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What is food fraud?

- Documented for over 200 years!

- What has changed?
  - The sophistication of methods used to commit fraud.
What is food fraud?

- At present there is no statutory or unambiguous definition of **food fraud/EMA** (Economically Motivated Adulteration). A comprehensive definition generally used by different bodies is from the *Food Fraud Initiative* of Michigan University.

- “Food Fraud: a collective term encompassing the **deliberate and intentional substitution, addition, tampering** or **misrepresentation** of food, food ingredients or food packaging, **labeling**, product **information** or false or **misleading statements** made about a product for **economic gain** that could impact consumer **health**” (Spink, J. & Moyer, DC (2011) Journal of Food Science, 76(9), 157-163)

- Food fraud undermines **product authenticity**, namely: its **origin**, **quality** (PDO, PGI) and **biological characteristics** (species, varieties, races)
What is food fraud?

- Key Characteristics

- Non-compliance with food law and/or misleading the consumer
- which is done intentionally
- for reasons of financial gain
What is food fraud?

Types of food fraud

- Adulteration/Dilution/ replacement
  - Substitution with an alternate ingredient (this can include misrepresentation of geographic, botanical, varietal, or animal origin; or the additional of a non-food grade substance. A component of the finished product is fraudulent.

- Counterfeiting/Concealment
  - To give a deceptive appearance of authenticity in whole or in part, of substances that are different in quality and quantity. Intellectual Property Rights (IPR) infringement. Copies of popular foods not produced with same food safety assurances.
What is food fraud?

- **Types of food fraud**

  - **Artificial enhancement/Substitution** of perceived quality *(with substances that increase apparent protein content, enhance color, or increase organoleptic qualities)*
  
  - **The use of non-declared, unapproved, or banned biocides** *(such as antibiotics, preservatives, or anti-fungal agents)*;
  
  - **Misrepresentation of nutritional content**
  
  - **Fraudulent labeling claims** *(such as organic, halal, cage-free, etc.)*;
  
  - **Removal of authentic constituents** *(Removal of nonpolar constituents from paprika (for example, lipids and flavor compounds) to produce paprika-derived flavoring extracts).*
What is food fraud?

Types of food fraud

- Alteration/Tampering
  - Change the chemical-physical and/or organoleptic characteristic of a product, due to spontaneous degenerative processes or to poor management or conservation e.g. changed expiry information.

- Formulation of an artificial product through the use of multiple adulterants and techniques.

- Theft
  - Legitimate product is stolen and passed off as legitimately procured

- Over-run and unauthorized production

- Fraudulent certificates of analysis / audit results
What is food fraud?

- There is fraud when the product:
  - Does **not** comply with legislation
  - Does **not** reflect the description on the label
  - Does **not** contain the « correct » ingredients
  - Is **not** obtained according to the « correct » process
  - Does **not** come from identified geographies
  - Does **not** match the typical organoleptic characteristics
Top 10 adulterated products

- EU Committee on the Environment, Public Health and Food Safety; DRAFT REPORT

**TOP 10 PRODUCTS THAT ARE MOST AT RISK OF FOOD FRAUD**

1. OLIVE OIL  
   (origin, mixing with other oils)

2. FISH  
   (species, quality, fresh vs frozen-thawed, wild vs farmed)

3. ORGANIC FOODS  
   (origin, type, dilution, melamine)

4. MILK  
   (basmati rice, durum vs tender wheat in pasta, GMO)

5. GRAINS  
   (sugars added, origin)

6. COFFEE & TEA  
   (arabica/robusta, origin and varieties, grass cuttings)

7. SPICES  
   (safron origin, chilli coloured with illegal dyes)

8. WINE  
   (origin-PGI)

9. FRUIT JUICES  
   (diluted, 100% declared fruit)
Types of products

- Ordinary flour as organic flour
- Battery cage eggs as organic eggs
- Road salt as food salt
- Horsemeat as beef
- Methanol-contaminated alcohol in spirits
Food fraud is a **global problem**

Food fraud is a **growing phenomenon**

10% of produced **food** is suffering from food fraud phenomena

- More and more complex food supply chains
- **Economic crisis**
- Increasing pressure to commit food fraud
Impact of food fraud

- Information available **within minutes**
- Heightened **media attention**
- Improved **detection systems**
- More **whistleblowers**
- Better **traceability**
- Increased **incidents**
- Growing **Google searches!**
Impact of food fraud

- Damage to consumers’ economic interest
- Decline in consumers’ confidence
- Overall economic damage
- Risk to public health
- Brand damage
Impact of food fraud

- **Food Adulteration Cost / Brand Damage Cost:**

  «*Food product counterfeiting worldwide is currently worth an estimated $1.7 trillion*»
  according to Roger Sexton
  (source: undercurrentnews, 2015; BGFC executive chairman)

