

RESEARCH REGARDING THE IDENTIFICATION OF COUNTERFEITING IN SPICES INDUSTRY

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Abstract: Herbs and culinary spices have been and will be used for flavoring food. They are also used in various pharmaceutical activities due to their beneficial properties, such as antioxidant and bacteriostatic effects.

Vulnerabilities that may change the probability of counterfeiting comprise supply chain length, fraud history, seasonality and harvest accessibility, weather events, natural disasters, cultural and geo-political procedures, the economic situation and advances in technology to camouflage fraud. Fraud can cause a risk to the wellbeing of consumers, even if it is economically motivated. Therefore, rapid screening techniques are required to detect and help avoid industrial fraud.

The identification of fraudulent spice handling requires a thorough knowledge of the normal product, its essential properties, as well as the principles and techniques of intervention of counterfeiters on the investigated products.

Key words: spice, counterfeit, fraud, forgery

INTRODUCTION

Spices can be considered a gift of nature. They are aromatizing components that are indispensable in gastronomy and at the same time with major implications in the food industry. Due to their beneficial properties on health, through their antioxidant and bacteriostatic effect, spices are also used in the pharmaceutical industry [1,6,11].

From ancient times the spices have been appreciated for their medicinal properties. Due to their antimicrobial properties, spices were used for the first time in preserving meat. Subsequently, spices began to be used more and more in gastronomy to intensify the aroma and taste of some dishes and beverages. With the discovery of techniques for extracting spice extracts, they began to be used in the pharmaceutical industry and of cosmetics. Nowadays, spices have become a source of additives for the food industry: natural dyes and flavorings, antimicrobials and antioxidants [4,11,16].

According to the FAO, spices can be defined as "vegetable products used for flavoring, seasoning and flavoring in food". Herbs, appreciated as a subcategory of spices, are leafy spices, and a few, such as dill and coriander, can supply both spice seeds and leafy herbs [11].

In accordance to the Codex Alimentarius, dried spices and herbs are defined as "dried components or mixtures of dried plants used in food for flavoring, coloring and flavoring. This term applies equally to whole, broken, ground and mixed forms" [17].

According to the U.S. Federal Regulations, the term spice means "any flavored vegetable substance in whole, broken, or ground form, except for those substances that have traditionally been considered foods, such as onions, garlic, and celery, whose significant function in food is seasoning rather than nutrition. Spices include: allspice, anise, basil, bay leaves, cumin seeds, cardamom, cinnamon, cloves, coriander, cumin seeds, dill seeds, fennel seeds, fenugreek, ginger, horseradish, marjoram, mustard flour, nutmeg, oregano, paprika, pepper, black pepper, white pepper, red rosemary, saffron, sage, thyme, star anise, tarragon, thyme, turmeric and saffron" [17].

According to the European Spice Association, a spice is *a mixture of permitted food ingredients added as needed to achieve the intended purpose, which is to improve the taste, quality of food and / or functionality of a food* [4,11].

The International Organization for Standardization (ISO) defines spices and condiments as: *vegetable products or mixtures thereof, not containing foreign vegetable matter, used for seasoning or flavoring foodstuffs* [4,13] The distinction between herbs and spices is usually as follows:

- herbs are the dried leaves of herbs used to flavor food;
- spices are the dry parts of herbs, without leaves [4].

The EU produces approx. 100,000 t of spices per year but imports three times more mostly, from Africa, East Asia, Caribbean and Latin America. Due to the fact that their supply chain is very long, complex and globalized fraudulent manipulations can take place at every stage [10].

The notion of expertise designates a means of proof of a special type representing the finding or opinion of a specialist in a certain field of knowledge, in order to elucidate controversial or litigious issues before some courts or partners of an economic contract. Commodity expertise is used to research and clarify controversial or contentious issues raised by the practice of food or non-food trade. Its purpose is to determine the exact quality of the batches of products, statically or dynamically, in relation to the conditions, causes, location and circumstances which have led to deviations from the prescribed and contracted quality during manufacture or their technical circulation [5].

