

### GLOBAL FOOD REGULATORY SCIENCE SOCIETY

GFoRSS is a Disciplinary Organization of IUFoST, devoted to Food Regulatory Science



GFoRSS Capacity Building Program Food Fraud: State of the Art and Key Challenges Conducting a Hazard Analysis for Food Fraud – Beyond Regulatory Alerts Karen Everstine, PhD MPH

> May 24-25, 2022 Virtual Event

### A Trusted Partner in the New Food Economy

We make it easier to keep the food supply chain safe, compliant, and transparent.

FOODCHAIN (ID)®

Seeing Food Clearly





- Hazard analysis including food fraud
- Development of a food fraud program
- Data sources to inform fraud risk
- Food Fraud Database statistics
- Specific commodity examples
- The cost of food fraud
- The future of food fraud prevention

# What is Food Fraud? (GFSI)



- Sunflower oil partially substituted with mineral oil
- Hydrolyzed leather protein in milk



# What is Food Fraud? (FFD)

Fraud Type	Definition
Dilution or substitution	Partial or full substitution of foods or food ingredients in any form (whole fillets, liquid, ground, powdered, etc.) with the intent to increase weight or volume (misrepresentation of geographic, botanical, animal, or varietal origin)
Artificial enhancement	The addition of a substance to artificially improve perceived quality through color, nutritional content, or organoleptic qualities (added for functional effect)
Undeclared, unapproved or banned biocides	Fraudulent use of unapproved pesticides, antibiotics, fungicides, or other biocides or preservatives during production
Misrepresentation of nutritional content	Fraudulent mislabeling of nutritional content, especially related to foods consumed by vulnerable populations
Fraudulent labeling claims	Misrepresentation of a label attribute that implies a particular production technique
Removal of authentic constituents	Removal of a component of an ingredient or food that characterizes and authenticates it
Multiple/other types	Creation of an entirely fraudulent product; intellectual property infringement, etc.



### Hazard Analysis

Seeing Food Clearly



### Food safety hazards:

- Biological (bacterial, viruses, parasites)
- Chemical (mycotoxins, pesticides, vet drugs, etc.)
- Physical
- Allergens
- Radiological
- Fraud

### Hazard Analysis in Various Food Safety Frameworks





# **Development of a Food Fraud Program**





### Food Fraud Vulnerability Assessment



Source: https://www.usp.org/sites/default/files/usp/document/our-work/Foods/food-fraud-mitigation-guidance.pdf



- Media reports
- Government reports/alerts
- Recalls
- Scientific Literature
- Trade Associations
- Etc.



Recherche par mot clé

POLITIQUE ECO ET BUSINESS SOCIÉTÉ SPORT CULTURE SANTÉ OPINIONS PERSONNALITÉS DOS

### Contrefaçon : une usine de fabrication de faux miel démantelée à Bafoussam

Publié le 29.03.2022 à 10h10 par Esther Fossi

Partager 🔰 f 8 🖂 🕥



Elle a été découverte par les éléments du bureau spécial de recherches et enquêtes criminelles de cette ville.

Il devient risquer de consommer du miel dans la ville de Bafoussam, dans la région de l'Ouest au Cameroun. D'après nos confrères de Canal 2 International, une usine de fabrication de faux miel a été découverte au quartier Ngouache 1 à Bafoussam. Elle était dissimulée dans une ferme avicole.

Vendu entre 2500 et 3000 F CFA le litre, ce miel impur était fait à base du sucre en poudre déversé en quantité dans des marmites d'eau bouillante.



- Media reports
- Government reports/alerts
- Recalls
- Scientific Literature
- Trade Associations
- Etc.

