truffle and a popcorn were also reported as non-compliant. Table 24 provides a breakdown of compliance by retail type.

Table 24: Undeclared Milk Compliance by Retail Type

Product	Number of Compliant samples	Number of Non-Compliant samples	Total
Internet	15	1	16
Retail - Independent	55	6	61
Retail - large	61	1	62
Wholesale	1	-	1
Total	132	8	140

All the non-compliant chocolate samples were from independent retailers (one purchased via the internet). The item from the large FBO that was non-compliant was a free from – flour confectionary product and was 1 of 3 popcorns tested.

P6 Undeclared Gluten

All 30 gluten-free flours or gluten-free flour alternatives were found to be satisfactory with respect to the presence of gluten. All the samples were purchased from Large FBOs.

Table 25: Undeclared Gluten Compliance by Product Type

Product	Number of Compliant samples	Total
Gluten Free Flour	15	15
Gluten Free Flour Alternative	15	15

Product	Number of Compliant samples	Total
Total	30	30

Duplication

Every effort was made to minimise duplication of samples however in a few cases the same product was purchased by different samplers from different locations. Sample descriptions and brand names were used to identify product duplicates in each sub project. Each sample submitted to the OLs was analysed once. Results from duplicated samples have been reviewed below. There were no duplications identified in sub projects P2 Fish, P4 Rice/Pasta or P6 Gluten.

P1 Mince and Processed Meat Composition and Speciation

Table 26: Duplicated P1 Meat Products and Compliance Status

Product	Number of distinct products	Number of Compliant samples	Number of Non-Compliant samples
Beef Ready Meal	1	2	0
Lamb Curry/Kebab	1	2	0
Lamb Mince	1	1	1
Lamb Ready Meal1	1	2	0
Total	-	7	1

Four distinct products were sampled more than once. The duplicated results for three of the products agreed. One product, a lamb mince, was reported as compliant and also non-compliant. The analytical composition of both samples was very similar and both reports identified a higher fat content than declared. The difference in compliance status is down to how the Public Analysts have undertaken labelling assessment - one considered 'typical declaration' and also compared to 'nutritional declaration' (non- compliant), the other has considered 'typical declaration' only (compliant).

One of the duplicated products was purchased from 2 different branches of a large supermarket. The other duplicate products were procured from different retailers (e.g. one from a wholesaler, the other from a large FBO).

P3 Spice and Herb Authenticity and Contamination

Table 27: Duplicated P3 Spice and Herb Products and Compliance Status

Product	Number of distinct products	Number of Compliant samples	Number of Samples Non-Compliant	Number of Inconclusive samples
Black Pepper	2	4	0	-
Ginger	3	10	0	-
Mixed Herbs	3	6	0	-
Oregano	6	10	3	1
Sage	2	3	1	-
Spice Mix	1	2	0	-

Product	Number of distinct products	Number of Compliantsamples	Number of Samples Non-Compliant	Number of Inconclusive samples
Thyme	4	8	1	-
Turmeric	9	19	0	-
Total	-	62	5	1

A total of 30 distinct products were sampled more than once as part of this sub project. This is, at least in part, a reflection of the marketplace. Even when shopping at geographically diverse independent or smaller retailers the same brands of spices/ herbs are on sale.

One oregano product that was submitted twice was reported as non-compliant against one sample and inconclusive against the other. However, both reports referred to the samples showing features not consistent with or different to other oregano samples.

Another oregano product that was submitted three times found 1 sample to be compliant but the other two were not of the quality demanded (mould spores, excessive extraneous plant material).

One thyme product was submitted three times, two samples were found to be compliant and the third to contain excessive extraneous plant material.

Whilst most sample duplications resulted in the same outcome, a number have had differing results demonstrating that quality can vary from batch to batch. Given the nature of the product and the nature of the failure (deemed to be not of the quality demanded) this is unsurprising.

P5 Undeclared Milk Allergens

Table 28: Duplicated P5 Undeclared Milk Products and Compliance Status

Product	Number of distinct products	Number of Compliant samples	Number of Non-Compliant samples
Dairy Alternatives: Butter	1	2	0
Dairy Alternatives: Cheese	2	5	0
Dairy Alternatives: ice cream	1	2	0
Dairy Alternatives: Yoghurt	1	2	0
Dark Chocolate	1	3	0
Total	-	14	0

Six distinct products were sampled more than once including a dairy alternative cheese and a dark chocolate both sampled three times. The duplicated results for all products agreed. Two of the distinct products were purchased from the same large retail outlet but from different geographical regions.

There are relatively limited choices in the marketplace for dairy alternative products as this is still quite a specialist product with a limited range of suppliers. This is likely to have been a contributing factor in the number of duplicates seen in this sub project.

Retail Surveillance Sampling Programme during Covid-19 pandemic - Conclusions

Conclusions

Consumers need to have confidence that their food is safe and what it says it is. This project undertook surveillance sampling to determine the extent of compliance of a number of food commodities throughout England, Wales and Northern Ireland during the Covid-19 pandemic which altered food supply chains and increased pressure on the supply of food.

82% of samples tested were reported as compliant for the tests carried out and therefore deemed to be safe and what it said it was.

