UK Parliament POST

POSTNOTE

Number 624

# Food Fraud

Evidence suggests that food fraud continues to be an issue in the global food supply chain. This POSTnote provides an overview of food fraud, including its drivers and impacts. It discusses methods for food authenticity testing, broader strategies to prevent food fraud and potential impacts of EU exit.

## Overview

- Food fraud includes intentional adulteration and mislabelling of food for financial gain.
- It has a financial and reputational impact on businesses and may pose a health risk to consumers.
- Responsibility for preventing food fraud is spread between industry, local authorities, and government departments and agencies.
- Strategies to prevent food fraud include scientific analysis to test food authenticity, supply chain risk assessment and data-led strategies such as intelligence gathering.
- EU exit may affect UK access to food fraud intelligence networks.

## Background

A 2017 survey by the Food Standards Agency found that consumers have confidence in the UK food system and perceive it to be safe.[1,2] However, it is still vulnerable to fraud.[1] Food fraud includes intentional adulteration or mislabelling of food for financial gain.[3] Although it is difficult to quantify the impact of food fraud,[4,5] estimates of the annual global trade in counterfeit food and drink range from $6.2 billion to $40 billion.[5–9] In 2019, over £80 million of fraudulent food and drink was seized across 78 countries; however, this may only represent a fraction of global occurrences.[10,11] Food is a devolved issue, so this POSTnote focuses on food legislation and regulatory enforcement in England and Wales.

Food fraud is not a new problem.[12,13] However, modern food supply chains and manufacturing infrastructure have greatly increased opportunities for it to occur, its scale and impact.[3] Examples of high-profile cases of food fraud include the addition of undeclared horsemeat to a variety of beef products in the UK and Europe in 2013, and the presence of other ingredients (such as olive or myrtle leaves) in around one in four UK samples of oregano in 2016.[14–18]

Following the horsemeat incident, the UK Government commissioned the Elliott Review into the integrity of the UK's food supply networks.[19] This recommended standardising approaches for food authenticity testing and enhancing mechanisms to deal with food crime incidents.[19] Two notable outcomes following the review were: the establishment of the National Food Crime Unit (NFCU) in 2014 to prevent, detect and investigate food crime,[14] and the establishment of the Food Industry Intelligence Network (FIIN) in 2015.[20,21] Despite these moves, some stakeholders have suggested that the NFCU has insufficient powers and that more resources are needed for local authorities.[22–27] There are also concerns that EU exit could make the UK vulnerable to future food fraud incidents.[28–32]

## Understanding food fraud

There is no universally agreed definition of food fraud. The NFCU defines 'food crime' as "serious fraud and related criminality within food supply chains".[33] It refers to 'food fraud' as a less serious type of food crime.[34] This POSTnote uses the term food fraud to refer to the activities in Box 1.

### Commonly adulterated food

Foods that are commonly reported to be adulterated (Box 1) include herbs and spices, coffee, seafood, honey and olive oil.[35] As these products are more prone to fraud, they are generally tested for authenticity more frequently.[36] There are concerns that fraudsters may move to target foods that are subject to less rigorous controls, making fraud harder to detect.[37–39]

### Responsibilities for tackling food fraud

Public bodies involved in detecting and mitigating food fraud include local authorities, government departments and regulators. Food regulations require food businesses to ensure that their food is safe, of a quality that consumers expect, and is not labelled in a false or misleading way.[40] Laws and regulations related to food fraud are outlined in Box 2.

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**Box 1: Types of food fraud**

Activities that may be classified as food fraud include:[3,41]

- **Adulteration.** An undeclared ingredient is included in a product to lower production costs or fake its quality. In China in 2008, melamine was added to baby formula to increase its apparent protein content.[42–44]
- **Substitution.** An ingredient of high value is replaced with one of lower value. This includes dilution of liquids, for example, replacing honey with sugar-syrup or extra virgin olive oil with a lower value oil (such as nut oil).
- **Misrepresentation/mislabelling.** A product is marketed or labelled to incorrectly portray its quality, safety, species, geographic origin or freshness. For example, by claiming a product is organic when it is not.
- **Counterfeiting.** A known brand's name, packaging, recipe or food processing method is copied, and counterfeit food is presented as a legitimate product.
- **Theft.** Legitimate products are stolen and enter the market through criminal or less regulated routes.
- **Diversion.** Legitimate food meant for one market is unlawfully diverted to another, or food waste is diverted back into the supply chain. For example, waste meat offcuts may be diverted for use in processed meals.[19,45]
- **Over-run and unlawful processing.** Excess unreported product is sold, or techniques or premises used for processing are unauthorised. For example, slaughtering meat in unlicensed facilities.
- **Documentation fraud.** False documents are made and used for the purpose of selling or marketing a fraudulent product.

