QUALITY CONTROL OF FINISHED PRODUCTS

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Contents

Summary

The quality of finished products is basic for consumers. Food products must first of all be safe and without danger for consumer health. They must also fulfill consumer requirements, both sensory and nutritional. Consumers have to be convinced that the control system applied guarantees the declared quality of the products. Therefore, proper labeling of products is important. The labeling has to fulfill the requirements given by food legislation. The label must contain the name of the producer, location of the company, nomenclature of food sort, information about quantity, date of usability, or date of durability for consumption (for some products, given by regulation), condition of storage (especially for products that require special storage conditions), data necessary for proper storage and application of such foods, data about food devoted to special nutrition (baby foods, different types of foods for dietary purposes, medical foods), data about the composition of products according to the raw materials and additives (in the form of the internationally adopted E number) used for production, description of the batch production number and, in special cases, other data that are legislatively regulated.

The control system for finished food products is regulated by law. The quality of the products is followed at least by three types of organizations. The first control step is at the producer level. Every producer controls food production in plant laboratories that allow him to regulate the most important items as quantity indices of final food products

(weight and volume), and other items important for produced food, such as content of proteins, sugars, fats, salt, minerals, vitamins, and so on. Governmental laboratories have the highest responsibility for quality control of finished food products. These laboratories have different structures in different countries (central laboratory and district laboratories). They are usually well equipped and able to conduct complicated analyses to determine contaminants in low concentration, and many other tests. Such organizations have great responsibility and authority given by law. They regularly control the entire production process of foods, and pay special attention to problems that occur in regions with newly developed products, newly imported products, with some risk components found in the environment, and with new diseases of animals, and so on. Consumer protection organizations are active in many countries. Such organizations are important because they are trying to find and to prove the validity of (in many cases unofficial) information about danger from some raw materials, food additives, contaminants, and produced foods. In this way they press the responsible state control organization to follow such problems and give consumers clear answers.

1. Introduction

Quality of a finished food product is the most important indicator for the consumer. Finished products have to fulfill all requirements on quality. They should have the appropriate nutritive value, typical sensory characteristics, and above all, fulfill all requirements from a safety point of view. For this reason the quality control of finished products is the crucial point of the whole quality control chain. For the consumer it is important that the quality of such products remain at the level declared by the producer (and on the product) during the storage period guaranteed by the producer. Labeling of foods is therefore important; its purpose is to provide the consumer with the data necessary for making an informed choice in the marketplace. The label must always bear the statement of identity; declaration of net contents; name and address of the manufacturer, packer, or distributor; and a list of ingredients. The date of production and final date of sale is most important, especially in perishable foods. National regulations usually require further data, such as content of nutrients (amount of proteins, fats, carbohydrates, vitamins, and minerals—in all enriched foods), energy content, and information about food additives (appropriate E number). Labeling of food is legislatively regulated on national or international levels.

The first step of quality control of finished food products starts in the factory. The producers are responsible for the quality of products. Therefore, they use the technological procedure in which the HACCP system is incorporated. That means that at least the critical control points are regularly examined. The high quality of produced foods is also important as a competition factor. In this respect the producers are economically stimulated to produce foods of better quality than a competitive company. Factory laboratories are on a high standard, and are reasonably equipped. For analysis not possible without special, and usually expensive, equipment, producers hire the services of special laboratories. The state protects consumers by running its own state control laboratories; their organization varies from state to state. Such laboratories, in developed countries, are well equipped, not only as far as the equipment is concerned but also with skilled and qualified analytical staff. The authority of such state laboratories is regulated by law. Although in the period after World War II considerable progress was made in establishing effective food inspection and control systems in developing countries—especially in food-exporting countries—the growing need to control food contaminants present in food in low quantities is difficult in many countries and needs further efforts for improvement of the present situation. These efforts are supported by actions of FAO/WHO.

Consumer organizations are also engaged in the food control system and play an important role. For example, these organizations inform consumers about the results of quality comparative studies and draw attention to products that do not fulfill given quality requirements. Generally, it is possible to say that the activity of such laboratories is focused on observation of the following: declared weight of products, chemical composition, organoleptic properties, quality of packaging, microbiological state, presence of food additives, and contaminants. Controlled products have to fulfill requirements for their given type of product, and they especially have to be safe for the consumer.

