SOME ASPECTS REGARDING THE TRACEABILITY OF FOOD PRODUCTS

Zeno Gârban[1,6], Florin Muselin[2,6], Cristina Szabo[3,6], Robert Ujhelyi[4,6], Sorin Marinescu[5]

[1]Department of Biochemistry and Molecular Biology (former), Faculty of Food Products Technology, University of Life Sciences "King Michael I of Romania" Timişoara, Romania
[2]Department of Toxicology, Faculty of Veterinary Medicine, University of Life Sciences "King Michael I of Romania" Timişoara, Calea Aradului No. 119, Romania;
[3] National Institute of Public Health-Branch Timişoara, Bd. Dr. V. Babeş, No.16, Timişoara, Romania;
[4]Medical Department, S.C. CaliVita International, Timişoara, Romania;
[5]Institute of Chemistry of the Romanian Academy, Bd. M. Viteazu Nr.24, Timişoara, Romania
[6]Working Group for Xenobiochemistry, Romanian Academy-Branch Timişoara, Bd. M. Viteazu No. 24, Romania
e-mail: zeno.garban@yahoo.com

Abstract
The traceability of food products is of major interest for ensuring the composition quality and protecting the consumers. The improvement of traceability control methods is based on preliminary stages of checking the purity of the component ingredients, technologies / biotechnologies for which analytical, bioanalytical and biophysical methods are used. A brief presentation of the specific methods for traceability control is presented in this paper.

Key words: foods, traceability, control methods

Introduction

The issue of traceability of food products has acquired a major importance with the globalization of agriculture and industries. In the food industries there are data on the origin of the raw material, its processing, distribution and location. Knowledge of traceability is of importance also in case of pharmaceutics and cosmetics which use substances obtained by extraction (phyto- and zoochemical) and/or obtained by chemical synthesis. The implementation of traceability systems to improve the ability to verify the safety and quality of products is aimed primarily at food products (e.g. raw materials and processed foods).

1. Traceability systems

Traceability can be approached in two distinct ways:

a) *Traceability in an integrated system*. This system involves tracking a particular product in the chain: raw material-transport-processing-storage-distribution-marketing-consumer
b) *Traceability in a differentiated system.* This system covers more limited areas of logistics management in the food chain. Within this system, internal traceability and external traceability are distinguished.

The specifics of the integrated systems will be briefly discussed below.

2. Systems of product identification

Different systems of identification can be used to know the food traceability data. Among these more important proved to be: a) *barcodes*; b) *landmarks based on radio frequency*; c) *biological*

and biochemical tests; d) *biodegradable markings;* e) *markings based on geospatial technology*. A brief description of them is of theoretical and applied interest (some in the perspective of expanding use).

2.1.Barcodes

This means of identification encodes the information on the basis of figures represented by a sequence of black and white bars of various sizes. Barcode decryption is done with a scanner.

In practice, the introduction of this system has been made in the USA and Canada since 1973 and has been called the "Uniform Product Code" - UPC. Subsequently in Europe, since 1979, the code has been used at the suggestion of the European Article Numbering Association (EAN). It has gradually spread to all continents. Representative figures for a particular code are integrated based on the "labeling program" entered into the scanner and can be used as a verification tool.

In practice, depending on the importance of the marketed product, 8 -14 digit codes are used for identification (indicating the country, manufacturer, product, other details).

Bar codes also allow the integration of a particular item in global trade. These codes can be used online. Mobile phone scanning is also possible.

2.2. Landmarks based on radio frequencies

In this case, the so-called "identification by radio frequency devices" - RFIDs (*Radio Frequency Identification Devices*) are used. For this purpose, food data are stored in "electronic circuits" or in "microchips" embedded in plastic material, constituting the so-called "*electronic label*".

Various devices that operate at various radio frequencies, in the ranges: 100 kHz - 2 GHz, are used for identification. These "tags" allow remote data reading. The data can also be entered in "menus" that are suitable for input on the touch screen.

