FOOD QUALITY AND STANDARDS

Radomir Lásztity
Department of Biochemistry and Food Technology, Budapest University of Technology and Economics, Hungary

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Summary

Governments over centuries have endeavored to provide for the safety and wholesomeness of people's food by legal provisions and appropriate punitive action when necessary. Consumer protection in the field of adulteration and falsification of food represents one of the earliest forms of government regulation of commercial enterprises. Ancient food regulations are referred to in Egyptian, Chinese, Hindu, Greek, and Roman literature.

The period beginning with the Industrial Revolution was a time of tremendous expansion in many fields, which had a particular bearing on food quality control and standardization. During this period legislation and other means to control the composition of various foods appeared in many countries. The twentieth century has seen remarkable advances in all areas of food technology and also in nutrition science.

These changes have in turn required an improvement of legal control, in order to adequately protect the consumer from newly emerging hazards and to assist the food trade and its development. In addition to national standards organizations, international organizations were established. The globalization of food production and food supply will stimulate the further international harmonization of standards and regulations.

Such events as the BSE episode or the recent Belgian dioxine crisis confirm the need for international co-operation in food inspection. The next internationally interesting problem to be rationally solved is the development and application of GMO (genetically modified organisms). One of the great challenges to food technology and food regulation will be to put the development of "health promoting foods" (functional foods, medical foods, nutraceuticals) on a rational basis.

Among the aims of efforts to improve food quality, standardization and food control, primarily the assurance of food safety may be mentioned, providing consumers with a safe and healthy food supply that fully meets the requirements of the science of nutrition. This article gives an overview about developments in food standardization, the world situation concerning food safety and preventing food contamination, methods of quality control, and organizations dealing with food quality assurance.

1. Introduction

Satisfactory food supply has always been a central problem for governments, since the formation of ancient societies several thousand years ago. Although many of the same foods are still produced and consumed, dietary preferences have changed over the centuries due to the development of the economy and the science of nutrition. Today, every consumer requires a safe and healthful food supply. The primary role of our diet is to provide enough nutrients to fulfill metabolic requirements, while giving us a feeling of satisfaction and well-being. In addition, recent investigations confirmed the hypothesis, recognized even in 500 B.C. by Hippocrates, that beyond nutrition, diet may modulate various functions in the body. Consequently adequate food consumption may promote the state of well-being, better health, and prevention of diseases. So it is understandable that interest in healthy food, and food quality and its regulation, is growing worldwide. When a product is offered for sale, the purchaser expects the product to be what it is purported to be: genuine and wholesome, and free of adulteration or contamination. Correct information about the composition and nutritive value of a food product is designed to protect the consumer from adulteration and falsification, and requires a well-organized quality control infrastructure and food regulations.

According to the Glossary of the European Organization for Quality Control, quality may be defined as: "The totality of features and characteristics of a product or service that bear on its ability to satisfy a given need." More simply, quality may be defined as fitness for purpose. In the case of food, quality primarily involves safety, nutritive value, and acceptance.

In thinking and writing about food quality, it can be stated first of all that the term quality covers something different for people involved in the production and distribution of foods and for consumers. From the viewpoint of the food industry, producing end products from raw materials obtained from agriculture, two essential requirements are the most important:

1. Is the raw material suitable for production as a food product, which meets the demands of the consumer? If yes, to what extent?
2. Does the raw material correspond to the requirements of use of up to date technology and commercially reasonable costs of processing?

Food producer–consumer quality will include the following requirements:

1. To what extent a product meets the demands of a given group of consumers, or to what extent a classified food is suitable to be in a given quality group in order to fulfill the requirements of consumers.
2. What is the generally accepted "goodness" of the product, or to what extent the food corresponds to regulations (food law, standards, other rules etc.).
3. Is the product preferred, and to what extent, in comparison with other products belonging to the same category of food products? Which characteristics made it preferable?

Summarizing, it could be stated that satisfactory food quality means corresponding to the requirements of the consumer.

Due to economic and social changes the quality of food is a continuously changing thing, even in the same country, not to mention big differences between countries with different climatic conditions and levels of industrial development.

The quality of food may be described by the determination of given physical, chemical, technological, microbiological, and organoleptic properties. These properties (quality indices) allow the objective measurement and by evaluation of the data, the determination of quality. Nevertheless, it should be mentioned that there are some additional factors, in many cases independent from characteristics of food products, which influence consumer preferences: for example, price, conditions of sale, and reputation of product.