2. General Aspects of Quality Control of Finished Products

It is without doubt that finished products must fulfill all criteria of food quality. Therefore, such products are regularly controlled not only by the producers but also by state control laboratories. Products on the food market have to be safe and to match all quality criteria. Such control has to eliminate possible health hazards and to guarantee that food products have not been adulterated. The food that the consumer receives from the farm or factory via food distribution systems may exhibit important compositional changes that may be relevant to health, social mores, or the aesthetic beliefs of the consumer, and may not correspond to production claims, the label, or trade agreements. The consumer is now more conscious about what he wants, and the industry is eager to deliver the quality the consumer prefers. At the same time, scientific advances are making available tools and techniques that are enhancing the sensibility, specificity, and reproducibility of analytical methods. This information arising from the basic biological sciences has assisted the analytical researcher in identifying new indicators of quality and the authenticity of foods. In many countries, mandatory provisions in food legislation are becoming more rigorous, especially with regard to safety aspects. The need has therefore arisen to give the consumer and health authorities much more information about the raw materials used in a food product, over and above assurances that the product is unadulterated. The objective of the food analyst is to encompass, in addition to detection of adulteration, characterization of the food with respect to its source, the history of its handling, storage, preprocessing, and so on.
Economically it is important that the quantity indices (weight, volume) of final food products are in agreement with the declared data; variations are limited by food laws and regulations.

When the food is wrapped or bottled, the quality of packaging should be also controlled. Especially in cases when packaging materials of synthetic plastic are used, residues that can be eluted from this material into the foods (as for example ftalates) are controlled.

Chemical composition of final food products is important to the consumer. Composition declared on the labels has to be in agreement with the given products. Economically, but not only for that reason, water content plays an important role regarding the stability of perishable foods during storage. Higher water content can manifest in microbiological spoilage of such foods. All other food components typical for given foods are regularly controlled. Great attention is usually paid to labile food components (vitamins, some essential amino acids, unsaturated fatty acids, and others) or such components that are crucial from the points of view that are nutritional (content of main nutrient), sensory (presence of typical aroma, taste, texture, and so on), or hygienic (residue of antinutritive or toxic compounds). Special care is devoted to the control of additives, because only some additives can be used in some food products, usually in a concentration given by law.

In addition to the above-mentioned criteria, produced food must fulfill quality microbiologically. The microbiological standards of foods are strictly given by the state. Determining microbiological quality is a time-consuming job. Food producers know that the risk from products that do not fulfill microbiological criteria is high, therefore, they control the whole technological procedure, step by step, using the HACCP system, which minimizes the risk of producing products that do not fulfill microbiological and other requirements.

Particularly in developed countries attention is being paid to the interrelations of health and nutrition. As a result, the production of "healthy foods" is growing from year to year. A new class of such industrially produced foods is the so-called functional foods. A food is "functional" if it is satisfactorily demonstrated to beneficially affect one or more target functions in the body, beyond adequate nutritional effects, in a way that is relevant to either the state of well-being and health, or the reduction of the risk of disease. A functional food does not need to be functional for everyone. In particular, specific functional foods can be developed to match with genetic requirements of some groups of the population. In all cases, the demonstration of such beneficial effects requires a strict scientific approach, for which a strategy can be proposed.

Food can be made functional by:

- Elimination of a component known or identified as causing a deleterious effect to the consumer (for example, an allergenic compound)
- Increasing the concentration of natural components in foods to reach a concentration able to induce the expected effects (e.g., fortification with vitamins to reach a daily intake higher than recommended but compatible with dietary guidelines for disease prevention), or to increase the concentration of a non-nutritive component for which data are available that it demonstrates beneficial effects (e.g., fiber)
- Adding a component not normally present in foods, but for which beneficial effects have been demonstrated (i.e. nonvitamin antioxidants or prebiotic fructans)
- Replacing a component, usually a macronutrient, the intake of which is usually excessive and which, consequently, causes deleterious effects (for example, fats) with a component for which beneficial effects have been demonstrated (e.g., a fat replacement)
- Improving bioavailability, or to modify food components for which beneficial effects have been demonstrated