Expertise is considered necessary only in those cases in which different interpretations can be given to some problems for the solution of which knowledge of a special technical, economic, medical competence, etc. is required. It is a means of proof by which, on the basis of a research activity carried out using scientific methods, the expert brings to the notice of the interested body scientifically reasoned conclusions regarding the facts for the elucidation of which specialized knowledge is required [5].

Although international law has not fully substantiated and defined the phenomenon of food fraud, an accepted definition of this concept is that stated by Spink J. "Food fraud is a collective term used to include, add, manipulate and misrepresent." of food, knowingly and intentionally made; or misleading or misleading statements about a product in order to obtain an economic gain " [7,8].

Another definition of food fraud was found in a report by Cornelia Culea, namely: "food fraud is a fraudulent and intentional substitution, dilution or addition to products or raw materials, or misrepresentation of products or materials for the purpose of financial gains, by increasing the apparent value of the product or reducing the cost of production " [13].

Louise Manning's work mentions that counterfeit foods are foods that acquire or contain: "any poisonous or harmful substance that could harm health; but if the substance is not an added substance, this food will not be considered counterfeit ..., if the quantity of such a substance in such a product is not normally harmful to health " [3]. Unsuitable foodstuffs are also defined as "foodstuffs which are falsely labeled or misleading, offered for sale under another name, or which are an imitation of another food, or in the case of a container, misleading as regarding its content " [2].

Food fraud refers to "any suspected intentional act by undertakings or natural persons in order to mislead buyers and to obtain an undue advantage thereof, in breach of the rules referred to in Article 1 (2) of Regulation (EU) 2017/625 (agri-food chain legislation) ". These intentional breaches of EU agri-food chain legislation can impede the proper functioning of the internal market and can also pose a risk to human, animal or plant health [10].

MATERIALS AND METHODS

In this study, the authors consulted a rich bibliography, namely scientific papers, publications, statistics provided by the European Commission. The methodology of the article combines standard research techniques and methods: documentation, analysis and synthesis and the formulation of conclusions.

RESULTS AND DISCUSSION

Chemical composition of spices

Most spices contain essential oils, which act directly on the olfactory nerves, causing a more abundant secretion of saliva. An important part of the spices contain hot-tasting substances (pepper, mustard, pepper, horseradish), substances that also activate the secretion of gastric juices. The spices are rich in polyphenols, capsaicin, carotenoid and flavonoid pigments, minerals (K, P, Mg, Na, Zn, Se etc.), representing real nutritional benefits [1,9,19].

As a general rule, all spices should be presented only in a pure state, not mixed with foreign substances or uncharacteristic plant parts and which not possessing the properties of that spice [18].

It is strictly forbidden to consume spices that contain occasional impurities: mineral impurities (sand, earth, brick dust, etc.), wood chips or parts of other plants, insects at any stage of development or other impurities. It is also forbidden to consume counterfeit, spoiled or toxic vegetable spices. Those spices in which mineral or organic additives, toxic coloring substances, substances containing vegetable residues (bran flour, legumes, fruit tails, wood sawdust, oil cakes, etc.) are considered to be counterfeit. Spices with parasitic molds or fungi, insects - eggs and larvae, as well as visible signs of their degradation by rodents are also prohibited. It is strictly forbidden to consume spices infected with pathogens, as well as spice substitutes and those flavored and artificially colored. [14,18].

Quality characteristics of spices

In the spice industry, the terms authenticity and quality appear distinctly. Authenticity refers to the lack of alteration in the sense of the absence of foreign bodies or materials, but also suggests the lack of impurities in the finished product. Regarding quality, this can be defined in the case of spices as "*appropriate (and usual) for the intended purpose*", the major quality specifications being based on dry spices [4].

Herbs and especially spices are considered high priced and easily counterfeit goods so quality standards appeared early. Today there are two important categories of standard: those set by the US and those set by the European Union. These, in turn, influence the standards of the main spice-producing countries.