2. Food Quality Standards

2.1. History of Food Quality Standards

Food laws were among the earliest known to humanity. Governments over many centuries have endeavored to provide for the safety and wholesomeness of food by legal provisions and appropriate punitive action when necessary. Consumer protection in the field of adulteration and falsification of food represents one of the earliest forms of government regulation of commercial enterprises. Ancient Hebrew and Egyptian laws included provisions to prevent the contamination of meats. The laws of Moses contain decrees on food similar to certain aspects of modern food laws. Books of the Old Testament prohibited the consumption of meat from animals that died other than from slaughter, and regulated on weights and measures in foods and other commodities. Other ancient food regulations are referred to in Chinese, Hindu, Greek, and Roman literature. Cato in his treatise "On Agriculture" included a method "to determine whether wine had been watered." Under Roman civil law, the rules concerning the sale of food were as complicated and detailed as modern legislation. Documentation relating to the first century A.D. describes the falsification of olive oil by a product made from wood, leaves and berries of trees, and the falsification of wine by a substance made from variety of plants. Early food laws were predominantly designed to protect purchasers from fraud. It was fortunate therefore that health protection happened, in many instances, to be almost synonymous with protection against fraud. Any action taken against offenders, however, was based specifically on a fraudulent transaction; there was no stated intention to protect public health.

In the Middle Ages some food producers formed Trade Guilds, which exerted a powerful influence on the regulation of commerce. These were groups of tradespeople of particular specialities whose purpose was to provide control and general supervision over the honesty and integrity of their members and the quality of their products. Trade Guilds strengthened the position of honest butchers, fishmongers, and bakers, and during the thirteenth and fourteenth centuries, regulations were drafted to prevent adulteration of foodstuffs. Bread was among the items for which detailed manufacturing procedures were stipulated. An example of early Anglo-Saxon law on this subject was

the "Assize of Bread" promulgated in England in the thirteenth century, under which bakers adulterating bread were heavily penalized.

In France, the most interesting and complete document of the Middle Ages available on the subject is the "Livre des Métiers," which in 1268 outlined a code of comparative practices of the Trade Guilds of Paris. In this work, all practical provisions were made for protection of consumers' material interests and health, and for ensuring the good reputation of the trade guilds, which were similar to these referred to in England of the same period. For example, the flavoring of beer by the addition of pepper seed or resin was forbidden "because these ingredients were considered pernicious to health." The sale of blood pudding was prohibited because "it is a perilous meat." Later, in the statute of the pastry cooks of Bourges, the use of saffron was forbidden because its color might create the impression that eggs had been used, or it might disguise deterioration or spoilage in food.

An interesting test of milk authentication has been described by Domenico Romoli in his "La singolar dottrina" in 1560. A droplet of milk is placed on the thumbnail. If a compact form is observed, the milk is good for drinking. If the droplets spread and become flat, the milk is spoiled and dangerous.

For five centuries the corporations in France continued to expand their food control, improving the specific point to be observed and tightening their professional discipline. However, the Revolution of 1789 swept away the Guild masterships and hierarchies, and freedom of industry and trade was proclaimed. During this period there was not a great deal of change—just the degree and level of sophistication of the fraud and the analytical techniques used to detect it. In this period chemistry was being used as an analytical tool in the fight against food adulteration.

Though there were some sporadic standardization activities already in Egypt, China, India, and the Roman Empire, standardization developed in the second half of the nineteenth century. The period beginning with the Industrial Revolution was a time of tremendous expansion in many fields, which had a particular bearing on food quality control and standardization. Change from a largely rural to a largely urbanized society, and from a domestic to a factory system, with concentrations of populations, placed strain on food production and distribution. The period created many public health problems. However, legislation and other means to control the composition of various foods appeared. For example, in 1858 a municipal service was set up in Amsterdam for the control of foodstuffs and beverages. This was followed in England by the enactment of the first comprehensive modern food law in the world. This was an Act of 1860 for "Preventing the Adulteration of Food and Drink." Similar types of laws appeared in France, Germany, Belgium, Italy, Austria, Hungary, and Scandinavian countries. Apart from European countries, laws were also passed in the United States of America and Canada.

The twentieth century saw remarkable advances in all areas of food technology and also in nutrition science. These changes have in turn required greater flexibility in legal controls, in order to adequately protect the consumer from newly emerging hazards and to assist the food trade in its development. Many developed nations and some emerging

nations have recently either completely reviewed and updated their laws or provided new laws to meet the new situation.

With the increasing interest in common markets and improved international food trade, Member governments in the Food and Agriculture Organization and the World Health Organization established in 1962 a Joint FAO/WHO Food Standards Programme and formed a subsidiary body—the Codex Alimentarius Commission. Details of the work of the Codex Alimentarius Commission are given later in this paper.

Most national standards organizations were established in Europe in the 1920s, usually as voluntary associations of engineers. The International Organization for Standardization (ISO) was established in 1946. Details of the activity of the section of the ISO dealing with food standards will be discussed elsewhere.