#### NOTIFICATION 2022.2484

Unauthorised color Sudan II (CAS 3118-97-6) Sudan III (CAS-85-86-9) and Sudan Red G (CAS 1229-55-6)

notified 28 APR 2022 by 🔤 Latvia | last update 28 APR 2022 🤡 EC validated

Reference	2022.2484	
Subject	Unauthorised color Sudan II (CAS 3118-97-6) Sudan III (CAS-85-86-9) and Sudan Red G (CAS 1229-55-6)	
Notification type	Food	٥
Notification basis	Border control - consignment released	٥
Classification	Information notification for attention	٥
Risk decision	Serious	٥

#### Risk

Risk decision	Serious	٥
Hazards observed	Not defined	٥
Nb. persons affected		٥
Symptoms / Illness	Unknown	٥



Notification de	etails - 2008.1180					Notification d	letails - 2008,1283				
	illegal	import of milk drink contain	ing melamine (25.6 mg/kg - )	opm) from China			melamine (153	; 259 mg/kg - ppm) in choc	olate and strawberry flavour	body pen sets from China	
Reference:	2008.1180	Notification type:	food - information - o	ficial control on the market		Reference	2008.1283	Notification type	food - information -	official control on the market	
Notification date:	03/10/2008	Action taken:	no stock left	no stock left			17/10/2008	Action taken:	withdrawal from the	withdrawal from the market	
Last update:	14/10/2008	Distribution status	distribution restricted	to notifying country		Last update:	12/11/2008	Distribution status	distribution restricter	d to notifying country	
Notification from:	Austria (AT)	Product	milk drink			Notification from:	United Kingdom (GB)	Product:	chocolate and straw	berry flavour body pen sets	
Classification	information	Product category:	milk and milk product	5		Classification	information	Product category:	confectionery		
Risk decision	undecided	Published in RASFF Consumers' Portal	has never been publi	shed		Risk decision	undecided	Published in RASFF Consumers' Portal	has never been pub	lished	
Follow-up :						Follow-up :					
Reference	Follow-up from	Date	Follow-u	o type	Info	Reference	Follow-up from	Date	Follow-up type		Info
inf01	Austria	14/10/2008	outcome o	f investigations		inf01	Canada	22/10/2008	follow-up from non-m	iember country	
						add01	United Kingdom	24/10/2008	outcome of investiga	tions	
Hazards						add02	Spain	12/11/2008	outcome of investigat	tions	
Substance / Hazard	Category		Analytical result	Units	Sampling date	Hazards					
illegal import	adulteration / fr	raud			22/09/2008	Exherence / Married	Catalogy		Application and	Inite	Campling data
melamine	industrial conta	aminants	25.6	mg/kg - ppm	22/09/2008	melamine	industrial cont	aminants	153: 259	maka - nom	03/10/2008

Source: Food Fraud – A Global Threat with Public Health and Economic Consequences (2021). Elsevier. Chapter 3 – "Food fraud mitigation: strategic approaches and tools." <u>https://www.sciencedirect.com/book/9780128172421/food-fraud</u>



- Media reports
- Government reports/alerts
- Recalls
- Scientific Literature
- Trade Associations
- Etc.



### Contents lists available at ScienceDirect

journal homepage: www.elsevier.com/locate/foodcont



CONTRO CONTRO CONTRO CONTRO

The detection and determination of adulterants in turmeric using fourier-transform infrared (FTIR) spectroscopy coupled to chemometric analysis and micro-FTIR imaging

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<sup>c</sup> Institute for Global Food Security, The Queen's University of Belfast, BElfast, BET9 5DL, Northern Ireland, UK
<sup>d</sup> Green Saffron Spices Ltd, Ireland

ABSTRACT

A R T I C L E I N F O Keywordz: Turmeric Spectroscopy Fraud Aduleration Spices Survey

Like many herbs and spices, turmeric is at risk of fraud due to its high commercial value and soaring consumer demand. Turmeric powder in particular is prone to adulteration; therefore, fast and robust screening methods are required to detect this fraud. In the present study, both Fourier transform infrared (FTIR) coupled with chemometric analysis and micro-FTIR imaging have been successfully used to correctly identify authentic and spiked samples of turmeric. In terms of performance, 100% of typical turmeric in the validation set were predicted correctly. In relation to correct classification of the spiked samples, 98.75% were classified correctly as atypical, against the 2-class and multiclass models. For the micro-FTIR imaging method, selectivity was 0.94 for authentic samples and ranged from 0.6 to 1 for spiked turmeric samples. A survey of commercial turmeric samples was undertaken and the results from the FTIR analysis revealed that 20% of the samples were study and the results demonstrated a good correlation between the two spectroscopic methods, with 80% of the samples returning the same result in both methods. The results demonstrate that spectroscopic methods, with 80% of the samples returning the tarmeric powder. Additionally, the results from the survey highlight the fraud problem in turmeric and demonstrate the need for reliable, rapid and robust screening methods to tackle this problem.

