

## AN OVERVIEW OF FOOD FRAUD IN TURKEY AND THE POTENTIAL RISK FOR PEANUT

Duman, Ahmet Dogan<sup>1,2</sup> and Tenekeci Onur<sup>3</sup>, Didin Mustafa<sup>1</sup>

<sup>1</sup>Mustafa Kemal University, Faculty of Agriculture, Department of Food Engineering, 31060 Antakya, Hatay/TURKEY

<sup>2</sup>Corresponding author: E-mail: [adduman@mku.edu.tr](mailto:adduman@mku.edu.tr), Phone: +903262213317, Fax: +903262213320

<sup>3</sup>Osmaniye Provincial Directorate of Food Agriculture and Livestock Ministry, Iskender Turkmen St., 80010, Osmaniye/TURKEY

### Abstract

*Depending on the increase in the demand for ready-to-eat food products in recent years, food fraud tends to increase as well. The color, smell, taste, appearance, content, nutritive value, origin, etc. in foods determine purchasing preferences of consumers. Food adulteration and counterfeit have been practiced since ancient times.*

*This paper consists of the results of two different studies on food fraud in Turkey. In the first study, questionnaire data were collected from 263 people with different occupations and ages with a total eleven questions throughout Turkey by using the face-to-face interview survey method. The collected data showed that the top three product categories that the highest probabilities of being fraudulent were milk and milk products (42.6%), meat and meat products (20.2%), and bread and bakery products (16%).*

*In the second study, research was conducted on what types of fraud were applied in Turkish peanuts. Total 30 peanut samples were analysed to determine synthetic colorant such as E124 ponceau 4R, E129 allura red and E122 carmosine etc. E124 ponceau 4R was found as a color material in 4 samples of the total 30 roasted unshelled peanuts in concentrations of 4.24 mg/kg, 3.30 mg/kg, 4.47 mg/kg and 2.49 mg/kg. On the other hand, it was below the detectable limit in other samples.*

### Keywords

Food, fraud, peanut, colorant, Turkey

### Introduction

Food fraud and economically motivated adulteration (FF/EMA) is a collective term that is driven by economic gain and encompasses the deliberate substitution, addition, tampering, or misrepresentation of food, food ingredients or food packaging, or false or misleading statements made in a food product (Spink & Moyer, 2011). The Grocery Manufacturers Association estimates that global food fraud costs between \$10 billion and \$15 billion per year affecting approximately 10% of all commercially sold food products (Johnson, 2014). A model of food integrity management and mitigation for food supply chain fraud is developed. The model has three key constructs a) food integrity is characterized as four elements: product, process, people and data integrity, b) drivers of supply chain of food fraud are described, and c) example mitigation measures are differentiated as operating at three levels: organizational, supply chain and global measures (Manning, 2016). The drivers to food safety and nutrition risks were identified recently in a scoping study on food safety and nutrition (FCEC, 2013): i) global economy and trade, ii) global cooperation and standard setting, iii) governance, iv) demography and social cohesion, v) consumer attitudes and behavior, vi) new food chain technologies, vii) competition for key resources, viii) climate change, ix) emerging food chain risks and disasters, and x) new agri-food chain structures.

Though FF/EMA has long existed in human society (Spink & Moyer, 2011), today the increasingly prolonged and intricate food supply chain, often with mixed ingredients in processed foods, may create an environment in which fraudulent activities are easier to hide but difficult to detect (Everstine et al., 2013; Moore et al., 2012), resulting in new emergence of FF/EMA (Zhang & Xue, 2016).

When the issue is addressed from the point of view of the size of the food supply and the health and economic losses of the consumers, it is considered that the risks arising from the adulteration of food are alarming. If it is assumed that about 60% of the income of the population group called "middle pole" in developing countries like Turkey is spent on feeding, the adulteration of food is easily seen to negatively affect both the health of the family members and the budget (Ilbegi, 2004).

The product categories of being FF/EMA in the world were respectively olive oil (14%), milk (11%), honey (7%), fruit juice (6%) and saffron (5%) (Eksi, 2015). Some of the news and claims regarding the food fraud in the media and in public in Turkey are as follows: cotton oil is added to olive oil, moldy and stale cheeses, mixing potatoes and margarine into butter, bleaching chicken meats with sodium hypochlorite, mixing colorant and pea to pistachio powder, adding extra salt to chickpea, mixing chicken skin and gut to salami and sausages, use of gelatin to make yogurt more solid, use of aluminum silicate to hide toxic aflatoxin in analysis of red ground pepper, coloring of roasted unshelled peanuts, etc. (Milliyet, 2015).