2.3.Biological and biochemical tests

Biological and biochemical tests used for identification draw attention to the performance of histology, biochemistry, and molecular biology (Alford and Caskey, 1994; Cunningham and Meghen, 2001; Cutroneo et al., 2014; Gârban, 2018).

Among the specific methods of this system are mentioned: a) identification of the *retinal image*; b) identification of the *genetic imprint* - also known as "*DNA imprint*" (deoxyribonucleic acid) or simply "DNA test". The application of these methods, although accurate, is limited due to high costs. One can mention their specificity.

a) Identification of the retinal image. The method is specific to biology (histology), being based on recording with special digital cameras the "retinal vascular aspect". This is an attribute of individuality (especially in animals), which is maintained throughout life. This method can be applied to live animals transported for slaughter (elsewhere in the world).
The method is also suitable for use in "modern zooculture" for the surveillance of live animals as well as animals intended for use in breeding to breed improvements (sent to various locations around the world). One of the applications of the method - given the rigor of the information - concerns zoo parks and nature reservations for animals protected by law.

b) Identification of the DNA imprint. The method is specific to biochemistry and molecular biology. It is suitable for application to live animals, by taking samples from blood, hair, saliva,

etc., but also from animal products (animal carcasses). This method is based on specific analyses to molecular biology applied in genetics. In the case of meat and meat products, for example, analyzes based on "DNA imprints" can be compared with data on animals in slaughtered lots. Details on these applications (Cunningham and Meghen, 2001) reveal the importance of using biomarkers / markers in this field.
In general, there is a great ability to discriminate methods based on molecular biology (Gârban and Ilia, 2024). It is reiterated that the method has been very useful in forensic medicine, pathology and animal and plant identification studies (Alford and Caskey, 1994).

From the above data it is noted that tests based on biology (histology) and molecular biology are in fact specific biomarkers / markers that provide accurate information on the traceability of animals / products of animal origin.

2.4.Biodegradable markings

These markings are also known as "*edible markings*" because they are placed directly on the food. They are invisible and made of an edible substance, e.g. cellulose derivatives.

The compound used for labeling is mixed with a certain food ingredient (usually additives). They are "fixed" due to the physico-chemical effects of food constituents (electrostatic forces, non-destructive interactions with protein compounds, lipids, etc.). The size of such markings is about 200 μm^2 readable area for a barcode.

2.5.Markings based on geospatial technology

These markings include: a) *Geographic Information System* - GIS; b) *Global Positioning System* - GPS . The latter is a satellite-based radio positioning system - which contains information and the GPS receiver indicates the location in the field (IUFoST, 2012; FAO, 2017).

For information, it is mentioned that for agricultural activities it is possible to collect, analyze and present data. It even becomes possible to "*mapping information*" to certain regions of the Earth. Marks that use geospatial technology may include the "Quick Response Code", commonly known as the QR Code.

QR codes arranged in squares (so two-dimensional) were initially used only in Japan (1995). The two-dimensional specificity originates from the barcode system. Such codes are printed on packaging, posters, billboards, online advertisements, various types of advertising, labels and even business cards. Usually, the QR code is a means of storing information in a visual tag, which can be read by a device (even a smartphone).

Such a code integrates black dot and white space templates, arranged in a square grid. QR codes have an extremely wide use, e.g.: postal addresses, telephone numbers, email addresses, websites or web pages, company inventory labels, etc.

In current practice there are online applications that allow the generation of QR codes. Consumers can access accurate information and valid traceability as well as food safety information only by accessing the QR code printed on the product label. A general observation regarding geospatial technologies draws attention to the difficulties related to the high economic costs of implementing the system.

All the above described systems can provide safe and qualitative products to consumers (Vermeer et al., 2013; Klein and Stolk, 2018).

Concluding remarks

Application of the traceability system is important not only for food products but also for biologically active substances which could be ingredients of food and/or medicine. It is recommended to know details on the: a) *natural sources*; b) *manufacturing procedures*; c) *control methods* (chemical and microbiological); d) *distribution chain.* In case of biologically active substances, the measures regarding nutrivigilance, respectively pharmacovigilance are also important.

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