#### 1. Introduction

Turmeric (*Curcuma longa* L.), a rhizomatous herbaceous perennial plant, is a member of the *Zingiberacea* family and is often called "Indian Saffron". It originated in Southeast Asia and has been in use over 6000 years (Nair, 2013). Currently it is in use for culinary, medical and cosmetic purposes, because of its nutritional, organoleptic and phar-

#### latent fingerprints (Garg et al., 2011).

Turmeric is classified as a natural food additive used to flavour and colour foods such as pickles, mayonnaise, beverages, butter and is a principal ingredient in curry (Spices Board India, 2015). India is the largest consumer, producer and exporter of turmeric; turmeric production in India was over one million metric tons in 2021. In 2017, USA consumers spent over \$42M on turmeric food supplements, an increase



# Record Types

Incident			
<ul> <li>Documented occurrence</li> <li>Contextual information</li> <li>Geographic information</li> </ul>	<ul> <li>Probable knowledge</li> <li>Inferred from published research</li> <li>Subject matter expertise</li> </ul>	<ul> <li>Food product sampling</li> <li>Percentage out of specification</li> <li>Geographic information</li> </ul>	<ul> <li>Analytical methods research</li> <li>Testing range, LOD</li> </ul>



# Data Summary – Food Fraud Database



FOODCHAIN D<sup>®</sup>

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### Global Distribution of Food Fraud Incidents





### Food Fraud Database Records

### Commodity Groups, 2012-2021





© FoodChain ID 2021 PAGE 17

### Food Fraud Database Records Fraud Types (2012-2021)



Source: https://www.foodchainid.com/food-fraud-database/



### Hazard Classification



### **48%** of records associated with at least one potentially hazardous adulterant (N=5085)

Source: Everstine, K., E. Abt, D. McColl, B. Popping, S. Morrison-Rowe, R.W. Lane, J. Scimeca, C. Winter, A. Ebert, J.C. Moore, and H.B. Chin. Development of a Hazard Classification Scheme for Substances Used in the Fraudulent Adulteration of Foods. *J. Food Prot.* 2018 Jan; 81(1):31-36.



### Food Fraud Examples



FOODCHAIN D<sup>®</sup> Seeing Food Clearly

# China melamine incident

"One journalist described what a rural milk merchant routinely added to a 10-ton truckload of milk: 5-7.5 kg of "protein powder" which included melamine or other protein-enhancing substances, 6-7 bottles of hydrogen peroxide, 20-30 packages of gentamicin (an antibiotic), 4-5 ml. of vitamin C, 10-15 kg of whey powder, 2-2.5 kg of fat, and sometimes sulfuric acid which he stirred in with a rake (Xu). The truck driver kept a bottle of hydrogen peroxide under the driver's seat to add surreptitiously before the milk was tested."



Reference: Supply Chain Issues in China's Milk Adulteration Incident. Fred Gale and Dinghuan Hu. Contributed Paper prepared for presentation at the International Association of Agricultural Economists' 2009 Conference, Beijing, China, August 16-22, 2009.



### Melamine as a "protein" enhancer

#### DETERMINAZIONE DELLA MELAMMINA **AGGIUNTA ALLE FARINE DI ORIGINE ANIMALE.**

P. CATTANEO - C. CANTONI

#### IDENTIFICATION AND DETERMINATION OF MELAMINE IN ANIMALS MEALS

Sono riportati i metodi qualitativi e quantitativi in grado di svelare la presenza di melammina aggiunta intenzionalmente alle farine di origine animale destinate all'alimentazione del bestiame.