*Local authorities*

Primary responsibility for enforcing food safety, labelling and standards regulation (Box 2) lies with local authorities.[46] Trading standards and environmental health officers inspect food businesses, collect samples and request testing.[47] Between April 2018 and March 2019, 4996 food samples were tested for composition or labelling on behalf of local authorities in England (compared with 24,855 samples tested for hygiene).[48] Nine registered public analyst laboratories in the UK test the authenticity of food on behalf of local authorities.[49]

*Regulators*

The Food Standards Agency (FSA) is a non-ministerial department that oversees food safety and standards in England, Wales and Northern Ireland.[22] The FSA is responsible for protecting public health in relation to food and investigating food fraud incidents.[50] It also oversees the work of local authorities and provides support.[51] The National Food Crime Unit (NFCU, part of the FSA) is responsible for intelligence gathering and investigation of food crime incidents.[21]

*Government*

In England, Defra is responsible for policy and legislation on food labelling (not relating to food safety or nutrition) and composition.[52,53] It is also responsible for the Government's food authenticity research programme, which identifies risks to food authenticity and develops and validates food testing methods.[50,54] The Department of Health and Social Care is responsible for nutritional labelling and policy on food health claims (advised by the FSA).[55,56] The UK Government Chemist provides food expert opinion and has a statutory function as a referee analyst by arbitrating in any analytical disputes between a local authority and a food business operator.[57]

**Box 2: Legislation and regulation**

A range of laws and regulation contribute to preventing food fraud.[40] Food and drink is a devolved area, so policy and regulation differ across the UK. In Scotland, food regulations are overseen by Food Standards Scotland (FSS).[58,59]

**Legislation**

The majority of law relating to food in the UK is based on the Food Safety Act 1990.[60] The Act specifies offences in relation to food safety, quality and labelling. It prohibits food which is not of the nature, substance or quality that consumers would expect, and describing or presenting food in a false or misleading way.[61] Other legislation that affects the production and marketing of food includes the Animal Health Act 1981, the Consumer Protection Act 1987, and the Consumer Rights Act 2015.[60,62]

**Regulation**

Local authorities are responsible for enforcing food regulations. In England and Wales, FSA has oversight of enforcement and Defra are responsible for making regulations.[52] A full detailed overview of UK legislation relating to food and feed is given in the FSA Food and Feed Law Guide.[52] Some key UK regulations relevant to food fraud (transposed from EU regulations), include:

- The Food Information Regulations 2014 applies to all food businesses and specifies the information that must be provided on pre-packaged food products (such as best/use before dates and ingredients).[63,64] Parallel legislation exists in the devolved nations.[65]
- The General Food Regulations 2004 amended the Food Safety Act 1990 to align it with EU regulation.[66] It outlines criminal offences for breaches of certain food laws, specifying penalties such as fines and imprisonment.[67]
- The Food Safety and Hygiene (England) Regulations 2013 set out required food safety and hygiene controls throughout the food supply chain.[68,69] Similar legislation exists in the devolved nations.[70–72]

## Drivers of food fraud

Food fraud is often carried out for economic gain.[3,38] It can be carried out at different points in the supply chain, by individuals, businesses or criminal gangs. In 2019, Europol reported that an organised crime group in Germany had made approximately €8 million a year by selling sunflower oil labelled as extra virgin olive oil.[73] Some of the factors that contribute to or facilitate food fraud include:

- **Pressure on supply.** Scarcity of raw ingredients can drive prices up and increase the use of alternative ingredients in food production.[74] The concentration of retailers into global chains can cause pressure on food prices, meaning suppliers may cut corners to compete for contracts.[75]
- **Supply chain complexities.** The length and complexity of global food supply chains can lead to a lack of traceability, making food fraud harder to detect.[13,76,77]
- **Technology.** Criminals may use the internet to carry out illegal trade or pose as a legitimate business in order to infiltrate supply chains.[78]
- **Penalties.** Penalties for food-related crimes in the UK are generally lower than for other criminal activities.[76]

## Impact of food fraud

*Consumer impact*

As well as affecting consumer confidence, food fraud may pose a health risk by exposing consumers to toxic chemicals,

pathogenic bacteria, or mislabelled allergens.[79] For example, in 2016 a restaurant owner was sentenced to prison after substituting almond powder with mixed nut powder containing peanuts, resulting in the death of a customer.[80] Other impacts include loss of nutrition and inadvertent consumption of foods that are normally restricted for ethical or religious reasons.[41]

*Economic impact*

Food producers may suffer losses due to factory closure, product recalls or destruction of contaminated ingredients or products. In 2003, the finding of a carcinogenic dye (Sudan I) in UK Worcestershire sauce resulted in the recall of over 600 different product lines across Europe, to the value of £200 million.[81] Other costs may include the expense of protecting supply chains against food fraud (including authenticity testing costs). Companies may also suffer reputational damage.[82]

## Food authenticity testing

Strategies to detect and prevent food fraud broadly fall into two categories: analysis to test the authenticity of foods to verify compliance with labelling and compositional standards, and broader mitigation strategies, such as intelligence gathering.