2.2. Basic Concepts of Food Standards and National Standards

Food legislation should be covered to the extent needed in any individual country's general regulations (including rules for the elaboration of food standards and regulations), and in food standards.

Food standards are helpful for the orderly marketing of foods and for effective application of food control laws. Without food standards the purchaser has no assurance that a packaged food will be of the identity and quality he or she expects. Traders in distant markets cannot buy with confidence if there are no standards by which they can specify the kind and quality of food to be delivered.

Uniform standards intelligently applied promote trade to the eventual benefit of producers, processors, traders, and consumers. They can be a powerful tool in upgrading the quality of foods.

What does a food standard constitute? To serve its purpose a food standard should include the following provisions:

- The food should be fully and accurately described.
- The scope of the standard should be indicated (e.g. it applies nationally).
- The essential composition and quality factors should be specified. This should include both optional and mandatory ingredients with any minimum or maximum levels of use.
- The packing medium should be specified.
- Chemical and physical indices and any tolerances for defects should be specified.
- Permitted additives should be listed with any restriction on use indicated. Standards may include maximum permitted levels of contaminants, such as toxic heavy metals, natural toxicants, pesticide residues, species and quantity of pathological micro-organisms etc.

In addition, standards may include specific requirements depending on the type of food products. Methods of sampling and analysis must be specified to ensure uniformity in

procedures and in interpretation of results. This may be done by reference to published methods or via a full description of the method to be used.

Obviously, the preparation of a food standard involves the gathering of much information and the co-operative efforts of many people. The establishing of a standard at the national level should indeed be a national effort based upon contributions from the government, the food industry, the food trade, the scientific community and consumers. This is often done through a committee or committees. As examples, the government (or its authorized agency) should assume responsibility for:

- Establishing the rules and procedures to be followed in accordance with the national constitution and specific legal requirements.
- Collection and analysis, when necessary, of samples for composition; for physical, chemical and organoleptic properties; for unavoidable contaminants; for international forms of adulteration and means for detection.
- Arranging for the drafting and publication of the proposed standard, with an invitation for all interested persons to submit comments within a specified time limit.
- Arranging for publication of the final standard in a prescribed format.

2.3. International System of Standards

The growing quality requirements regarding food quality and the rapidly increasing trade in food products and safety problems connected with it (see section 3) stimulated and stimulate the programs of international harmonization of food standards. Of the organizations and programs active worldwide in this field, first at all the International Standardization Organization (ISO) and the Joint FAO/WHO Food Standards Programme should be mentioned. In addition some other organizations and scientific associations take part in the elaboration of international standards. In the following only the aims of two main organizations are treated in detail. A short summary is given of other organizations, including regional organizations.

International standardization began in the electrotechnical field, when the International Electrotechnical Commission (IEC) was established in 1906. The International Federation of the National Standardizing Association (ISA), which was set up to 1926, carried out pioneering work in other fields. The emphasis within the ISA was on mechanical engineering. Its activities came to an end in 1942.

In 1946, delegates from twenty-five countries met in London and decided to create a new international organization, the object of which would be “to facilitate the international co-ordination and unification of industrial standards.” The new organization, ISO, officially began operating in 1947. At present ISO has 133 member organizations from countries large and small, industrialized and developing, in all regions of the world, on the basis of one member per country. The object of ISO is to promote the development of standardization and related activities in the world with a view to facilitating the international exchange of goods and service, and developing co-operation in the spheres of intellectual, scientific, technological, and economic activity.

Since 1947, ISO has published thousands of International Standards. Systematically, every fifth year after publication of an ISO standard, it is reviewed in order to decide on its confirmation for a further five-year period, revision, or withdrawal. This procedure ensures the continuous updating of existing ISO standards and the withdrawal of those, which are out of date or no longer valid. At present there are nearly 12,000 existing ISO standards, and this number is growing year by year. In 1998, the ISO published 1,058 new and revised International Standards.

From the point of view of food standards, the activity of ISO Technical Committee No. 34 (Agricultural and Food Products) is of main interest. ISO TC 34 was established in the same year as ISO, i.e. in 1947. Considering the present number of its member bodies (the membership is seventy-six in all) ISO/TC 34 is still the second greatest technical committee of the ISO.

As the following statement shows, the activities of ISO/TC 34 are rather wide: "Standardization of products of agricultural origin used for human and animal feeding purposes as well as of animal and vegetable propagation materials with particular reference to terminology, sampling, methods of test and analysis, product specifications and requirements for packaging, storage and transportation." At present 528 International Standards are within the responsibility of ISO/TC 34.