Gli amminoplasti, o le materie prime base per la loro produzione (urea, tiourea e melammina), possono essere aggiunti alle farine di carne e di pesce, a scopo fraudolento, per aumentarne il contenuto in azoto e quindi quello proteico.

In un lavoro pubblicato precedentemente (Grieco e Cantoni, 1977) avevamo descritto una metodica atta ad individuare la presenza di amminoplasti, basata sulla determinazione della formaldeide che, in combinazione con urea e tiourea dà annunto origi

del contenuto proteico delle farine del 4.19%, 8.31%, 12,5%, 16,69% e 20,81%.

Le metodiche da noi messe a punto sono di ordine qualitativo e quantitativo. Le prime si basano sulla sublimazione della melammina dalla farina riscaldata a 250°C in bagno ad olio, sulla sua precipitazione sulla superficie esterna di un « dito freddo » e sulla identificazione dopo reazione con ac. picrico o con ac. ossalico o con ammoniomolibdato.

La determinazione quantitativa si esegue allo spettrofotometro leggendo la d.o. di un estratto di farina all'U.V. (236 nm).

Qui di seguito sono riportati in dettaglio, le modalità d'esecuzione delle analisi, le prove eseguite ed i risultati ottenuti.

Identificazione della presenza di melammina in farine di origine animale

### PRESENZA DI MELAMMINA IN FARINA DI PESCE F. CATTANEO - C. CANTONI MELAMINE ON THE PRESENCE OF MELAMMINA IN RISULTATI FISH MEALS AA Nella tab. 1 sono riportati i risultati ottenuti dall'esame di 25 campioni. La presenza di melammina è stata riscontrata nel 56% dei campioni di farina di pesce esaminata. Il metodo da noi proposto nel TAB. 1 - Contenuto in melammina di farine 1979 si è rivelato estremamente efficace per di pesce analizzate. la identificazione del composto azotato.

Gli amminoplasti possono venire aggiunti alle farine di carne o di pesce o scopo fraudolento per aumentare il tenore in azoto e perciò quello proteico. In lavori pubblicati precedentemente

% melammina	% aumento di N	% aumento di proteine	
1,25	0,83	5,24	
1,67	1,11	7,00	
2,13	1,42	8,92	
2.25	1 50	0.43	÷.,



# Vulnerability in spices



- High value
- Long, complex supply chains
- Shelf-stable
- Physical form ground
- Quality attributes (color)

Everstine, K. Supply Chain Complexity and Economically Motivated Adulteration. In: *Food Protection and Security - Preventing and Mitigating Contamination during Food Processing and Production*. Shaun Kennedy (Ed.) Woodhead Publishing: 26th October 2016. Data source: Food Standards Agency of the U.K. National Archives and The Guardian.



# Vulnerability in spices

**Turmeric Powder** 

**Origin: Bangladesh** 

(Southern Foods USA Inc.)

**Contains:** 

**Lead Chromate** 

Lead 146.0 ppm Chromium 30.0 ppm

Chromate Test = positive (Indian Standard 3576 : 2010)



### "Best" Sample of 2013!

#### **Origin: Pakistan**

Contains: Sudan I > 300 PPM (CFIA) (427 PPM Oct. 2014)

Sudan IV > 300 PPM (CFIA)

Trace amounts of: Rhodamine B Auramine O Orange II Dimethyl Yellow Fast Garnet GBC Metanil Yellow Malachite Green

Update Aug. 2014...

Curcumin = 147.0 ppm (CFIA) Demethoxycurcumin = 54.1 ppm (CFIA) Bisdemethoxycurcumin = 55.1 ppm (CFIA)



Courtesy: Tom Tarantelli, Retired (New York State Department of Agriculture & Markets Food Laboratory)



### Public health risks

Practice Full Report





# A Spoonful of Lead: A 10-Year Look at Spices as a Potential Source of Lead Exposure

Paromita Hore, PhD, MPH; Kolapo Alex-Oni, MPH; Slavenka Sedlar, MA; Deborah Nagin, MPH

January/February 2019 • Volume 25, Number 1 Supp

www.JPHMP.com S63

"A total of 1496 samples of more than 50 spices from 41 countries were collected during investigations of lead poisoning cases among New York City children and adults and local store surveys. More than 50% of the spice samples had detectable lead, and more than 30% had lead concentrations greater than 2 ppm."