The main quality characteristics of dry spices resulting from international standards are: cleanliness, ash content, volatile oil content (it is a parameter that helps to check if the plant or spice has been altered), humidity (12% max.), water activity (aw) (a water activity value of 0.6 is generally accepted as a value below which microbiological activity cannot take place) [4,10]

The quality parameters specific to spices are: piperine content (specific property especially for peppers of the genus *Piper*); (ASTA) color values (property specific to products of the genus *Capsicum* and used as a quality indicator for paprika); capsaicin content and Scoville units (property that measures the capsaicin content of *Capsicum* species, respectively the intensity of hot taste) [4,12]

The assessment of the quality of natural spices is done by:

- sensory analysis following: appearance, shape, color, consistency, smell, taste and aroma that must be specific to each spice;

- microscopic examination to verify the structure of the plant tissue, in order to identify possible falsifications, by substitution;
- verificarea caracteristicilor fizico-chimice: umiditate, continut de uleiuri eterice, aciditatea totală, cenușa insolubilă în HCl 10%, conținutul de impurități [17].

Depending on the spice, in order to establish the quality, the following are followed: the mass of 100 berries (pepper), 100 flower buds (cloves), the percentage of dried berries (pepper), the floating sample (cloves), the dimensions are checked, the seasoning capacity (dilution method) [17]

Spice counterfeiting methods

The worldwide production of spices is constantly threatened by the emergence of various economically motivated counterfeiting methods. Opportunities for counterfeiting spices can occur at any point along the supply chain that is long and complex. The economy and consumer confidence can be adversely affected, with fraud posing a risk to consumers' health, such as cumin nuts and paprika [12, 14].

In the methodology of detecting counterfeits, the characteristics typical of the normal product must be considered, along with the characteristics imprinted on the products investigated by the counterfeiting methods (modification of the initial chemical composition, modification of some organoleptic or physical characteristics by treatment with certain substances. etc.) [14,15]

In the herbs and spices segment, fraudulent manipulations comprise, not limited to:

- ingredients, additives, colorants or any extra constituent not accepted for utilize in food and/or spices and herbs;
- any other component permitted for use in food, but not illegally stated, or in a structure which could misinform the client;
- a diverse part of the same botanical plant, different from the one declared to the extent that it misleads the client [14,15].

On 14 January 2014 spices were mentioned in the European Parliament's resolution among the most susceptible goods to fraud. Within the European Union, information accessible to the European Commission indicates that fake herbs and spices are current on the EU market but remain hidden. The European Commission has therefore set up a harmonized control plan inviting EU Member States to test specific herbs and spices and send them for analysis to the Joint Research Center. The main objective of the plan was to set up the market occurrence of non-compliances and probable prohibited practices in the marketing of spices and herbs. The EU Member States plus Norway and Switzerland submitted approx 1,900 samples for analysis. The synchronized control plan had the role to study the herbs and spices most targeted for manipulations like saffron, cumin, turmeric, hot pepper, oregano, pepper [10].

The total rate of suspicious samples was 17%, with testing actions focusing on the detection of fractional substitute of herbs and spices with other botanical or filler supplies, such as flour, powder, starch or chalk. The oregano supply chain was the most defenseless, as 48% of the samples were supposed to be faked, in most of the situations with olive leaves. “The percentage of samples that were suspected of counterfeiting was 17% for pepper, 14% for cumin, 11% for turmeric and 11% for saffron. The lowest suspicion rate (6%) was found for chilli. Most of the suspicious samples contained undeclared plant material, and in 2% of the samples of spices analyzed, unauthorized colorants were detected” [12].

Counterfeiting methods used were:

- a). replacement of the original product with foreign, vegetable or mineral substances;
- b). adding colorants to spices to enhance their commercial value [12].

These frauds are usually based on economic motivation. The first two methods used to detect counterfeit spices were liquid chromatography and infrared spectroscopy. Currently used: mass spectrometry, spectroscopy, chemometry, etc. Spectroscopy, in combination with chemometry, allows the development of non-targeted qualitative methods to detect the ever-evolving criminality related to spice counterfeiting [15].

CONCLUSIONS

For the removal of counterfeits and illegal practices, product testing is recommended: targeted analysis such as dye testing, purity confirmation, organoleptic evaluation, microscopic identification.

European Spice Association (ESA) works with bodies around the world to prevent and eliminate spice fraud practices.

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