A study conducted by Turkish Food Safety Association (TFSA) found that 82% of the consumers were concerned about various food frauds and deceptions and 15% reported that this was partly thought-provoking. In the same study, it was declared that 77% of the consumers were very worried about the colorants, preservatives or flavoring substances in the foods and 19% defined the situation as partly thought-provoking (TFSA, 2008).

The aims of this research were two-folds: Firstly, to found out the awareness of the deceptions in Turkish food chain using a face-to-face survey study and to reveal the cases which are known and seen by consumers but cannot be determined by official authorities. Secondly, to study the color analysis for food fraud in sampled roasted unshelled peanuts.

### **Materials and Method**

Data were collected from 263 people with different occupations and ages with a total of eleven questions throughout Turkey by using a face-to-face interview survey method. Detailed information about the questions of the survey is outlined in Table 1.

Frauds/adulterations were presented in 13 different food categories, including meat and meat products, milk and milk products, cereals and bakery products, nuts, nut products and seeds, herbs and spices, confectionery, oils and fats, alcoholic beverages, non-alcoholic beverages, grains and pulses, herbal mixtures and supplements, fruits and vegetables, and other foods (Table 1).

As a secondary data source of the study, total of 30 samples with a mass of about 500 g each were taken from roasted peanuts offered for sale in Osmaniye, Adana and Hatay provinces located in mid-south Turkey. The samples that were roasted and unshelled were analyzed.

SPSS statistical package program (Version: 17.0) was used to evaluate the survey results. Analysis for colorant in peanut samples was carried out based on the food survey information no: 37/30 and 37/03 methods and High Performance Liquid Chromatography combined with diode array detection (HPLC-DAD). The recoveries range was between 85 and 102% (FSA, 2013).

Table 1. Survey questions for food fraud and adulteration

Survey	
Survey Topic: Frauds and adulterations in foods	
Name-Surname:	
Occupation/Sector:	
Task:	
Address:	
Education status:	
Please answer the following questions.	
1. Do you know about adulteration and counterfeit in foods?	
2. Would you say the first three foodsthat are frauded?	
3. Please give some examples of mislabeling in food packages?	
4. Please say some of the improper food label notifications?	
5. Pleasetell the first three unsafe food categories from the list given below:	
Meat and meat products Milk and milk products Cereals and bakery products Nuts, nut products and seeds Herbs and spices Confectionery Oils and fats	Alcoholic beverages Non-alcoholic beverages Grain and pulses Herbal mixtures and supplements Fruits and vegetables Other foods
6. Types of fraud that you estimate and encounter in foods?	
7. Measures to be taken in order to prevent food fraud.	
8. List the disadvantages of foodfraud according to their importance. Health/Economical/Social/Another	
9. Is the Food Inspection authority sufficient? Enough/Insufficient/Partially/Absolutely	
10. Is there a fraud in peanuts? If so, what type?	
11.Do you have any information about the colors used in roasted peanuts?	

## Results and Discussion

Our results included peoples with different age groups of 18-26, 27-31 and  $\geq 32$ . The participants were questioned about food fraud and adulteration. 92% of the participants reported that they knew the concepts of industry perspective food deceptions.

When occupational status of the participants was examined, it was seen that some people were not aware of food misrepresentation and tampering even among agricultural engineers and students.

Another survey question was about the first three food categories that came to mind with food fraud. Milk and dairy products were the first choice with 36% in all age groups. The others were bread and bakery products (22%), meat and meat products (17%), nuts (6%), fruit/vegetables (5%), respectively.

As the third question, we asked about fraud labels in food packaging. 90% of the questioned people were aware of label constancy. Approximately 10% of the participants did not know about this definition. It was observed that as the ages of the participants increases, the awareness increased as well.

We wanted the interviewer to give an example about the label fraud. 55 people (21%) did not give an example. Among the ones that provided an example, most mentioned food groups were the meat and milk products (49%), fruits and vegetables (23%) and other food categories (7%). Food labeling information must be true and the consumer should not be deceived. But this adulteration is economically motivated (Lutter, 2009). Common mislabeling statements are natural bread, unpasteurised ice cream, alternative butter products, Turkish delight (lokum) made from glucose syrup and aphrodisiac substances, vegetable oil (palm, cotton, corn, soy) in olive oils, honey and syrups with fruit aroma, small font character label information, etc.. Zhang and Xue (2016) reported a 110 (7%)

mislabeling case out of a total 1553 media reports with food scandals or fraud incidents in China. These results were similar to the economically motivated adulteration.