### Health risks of adulterated spices

Commentary

### Ground Turmeric as a Source of Lead Exposure in the United States

Whitney Cowell, MPH<sup>1</sup>, Thomas Ireland, PhD<sup>2</sup>, Donna Vorhees, ScD<sup>1</sup>, and Wendy Heiger-Bernays, PhD<sup>1</sup>

"...turmeric containing excessive concentrations of lead is available for purchase in US grocery stores and that childhood lead-poisoning cases attributable to consumption of contaminated turmeric have occurred in the United States."

Public Health Reports 2017, Vol. 132(3) 289-293 © 2017, Association of Schools and Programs of Public Health All rights reserved. Reprints and permission: sagepub.com/journalsPermissions.nav DOI: 10.1177/0033354917700109 journals.sagepub.com/home/phr



Public Health



### Lead in Turmeric

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#### Detection and Estimation of Lead in Curcuma Longa Bulbs (Turmeric) by Atomic Absorption Spectrophotometry

AZHAR M. SYED, M.QADIRUDDIN AND ATAULLAH KHAN PCSIR Laboratories, Karachi-39, Pakistan.

(Received 7th July, 1985, Revised 16th March, 1986)

Summary:Lead has been detected and estimated in turmeric by Atomic Absorption Spectrophotometry. The solutions for analysis were prepared by sulphated-ash method and the absorptions were measured against standard solutions of lead in a concentration of 20 ug/ml. The pure sample of curcuma longa bulbs were analysed for lead contents in the inner portion (matrix) and outer portion (cuticle) of the roots. The so called adulterated samples in which lead contents are very high were purchased from the market.

#### Introduction

Lead is known to be a cumulative poison which is slowly and incompletely absorbed from the gastrointestinal tract but excreted even more slowly [1]. Due to this reason lead poisoning is usually chronic. Lead is not an essential constituent of any living organism. If a person is exposed to lead poisoning, the lead is stored in the tissues, espeically in the bones.

The symptoms of acute poisoning are intense thirst, a metallic taste in the mouth, a burning abdominal pain, vomiting, diarrhoea, black stools, oliguria and coma. In young children, it is indicated by anorexia, constipation, headache, weakness, the development of a blue line on the gums, and anaemia [2].

Lead in food is controlled by the lead in Food Regulations, 1961 which restricts the amount of lead in food to 2 ppm with the exception of certain foods and drinks tabulated in the of lead in turmeric is well known and is supposed to occur due to two reasons.

i. The actual presence of lead in the roots is either due to uptake of lead from the soil and water; or

ii. due to external treatment of turmeric for colouring and polishing by lead chromate.

Qin et al. [4] have detected various trace elements in Chinese herbal medicinal plants by the Energy Dispersive X-ray methods. They have also reported the presence of lead in Curcuma longa bulbs.

The contaminated turmeric powder by  $PbCrO_4$  has been analysed for lead

by Hartman and Divakar [5]. The basis of test was the production of blue perchromic acid. This colour was more stable at O°C than at room temperature.

## **Oregano adulteration**

	Contents lists available at ScienceDirect Food Chemistry	FOOD CHEMISTRY
ELSEVIER	journal homepage: www.elsevier.com/locate/foodchem	The second of

#### A comprehensive strategy to detect the fraudulent adulteration of herbs: The oregano approach



#### Connor Black, Simon A. Haughey\*, Olivier P. Chevallier, Pamela Galvin-King, Christopher T. Elliott

Institute for Global Food Security, Advanced ASSET Centre, School of Biological Sciences, Queen's University Belfast, Northern Ireland, United Kingdom

#### ARTICLE INFO

ABSTRACT

Article history: Received 2 February 2016 Received in revised form 20 April 2016 Accepted 1 May 2016 Available online 3 May 2016

Keywords: Oregano Authenticity Adulteration Fourier transform infrared High resolution mass spectrometry Biomarkers