Food Authenticity and Adulteration

The project included tests for authenticity and adulteration of meat and fish products, herbs and spices, basmati rice and durum wheat pasta. Generally, the motive for food adulteration is cost as expensive ingredients are substituted with cheaper alternatives but could also be due to poor hygiene practices which enables carry over of products during processing, Exact causes of the adulteration can only be determined by further investigation with the FBO and manufacturer.

A key finding of this project is that no horse meat was detected in any of the 300 meat samples tested. Following the 2013 horsemeat scandal measures were put in place to tighten up supply chains and these results suggest that there is no longer large-scale infiltration of horse meat into the food chain.

However, 21% of the meats tested did contain additional meat species that the consumer would not expect to find. Beef products had the lowest level of contamination with less than 5% of products containing DNA from other species. All of the burgers and ready meals sampled in this project only contained beef.

Goat can be sold at a premium price and had the highest proportion of adulterated samples with only 3 out of the 10 samples tested wholly comprising of goat meat and 4 containing no goat DNA at all.

Minced meat products are attractive targets for adulteration. The production process makes it easy to use alternative ingredients and the appearance and nature of the final product makes it difficult for the consumer to detect any malpractice. Almost 60% of lamb mince were found to contain other meats as were over 40% of pork mince samples tested.

Premium fish products such as cod, haddock and plaice have all been identified as potential commodities for substitution. Only 4% of fish products tested had different DNA to the species expected and these were all haddock samples.

The largest number of samples were taken for sub project P3 which tested 375 herbs and spices for authenticity using microscopy. 10.4% of the samples were reported as non-compliant with many of these deemed not to be of the quality demanded due to the high proportion of extraneous plant matter present. Only 4 of the samples had missing or substituted ingredients.

The intelligence for including sage samples in the sub project was based on research carried out at the Institute for Global Food Security (IGFS) at Queen’s University, Belfast which showed that just over 25% of the 19 sage samples analysed in August and September 2020 were heavily adulterated (10). This research used a tailored blend of spectroscopy and chemometric modelling to identify a food fingerprint. This method is currently not an accredited official control method and as such samples analysed for herb and spice authenticity during this project used light microscopy methods and Public Analyst expertise.

Basmati rice sells at a higher price than other rice varieties and 6 out of 40 basmati rice samples were reported as having been adulterated with either non-basmati rice varieties or with a basmati rice different to the marked variety.

Durum wheat pasta was the only commodity tested for adulteration that had 100% compliance.

Food Contamination

Some of the herbs and spices sampled were tested for the presence of heavy metals and aflatoxins. 1 sample of curry spice mix had levels of aflatoxin B1 above legislative levels. No contamination with heavy metals was detected in any of the herbs and spices analysed.

Presence of unlabelled allergens

Consumers managing food allergies have to rely on products being correctly labelled to ensure that they do not suffer allergic reactions which can be severe and, in some cases, fatal. Milk free products and gluten free flours were tested for the presence of the respective allergens.

There is increasing demand for dairy free alternatives not only by consumers managing milk allergies but also by those concerned about sustainability and animal welfare or making specific dietary choices. For those with a milk allergy it is essential that these products do not contain milk proteins.

All of the milk free dairy alternative products tested were free of milk. Milk was detected in 8 out of 140 samples with 15% of dark chocolate samples testing positive. All of the gluten free flours tested were free from gluten allergens.

Composition and labelling

The 300 meat products were tested for composition and labelling as well as speciation. It is important that food is authentic and matches its description. Food labels are a legal requirement and are crucial in delivering key information to consumers including ingredients, nutrition and allergy information so that they can make informed choices based on diet, allergies, personal / religious beliefs or cost.

23% of meats were non-compliant for composition or labelling requirements. 8% of meats had no quantitative ingredient declaration meaning that consumers were not informed of the amount of meat in the product. 8% had a meat content lower than declared and 4% had excess fat.

Retail Outlet Types

Samples purchased via the internet had the highest rate of non-compliance with around a third of the 102 samples ordered on-line not meeting all of the legislative requirements. Approximately one fifth of samples bought from independent retailers including takeaways were deemed by Public Analysts to be non-compliant. Samples bought from large retailers had the lowest level of non-compliance although around one in eight samples were still reported as unsatisfactory.

Secondary benefits to the project

This project highlights the importance of undertaking surveillance sampling in order to provide intelligence and evidence of the safety and authenticity of food and provided an excellent opportunity for the 5 OLs to work together in a co-ordinated manner.

The project led to improved collaborative working and an improved increase in the flow of information between the OLs and the FSA. It also strengthened the enforcement network by

making connections between national, regional and local knowledge. Regular communication between OLs and the FSA has enabled intelligence sharing not only with regards to this project but also other aspects of enforcement.

Retail Surveillance Sampling Programme during Covid-19 pandemic - Recommendations

Collaborative working has increased the flow of information between the OCLs and the FSA and has strengthened the enforcement network by making connections between national, regional and local knowledge.

Regular communication between OCLs and the FSA has enabled intelligence sharing not only with regards to this project but also other aspects of enforcement.

In order to maintain a robust food enforcement network OCLs need to be appropriately resourced and with the decline in samples submitted by Trading Standards this project has been a key source of income for all of the OCLs during the Covid-19 pandemic.
The 5 OCLs would welcome the opportunity to work together on future projects identified by the FSA.

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