Regarding the three food groups in which the participants thought that they were generally produced insecurely; most common answers were the meat and meat products (22%), bread and bakery products (16%), milk and milk products (14%), nuts and seeds (14%), oils and fats (14%), and confectionery (10%). According to the age of the respondents, the meat and meat products appeared to rank first in all groups. Similarly, in China, animal-based food products (38%) including dairy, meat, eggs, etc., grain-based foods (23%), drinks/beverages (13%) were economically motivated food frauds and adulterations based on an analysis of 1553 media reports (Zhang and Xue, 2016).

Another question was about the food frauds that the participants did not expect to hear but they have heard about. The most common notification types were meat and meat products (34%), milk and milk products (25%), cereal products (18%), fruits-vegetables (15%) and other products (8%). Marvin et al. (2016) reported fish/seafood (21%), meat (13%), fruits/vegetables (10%) and nuts (10%) as a product categories on Bayesian Network model of food fraud detection. This report has common characteristics with the present study results.

Another question was “What do we need to do to prevent food counterfeit?”. The most important measures were to increase government control (82 person; 31%), to make the producers and consumers more conscious (58 person; 22%), to give government support (51 person; 19%), to employ food safety specialists in the workplace (36 person; 14%) and other preventive rules (36 person; 14%). Food fraud vulnerability is a complex and rapidly evolving problem. The key counter-measures are detection, deterrence and prevention. Effective strategic elements include: intelligence gathering, collaboration among the food industry, government and academics, creating a public forum, awareness and harmonisation (Spink et al., 2015)

The survey data included the negative effects of the food fraud as well. They were stated by the participants as public health problems (48%), economic loss (20%), social factors (16%) and other reasons (16%) in all age and occupation groups.

The ninth question was that whether the food inspection authority was enough to detect all types of food frauds. Respondents stated that the authority was satisfactory (99), inadequate (76), partially satisfactory (44), and partially inadequate (44) in terms of official inspection. 54% of the participants thought that inspection authorities were not sufficient to detect the food frauds. Interviewers who did not specify their names and cities found the competent authorities insufficient. Working together as like-minded scholars, experts, industries, governments, consumers, producers can create more efficient and effective counter-measures (Spink et al., 2015).

The tenth question was “Is there a faulty presentation in peanuts? If so, what is it?”. 118 participants expressed the use of colorants. 61 of the respondents indicated fraud on the amount of product. The others (84 person) did not declare any answer. Students and business owners see insufficient authority over supervision. Color fraud was firstly expressed deception in all groups (occupation and also industry).

To the question “Do you have any idea about counterfeit and adulteration applied and / or practiced in peanuts?”, 64% of the participants in Adana province, where farming and marketing of peanuts are intensely carried out, had no idea. On the other hand, in Osmaniye province, which is another place in which the peanuts are intensively produced, this rate was 33%. Turkish Government does not allow the use of food coloring in peanut productions based on standards, regulations, and laws. However the producers use it to improve the appearance of the peanuts.

The last question in the questionnaire was “Do you have any information about the stains used in roasted peanuts?”. 229 participants answered “Yes” to this question. 34 people

answered “No”. Consumers consume the products even though they are aware of the fraud.

As age increases, the level of knowledge about the subject increases as well. Regarding the locations of the participants, when the answers were examined, it was observed that all the participants from Hatay, İzmir, Adana, Istanbul, Ankara, Antalya and Adiyaman provinces were found to be informed about the subject.

In the second study, research was conducted on what types of fraudulent were applied in Turkish peanuts. E124 ponceau 4R as a suspicious color material in 4 samples out of total 30 roasted unshelled peanuts were determined in the concentrations of 4.24 mg/kg, 3.30 mg/kg, 4.47 mg/kg and 2.49 mg/kg. On the other hand, it was below the detectable limit in other samples. According to the Turkish Food Codex, the use of colorant in some foods is restricted. However, it is banned in peanuts. This colorant (ponceau E124 4R) is inexpensive and easy to find (alternative another colorings are: carmoisine E122 and allura red E129). Ponceau 4R colorant is especially found in spices and some other wholesale food producers.