Fraud in the global food supply chain is becoming increasingly common due to the huge pro ated with this type of criminal activity. Food commodities and ingredients that are expensive a of complex supply chains are particularly vulnerable. Both herbs and spices fit these criteria pe yet strategies to detect fraudulent adulteration are still far from robust. An FT-IR screening m pled to data analysis using chemometrics and a second method using LC-HRMS were developed latter detecting commonly used adulterants by biomarker identification. The two tier testin was applied to 78 samples obtained from a variety of retail and on-line sources. There was 1 ment between the two tests that over 24% of all samples tested had some form of adulterants p innovative strategy devised could potentially be used for testing the global supply chains for many different forms of herbs.

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Table 2Results from the oregano survey.		
Oregano Survey	UK/Ireland <sup>a</sup>	Internet/Other <sup>b</sup>
Samples Tested	53	25
Samples Adulterated	13	6
Samples Adulterated %	24.5	24
Level of Adulteration <sup>c</sup>	~30 to >70%	~30 to >70%
Most Common Adulterants	1. Olive leaves	1. Olive leaves

2. Myrtle leaves

<sup>a</sup> Includes Retail and Service Sector.

<sup>b</sup> Includes Amazon, Ebay and Purchases made abroad.

<sup>c</sup> Based on scores from chemometric analysis.

Black, C., Haughey, S. A., Chevallier, O. P., Galvin-King, P., & Elliott, C. T. (2016). A comprehensive strategy to detect the fraudulent adulteration of herbs: The oregano approach. Food Chemistry, 210, 551–557. doi: 10.1016/j.foodchem.2016.05.004



2. Myrtle leaves

# Olive leaves in Oregano

(ID)

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M. BONONI and F. TATEO\*

**LC-ESI-MS/MS IDENTIFICATION OF OLEUROPEIN** 

AS MARKER OF OLEA EUROPAEA L. LEAVES

**USED AS A BULKING AGENT** 

IN GROUND OREGANO AND SAGE

Dipartimento di Produzione Vegetale, Facoltà di Agraria, Università degli Studi di Milano, Via Celoria 2, 20133 Milano, Italy \*Corresponding author: Tel. +39 02 50316540, Fax +39 02 50316539 email: fernando.tateo@unimi.it

Ital. J. Food Sci., vol. 23 - 2011



### Honey Identity Standard

- USP Food Chemicals Codex
   (https://www.foodchemicalscodex.org/)
- Specifications and methods to ensure authenticity
- Account for natural variability
- Appliable to business-to-business relationships
- Companion document: Honey Fraud Mitigation Guidance in development

See also: <u>https://foodsafetytech.com/column/why-is-honey-fraud-</u> such-a-problem/

# Peanut in Soy Lecithin

Date ↓₹	Commodity group ↓†	Commodity ↓†	Country of origin ↓↑	Reason for notifying	Notified by ↓î	Hazard ↓↑	Type of control
20 May 2022	<u>Chemicals used in</u> foods	<u>Chemicals excl.</u> <u>colourings, enzymes</u> <u>&amp; flavourings</u>	India	Batches of a food additive from India have been found to contain undeclared peanut protein prompting authorities to warn of a serious risk to allergic consumers. The Food Standards Agency (FSA) and Food Standards Scotland (FSS) said some batches of soybean lecithin imported to the United Kingdom were found to contain undeclared peanut protein. Lecithin is used in chocolate, margarine, bread, ice cream and dairy products, infant formulas and convenience foods.	United Kingdom	Peanuts - undeclared	Not known
18 May 2022	Processed foods	<u>Chocolate-based</u> <u>confectionery (except</u> <u>spreads)</u>	Unknown origin	Recall of chocolate products due to undeclared peanuts found in the soy lecithin ingredient	Spain	Peanuts - undeclared	Not known
11 May 2022	<u>Oilseed products</u> (other than oil)	<u>Lecithins (soya,</u> sunflower etc.)	India	Presence of peanut protein in liquid soy lecithin from India	Spain	Peanuts - undeclared	company's own check
19 Apr 2022	<u>Oilseed products</u> (other than oil)	<u>Lecithins (soya,</u> sunflower etc.)	India	Peanut protein in food additive lecithin from India	Germany	Peanuts - undeclared	company's own check