  «*Economic adulteration and counterfeiting of Global Food & Consumer Products cost industry $10 - 15 billion per year*»
  (source: atkearney.com, 2009; according to Grocery Manufacturers Association & ATKearney Research)

  **$49 billion (US)**: Annual estimated cost of food fraud to the world economy due to the joint effort required by industries across the food supply chain and governments to face and treat food fraud

  Source: The implications of Food Fraud, july 2013: The Growing Global Epidemic of Food Fraud. NSF International;
Food fraud lessons

- **Supervisory bodies** and **distributors** are paying **increasing attention** to **food fraud**

- **New Certification** standards and requirements

- **Public opinion** is attentive to food authenticity in terms of consumer health and economy
  - food safety
  - consumers' economic interest

- **Manufacturers and Retailers** to protect their own brands and organizations.
European legislation is constantly evolving to prevent and/or punish food fraud to the detriment of the consumer:

- **Hygiene package 193/06 and reform 2013** - food traceability
- **EU Reg. 1169/2011** - product labeling
- **Quality Package 1151/2012** - *ex officio* protection

South Africa legislation

- Foodstuffs, Cosmetics and Disinfectants Act (Act 54 of 1972) including labelling regulations R146/2010 as amended – traceability
- Draft Geographic indications regulations were circulated for comment in 2016,
- Agricultural Products Standards Act 119/1990
Certification standards have evolved to meet global, economic, social and health needs to prevent food alteration.

New certification standards include sections entirely devoted to the control of product authenticity and to the actions to be taken to prevent food fraud.

- BRC7
- FSSC 22000
- IFS
- ...
Explicit intent of BRC version 7 is to protect food authenticity and prevent/reduce food fraud.

5.4 AUTENTICITÀ DEL PRODOTTO, DI CHIARAZIONI E CATENA DI CUSTODIA

BRC7 Requisites

5.4.1 … to access information on historical and developing threats to the supply chain which may present a risk of food fraud

5.4.2 … a documented vulnerability assessment shall be carried out on all food raw materials

5.4.3 … Where raw materials are identified at risk, appropriate assurance and/or testing to reduce the risk
Food Fraud Mitigation Plans

- Vulnerability assessment - identification and assessment of vulnerable ingredients and supply chains
- USP - Food Fraud Mitigation Guidance (FFMG), published in 2015 in the Third Supplement to the *Food Chemicals Codex* 97
- 9 Contributing factors
- [www.foodfraud.org](http://www.foodfraud.org)
Food Fraud Mitigation Plans

- **Supply chain:**
  
  *What is the degree of vertical integration in the supply chain for a particular ingredient, or are purchases made on the open market?*

- **Audit strategy:**
  
  *Is there a robust, onsite audit strategy with anti-fraud measures, or a less mature audit strategy without targeted anti-fraud measures?*

- **Supplier relationship:**
  
  *Is the supplier relationship established and trusted?*

- **History of regulatory, quality, or safety issues with a supplier**

- **Susceptibility of quality assurance methods and specifications**
  
  *Are quality assurance methods and specifications specific and effective for a range of potential adulterants?*
Food Fraud Mitigation Plans

- **Testing frequency:**
  
  *Is every lot tested by the buyer, is testing conducted intermittently, or is there reliance only on Certificates of Analysis?*

- **Geopolitical considerations:**
  
  *Is the ingredient sourced from, or does it travel through, a geographic area with political, food safety, or food security concerns?*

- **Fraud history:**
  
  *Is there a high volume of known and documented food fraud incidents in the ingredient?*

- **Economic anomalies:**
  
  *Are there supply pressures, pricing discrepancies, or other economic factors that may increase the incentive for fraud in the ingredient?*
**Detection Methods**

- **Biological Methods**
  - ELISA
  - PCR
  - DNA sequencing

- **Physico-chemical Methods**
  - Regular Spectroscopy with or without chromatography for targets
  - NMR Spectroscopy

- **IRMS**
  - Isotope Ratio

- **High Resolution MS**
  - TOF technologies non-targeted approach

- **Microscopy**
  - SEM

- **Non-targeted approach** – combination of lab-based methods with statistical software to determine if sample falls within expected parameters

- Detection of **wide range adulterants**

- Profile for both **authentic and non-authentic** adulterants developed
Conclusion

FIGHTING FRAUD AND ADULTERATION WILL REMAIN A RACE BETWEEN THE CRIMINALS COMMITTING FRAUD AND THE SCIENTISTS DEVELOPING NEW METHODS TO UNCOVER THEM.

Prevention starts with:

- Practical vulnerability assessment tools
- Innovation in analytical methods
- Novel approaches to data analysis/sharing
- Daily in your role as a Food Scientist/Food Technologist
References

- White Paper Food Authenticity and Food Fraud – Merieux Nutrisciences
- The Food Fraud Combat Triumvirate: Vulnerability, Management, Market Intelligence, and Detection Methods - Food Quality Magazine Issue 03/July 2016