The Joint FAO/WHO Food Standards Programme started in 1961. In the framework of this program in 1961 the Codex Alimentarius Commission (Codex) was established. Codex is responsible for making proposals to on all matters pertaining to the implementation of the Joint FAO/WHO Food Standards Programme (FSP). The main purposes of the FSP were summarized in Statutes and Rules of Codex as follows:

(a) Protecting the health of the consumers and ensuring fair practices in the food trade.
(b) Promoting co-ordination of all food standards work undertaken by international governmental and non-governmental organizations.
(c) Determining priorities and initiating and guiding the preparation of draft standards through and with the aid of appropriate organizations.
(d) Finalizing standards elaborated under (c) above and, after acceptance by governments, publishing them in a Codex Alimentarius as either regional or worldwide standards, together with international standards already finalized by other bodies under (b) above, wherever this is practicable.
(e) Amending published standards, after appropriate survey in the light of developments.

Membership of the Commission is open to all Member nations and Associate members of FAO and WHO that are interested in international food standards. In January 2000, 165 countries from all continents were members of Codex. The standards elaborated and adopted by the Codex Alimentarius Commission are collected and published in the Codex Alimentarius.

Among other international and regional organizations, the International Plant Protection Convention (IPPC) may be mentioned. This is a multilateral treaty deposited with the

Director-General of the Food and Agriculture Organization of the United Nations (FAO). 110 governments are contracting parties to the IPPC. The IPPC plays a vital role in the efforts to prevent the spread of pests of plants and plant products, and in trade as the source of international standards for phytosanitary measures.

Additionally, the Organization for Economic Co-operation and Development (OECD) provides its twenty-nine member countries with a setting in which to discuss, develop, and perfect economic and social policy.

The main objectives of the Office International des Epizooties (OIE) (World Organization for Animal Health) are to: inform governments of the occurrence and course of animal diseases throughout the world and ways to control these diseases; co-ordinate, at the international level, studies devoted to the surveillance and control of animal diseases; and harmonize regulations for trade in animals and animal products among member countries.

The World Trade Organization (WTO) is the only international body dealing with the rules of trade between nations. At its heart are the WTO agreements, the legal ground rules for international commerce and for trade policy. The agreements have three main objectives: to help trade flow as freely as possible, to achieve further liberalization gradually through negotiation, and to act as an impartial means of settling disputes.

The United Nations Economic Commission for Europe (UNECE) is the forum at which the countries of North America, Western, Central, and Eastern Europe and Central Asia come together to forge the tools of their economic co-operation.

3. Food Sanitation and Safety

The question of "Is it safe?" is probably the one most frequently put to food producer, inspectors and distributors and also to toxicologists by the public and media. Safety in a sense of total absence of risk does not exist. Thus a more practical question is: "Is the risk acceptably low?"

Risk is a measure of the probability of harm and is a function of a compound's toxic properties and the amount of exposure that an individual sustains. In summary, nothing—including food—is absolutely safe or risk free. People can be involuntarily exposed through food to toxic chemicals. In evaluating risk, food is considered a special category, separated from other consumer products, such as drugs, cosmetics or tobacco, just as eating is a fundamentally different activity from driving, skydiving or mountain climbing. For foods, a high standard of safety is expected and is justified.

Studying the world situation concerning food safety, it could be stated that although big efforts have been made in recent decades to reduce biological, chemical and other forms of food contamination, foodborne diseases are one of the most widespread global public health problems in recent times, and their implications for health and economy are increasingly recognized.

A FAO/WHO International Conference held in 1996 acknowledged that hundreds of millions of people suffer from communicable and non-communicable diseases caused by contaminated food and water. These diseases are attributed to a wide range of agents with varying severity from mild indisposition to chronic or life threatening illness.

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Biographical Sketch

Radomir Lásztity, Professor of the Department of Biochemistry and Food Technology at Budapest University of Technology and Economics, was born in 1929 in Deszk (Hungary). R. Lásztity received his M.Sc. degree in Chemical Engineering in 1951 and his D.Sc. degree in Chemical Science in 1968. He is

honorary president of the International Association for Cereal Science and Technology (ICC). He was acting chairman of the Codex Committee on Methods of Analysis and Sampling of the FAO/WHO Food Standards Programme between 1975 and 1988. Dr Lásztity is a member of the Food Division of the Federation of European Chemical Societies and a member of the editorial boards of several international scientific journals. Among other awards he has received the Bailey and Schweitzer Medal of the ICC, the State Prize of the Hungarian Republic, and the Golden Medal of the Czech Academy of Sciences. Dr Lásztity's main research activities are chemistry and biochemistry of food proteins, food analysis, and food control. He has published more than 700 articles in Hungarian and overseas journals. He is the author of more than twenty books and textbooks.