Source: HorizonScan™

### Soybean Prices



#### Source: https://tradingeconomics.com/commodity/soybeans



### Future Opportunities in Food Fraud Prevention Programs

- Appropriately grouping and prioritizing
- Evaluating the vulnerability of multicomponent finished products
- Collecting and evaluating supporting data
- Evaluating public health and economic impacts
- Resource constraints at small/medium-sized companies and in developing countries
- Understanding and creating standards for fraud-focused analytical detection methods
- Evaluating fraud vulnerability in food
   packaging

Barrere, V., Everstine, K., Théolier, J., Godefroy, S., 2020. Food fraud vulnerability assessment: Towards a global consensus on procedures to manage and mitigate food fraud. Trends Food Sci. Technol. 100, 131–137. https://doi.org/10.1016/j.tifs.2020.04.002

### The cost of food fraud

Previous estimates of the cost of food crime:

- US\$10-15 billion per year in the U.S. (GMA)
- US\$30-40 billion globally per year (PwC)
- £11.2 billion per year in the U.K. (Center for Counter Fraud Studies/BDO)

"The cost of food crime" U.K. Food Standards Agency, 3 Jun 2020. Cox, A., Wohlschlegel, A., Jack, L., Smart, E. Available at: https://www.food.gov.uk/sites/default/files/media/document/the-cost-of-food-crime.pdf





# Social Costs of Food Crime - Categories

### Victim costs

Direct economic losses suffered by crime victims, including medical care costs and lost earnings.

### Criminal justice system costs

Costs of anti-food crime activities, legal and adjudication services, and corrections programs including incarceration. Crime career costs Opportunity costs associated with the criminal's choice to engage in illegal rather than legal and productive activities.

### Intangible costs

Indirect losses suffered by crime victims, including pain and suffering, decreased quality of life, and psychological distress.

### Market costs Loss of profits for genuine firms.



https://www.food.gov.uk/research/food-crime/the-cost-of-food-crime



# Estimating the Social Costs of Food Crime

### Consider a specific market

Example: substitution of "ground nuts" due to shortage or tight margins Identify ways in which harm may be inflicted Example: Suffering from severe

allergic response

### Quantify costs of these harms

Examples : Monetary costs such as medical cost or lost earnings which can be approximated based on medical data.

Intangible costs which can be quantified using damages awards in civil trials. Work our way up from casebased level to aggregated level by quantifying the incidence of each type of food crime.



https://www.food.gov.uk/research/food-crime/the-cost-of-food-crime



*"Economic conditions and market structure can influence food safety."*<sup>1</sup>

"Authentic food is a social good that benefits consumers. Ensuring that the food supply is authentic is good governance."  $\frac{2}{2}$ 

# *"Unchecked food fraud encourages further malfeasance and inappropriate risk-taking with food."* <sup>3</sup>

1 Gale, F. and Dinghuan, H. Supply Chain Issues in China's Milk Adulteration Incident. Contributed Paper prepared for presentation at the International Association of Agricultural Economists' 2009 Conference, Beijing, China, August 16-22, 2009. Available at: https://www.researchgate.net/oublication/228312109\_Bupply\_Chain\_Issues\_in\_China's\_Milk\_Adulteration\_Incident

2 Roberts, Michael T. and Turk, W. White Paper: The Pursuit of Food Authenticity – Recommended Legal & Policy Strategies to Eradicate Economically Motivated Adulteration (Food Fraud). 2017. Available at: https://law.ucia.edu/centers/social-policy/resnick-program-for-food-law-and-policy/publications/food-fraud-white-paper/

3 Roberts, Michael T., Viinikainen, Teemu, and Bullon, Carmen. International and national regulatory strategies to counter food fraud. FAO and UCLA Resnick Center for Food Law & Policy. 2022. Available at: https://www.fao.org/documents/card/en/c/cb9035en/



## Thank you!

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