In other peanut samples, it was estimated that the colorant was below the detectable amount. Periodical monitoring, analysis and evaluations of the mostly fraud food products can be recommended to the official authorities.

### **Conclusion**

In this research, a survey study was conducted on the perception and awareness of people on food fraud in Turkey. Data was collected from 263 people with different occupations and ages with a total 11 question by using the face to face interview survey method. The product categories that the highest probabilities of being fraudulent were milk and milk products (42.6%), meat and meat products (20.2%), bread and bakery products (16%).

In the study 30 samples of peanuts were also analysed for food fraud. E124 ponceau 4R was a color material in 4 samples out of total 30 roasted unshelled peanuts and the concentrations were 4.24 mg/kg, 3.30 mg/kg, 4.47 mg/kg and 2.49 mg/kg.

Interviewers who did not specify their names and cities found the competent authorities insufficient on food fraud. Working together as like-minded scholars, experts, industries, governments, consumers, producers can create more efficient and effective counter-measures against food fraud.

Researches and inspections on the use of colorants without declaration in food product labels should be increased. Routine inspections by food control personnel are important for food safety and public health. It is advisable to raise awareness of consumers and producers. Increased work in this area is expected to keep the databases up-to-date in the combat against food fraud.

### **Acknowledgements**

The authors are grateful for the funding support from Mustafa Kemal University (Project BAP9360).

### **References**

- Everstine, K., Spink, J., & Kennedy, S., 2013. Economically motivated adulteration (EMA) of food: common characteristics of EMA incidents. *Journal of Food Protection*, 76(4), 723-735.
- Eksi, A., 2015. *Gıda gerçekleri (Food realities) (In Turkish)*. Labmedya, 32s.
- FCEC (Food Chain Evaluation Consortium), 2013. *Scoping study delivering on EU food safety and nutrition in 2050-Scenarios of future change and policy responses*. (European

- Commission) FSA, 2013. Food Safety Agency. Available at: [www.food.gov.uk/science/research/surveillance/](http://www.food.gov.uk/science/research/surveillance/) (accessed on 03.06.2013)
- İlbeği, I., 2004. Gıda güvenliği ve tüketicinin korunması (Food safety and the protection of the consumers) (In Turkish). Food Engineering Journal, 18, 13-16.
- Johnson, R., 2014. Food fraud and “Economically Motivated Adulteration” of Food and Food Ingredients, CRS Report, January 10. Congressional Research Service.
- Lutter, R., 2009. [www.fda.gov/downloads/newsevents/meetingsconferenceworkshops/ucm163631.ppt](http://www.fda.gov/downloads/newsevents/meetingsconferenceworkshops/ucm163631.ppt), Addressing Challenges of Economically Motivated Adulteration (accessed on 28.03.16)
- Manning, L. 2016. Food fraud: policy and food chain. Current Opinion in Food Science, 10:16-21.
- Marvin, H.J.P., Bouzembark, Y., Jansenn, E.M., Van der Fels-Klerx, H.J., Van Asselt, E.D. and Kleter, G.A., 2016. A holistic approach to food safety risks: Food fraud as an example. Food Research International, 89, 463-470.
- Milliyet, 2015. <http://milliyet.com.tr/hileli-gidalara-dikkat-pembekendar-detaysagliklibeslenme-539022/> (accessed on 06.02.2015)
- Moore, J.C., Spink, J., & Lipp, M., 2012. Development and applications of a database of food ingredient fraud and economically motivated adulteration from 1980 to 2010. Journal of Food Science, 77(4), R118-R116
- Spink, J., & Moyer, D.C., 2011. Defining the public health threat of food fraud. Journal of Food Science, 76(9), R157-R163.
- Spink, J., Moyer, D.C., Park, H., Wu, Y., Fersht, V., Shao, B., Hong, M., Paek, S.Y., Edelev, D., 2015. Introducing food fraud including translation and interpretation to Russian, Korean, and Chinese languages. Food Chemistry 189, 102-107.
- TFSA (Turkish Food Safety Association), 2008. Tüketici risk algılama raporu (Consumer risk perception report) (In Turkish). Istanbul/Turkey.
- Zhang, W., & Xue, J., 2016. Economically motivated food fraud and adulteration in China: an analysis based on 1553 media reports. Food Control, 67, 192-198