### UK food testing

Each food business has its own approach to testing the authenticity of its products. Food retailers often have contractual agreements with suppliers that require them to carry out authenticity testing of their ingredients, and large food retailers, such as supermarkets, typically have their own routine monitoring programmes.[50,83–85] Food suppliers do not usually have the capacity to perform a wide range of authenticity testing on site. Typically, analysis is carried out in private laboratories on behalf of industry, or at public analyst laboratories on behalf of local authorities for enforcement purposes. In some cases, samples are sent to be tested at specialist laboratories elsewhere, including in Europe.[86] Testing cannot identify all forms of food fraud (for example theft).

### Analysis techniques

There are a variety of analytical techniques that can be used to test for adulterated food and drink, and often a combination of methods will be used.[87] These methods can be targeted or non-targeted (Box 3) and categorised by what is tested.

*Isotopes*

Isotopes are forms of the same chemical element but with different masses. Techniques that measure the ratio of different isotopes in a sample are typically used to examine the geographic origin of a food and can determine whether an animal or plant is likely to have come from a specific area.[88,89] For example, measuring the ratio of carbon isotopes in a sample can indicate whether an animal has been grass-fed (UK) or corn-fed (US), and hydrogen isotope ratios indicate how far from the coast an animal was reared or a plant grown.[90]

*Small molecules*

Test methods that seek to identify the presence of small molecules or chemicals can be used to confirm if a food or drink is adulterated, for example the analysis of spices to check for the presence of illegal dyes.[91–93] There are many methods and analytical instruments that can be used to identify the presence of small molecules.[13,87] These can be useful for targeted testing.

**Box 3: Targeted and non-targeted testing**

**Targeted testing**

Targeted testing looks for a pre-defined characteristic, including specific adulterants or sections of DNA.[36] For example, analysis might look for the presence of chemical residues related to a particular dye in chilli powder. Targeted testing is usually more sensitive than non-targeted methods. The main limitation is that only known adulterants can be analysed, and an adulterant will only be identified if the test is capable of detecting it in the specific foodstuff.[36]

**Non-targeted testing**

Non-targeted testing, which is increasingly being used, takes multiple measurements of a sample using a variety of techniques to obtain a sample's '(bio)chemical fingerprint'.[13] This is compared to a reference database.[94] If there are unexpected characteristics of the sample's chemical fingerprint, further investigation can be undertaken. This approach can detect anomalies in a sample without the need to specify what to test for in advance.[94] Its main limitation is that it requires comprehensive reference databases.[95]

*DNA testing*

DNA testing is used to analyse the DNA present within a food product, allowing for the identification of foreign ingredients.[94,96] The most widely used method is polymerase chain reaction (PCR), a targeted approach (Box 3), in which multiple copies of a specific piece of DNA from the animal being tested for are copied if that DNA is present. There are also non-targeted methods whereby DNA sequences are compared to a reference database to establish the exact animal or plant species present in the food.[97] DNA analysis has also been used to detect the presence of genetically-modified organisms, microbial pathogens or undeclared allergens.[38] Comprehensive reference sequence libraries are needed for DNA testing, however availability and/or access to these databases varies.[98]

### Novel technologies

Current techniques for authenticity testing require specialist laboratories.[36,87] Government and the food industry are seeking to develop quicker, cheaper and more portable methods of analysis.[99] Examples include:

- portable mass spectrometry to screen for small molecules that avoids methods involving sample preparation.[100]
- non-invasive testing methods, which can detect adulterants through food packaging.[101,102]
- advances in DNA analysis techniques to offer improved speed, accuracy and portability at a lower cost.[103–111]

## Broader mitigation strategies

### Intelligence sharing

Intelligence sharing allows for quicker identification of food fraud threats and incidents.[112,113] A number of routes currently exist for sharing information between stakeholders, including:

- The Food Industry Intelligence Network (FIIN) allows its members to share anonymised information and authenticity test results. Information sharing agreements are in place between FIIN, the FSA and FSS.[20]
- The Food Authenticity Network, which has a global membership base, provides information on food authenticity testing, fraud mitigation and news related to food fraud.[114]
- The EU Food Fraud Network and European Commission Knowledge Centre for Food Fraud and Quality provide

mechanisms for collaboration between EU countries.[115–119]
- The EU Rapid Alert System for Food and Feed is used to communicate food fraud incidents that pose health, safety and economic concerns.[120,121]

### Vulnerability assessments

Businesses can carry out vulnerability assessments to identify potential areas of fraud vulnerability in their supply chains.[122] Assessments consider factors such as the type of and demand for ingredients, the known potential for fraud of specific types of products and ingredients, and the strength of a company's food fraud mitigation strategy.[123]

### Economic analysis strategies

Some stakeholders have suggested that market data analysis (such as data on the price of ingredients and the volume of trade in certain products) could help predict food fraud occurrences and allow for earlier mitigation.[124,125] Models based on these data have successfully predicted food fraud and safety risks.[124–127] There is an increasing interest in forensic accounting; the analysis of a company's financial records for abnormalities indicating fraud.[128–130]

## Impacts of EU exit

The FSA has said that there is no evidence to suggest the UK will be at more risk from food crime after the transition period.[131] However, some stakeholders have raised concerns that EU exit may impact the UK's vulnerability to food fraud.[31,132,133] The FSA, FSS and Defra are currently reviewing legislation to ensure it will remain effective in the UK after the transition period.[134–136] The NFCU has been granted additional funding to develop its counter fraud capability by 2021.[137,138]

### Intelligence and information sharing

There is uncertainty over both the extent of UK access to EU intelligence networks and collaboration between the EU and UK on future food fraud issues following Brexit. The Local Government Association have said that continued access to EU intelligence networks is of vital importance.[28,139]

### Checks on foods imported into the UK

Currently, while food from the EU can be imported into the UK with no border checks, a large proportion of non-EU goods intended for the UK are checked and processed at EU ports.[29,140] After the transition period, foods imported into the UK will need to be checked and processed at UK borders. In February 2020, the Government confirmed that import controls will be introduced on all EU goods, including food.[141] A 2018 Lords EU Committee inquiry concluded that if EU food imports are subject to the same border checks as non-EU food imports, the UK would not have the capacity to meet the increased demand.[29] In its response, the Government said that checks on goods from the EU could be minimal and committed to ensuring borders have the resources to manage increased activities.[142] Some stakeholders have raised concerns that insufficient checks at borders could mean that fraudulent foods go undetected.[31]

### UK testing capacity

The number of official laboratories for testing has declined in the UK over the past 10 years, partly due to a reduction in the number of samples submitted for testing, raising concerns about the UK's capacity to meet potential increases in demand for testing.[86,143] Stakeholders have questioned whether the UK would have the same level of access to EU labs for specialist testing.[144] A 2018–19 FSA-commissioned review of official laboratories concluded that laboratory capability and capacity was sufficient for day 1 of EU Exit.[86,144] Official control labs could resolve some of the potential gaps that the review highlighted by accessing laboratories in their wider network, including private UK facilities and overseas partner labs.[144,145]

## Barriers to tackling food fraud

The lack of a globally agreed definition for food fraud makes it difficult to assess the scale of the problem and generate global statistics on its impact, [115,146–148] though a number of organisations are developing internationally agreed definitions. The European Committee for Standardization (CEN) published definitions of food fraud and related terms in 2019.[149–151] Other barriers relate to authenticity testing and enforcement.

### Cost and availability of testing

Many authenticity testing methods require specialist instrumentation and skills, which can be a significant cost for industry and local authorities.[152–154] Local authority funding for food authenticity testing has fallen in the last 5 years, resulting in a reduction in testing.[22] There are also scientific challenges in moving from targeted to non-targeted methods for food authenticity testing (Box 3).[155] Comprehensive chemical fingerprint databases are needed for non-targeted methods. However, the chemical fingerprints of foods can vary depending on factors such as seasonal variation.[156] There are currently no official standards for developing and validating non-targeted testing methods, and there is difficulty in obtaining reference material samples to build databases.[95,155,157]

### Coordination between regulators

The enforcement system for food regulations is split between multiple bodies, including local authorities and regulators. A review for the FSA highlighted that it is complex and fragmented, with no central accountability.[145] The NFCU currently relies on law enforcement agencies to act on fraudulent activity.[22] It is working towards securing powers to carry out additional investigations.[158,159] Local authorities typically treat food fraud incidents as food safety-related offences rather than fraud, sometimes due to a lack of evidence that a person intended to commit fraud.[25] While most consider current legislation fit for purpose, some suggest that the Fraud Act 2006 could be better applied to food fraud incidents.[25]

## Future directions

The FSA has highlighted four key action areas for the food system in the UK: improving national co-ordination, sustaining national capability, reviewing options for long-term resourcing, and evaluating the role of public analyst laboratories.[160] Many stakeholders suggest that tackling food fraud requires a more joined-up approach.[159] Some have also advocated for more of a focus on behaviour change interventions to tackle food fraud (such as reducing the motivation to commit it).[161–163]

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