Functional food can either enhance function or reduce disease risk. Enhanced function refers to the positive consequences of interactions between a food component and a specific genomic, biochemical, cellular, or physiological function without direct reference to any health benefit or reduction of risk of disease (rebalancing of the metabolic activities, strengthening the immune functions, protecting against chemical toxicity, restoring or stabilizing a balanced colonic microflora, improving bioavailability of nutrients). Disease risk reduction refers to the reduction of risk of a disease by consuming a specific mixture of specific food components. Reduction of cardiovascular disease, infections, atherosclerosis, liver disease, diarrhea, constipation, osteoporosis, and diseases associated with syndrome X (for example, noninsulin-dependent diabetes or obesity). The demonstration of such health effects remains a difficult task that requires long-term experiments, of which the final results are difficult to predict. This reinforces the requirement for a strict scientific approach based on a sound hypothesis supported by reasonable explanation about the mechanism of the effect to be expected.

It is possible to recognize a growing importance of nutrition and new food products (dietary supplements, fortified foods, functional foods, nutraceuticals, and so on) in the maintenance of human health in comparison to some pharmaceuticals. Findings by clinical nutritionists trigger research into agronomic methods, food processing methods, and the marketing of specific foods and components. As was proved, it is possible to alter meat, milk, and eggs (improve the nutritional quality) by appropriate animal feeding. The supplementation of the diets of cows with conjugated linoleic acid and soybean oil can alter the nutritional quality of dairy products through the increase of conjugated linoleic acid content and the decrease in saturated fatty acid content. Similarly the quality of eggs (high levels of essential fatty acids omega-3 and omega-6) can be improved by feeding with flaxseed, dietary grit, menhaden oil, and vitamin E, without reducing production or requiring increased dietary supplementation costs and procedures.

New technologies have been developed that make possible the creation of novel plant varieties containing increased levels of naturally occurring phytochemicals that can be used in the formulation of health-promoting foods. New technologies also facilitate the rapid identification of the specific genes that regulate the levels of such phytochemicals as carotenoids, lycopene, flavonoids, isoflavones, vitamins, and various elements and minerals.

Research trends in the area of healthy foods are clear. Determining which compounds in foodstuffs are active ingredients, how the activity produces a result, and how to define the active ingredient precedes the work that determines how to separate, enhance, and purify the compounds. All of the steps are important.

On the horizon is research that will help us understand the role of components so that foods are formulated to maximize positive vitamin and mineral interactions, modify rations to produce eggs, milk, and meat that balance human nutritional needs, and learn about the effect of altering the composition of soil to produce improved grains, fruits, and vegetables.

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Biographical Sketch

Jiří Davídek, D.Sc., is a Professor of Food Science on the Faculty of Food and Biochemical Technology, and is a member of the Department of Food Chemistry and Analysis, Institute of Chemical Technology, Prague, Czech Republic.

Professor Davídek received his M.Sc. degree from the Institute of Chemical Technology, Faculty of Food and Biochemical Technology in 1954. He obtained his Ph.D. in 1969 from the same Institute under the direction of Professor Dr. G. Janíček. After doing postdoctoral work with Dr. J. Fragner at the Research Institute of Food Industry in Prague and with Dr. A.W. Khan at the National Research Council, Division of Biosciences, in Ottawa, Canada, he was appointed Associate Professor of Food Chemistry and Analysis at the Faculty of Food and Biochemical Technology, Institute of Chemical Technology, Prague, in 1960, and became a full Professor there in 1970.

Professor Davídek is a member of the Czech Chemical Society and Chairman of the Division of Food and Agricultural Chemistry. He is a national representative in the Food Chemistry Division, Federation of European Chemical Societies (FECS) and is member of the Czech Biochemical Society, the American Institute of Food Technologists, and numerous other scientific societies. He is also a member of the editorial board of the Czech J*ournal of Food Sciences*, German *European Research and Technology*, and Chinese *Biomedical and Environmental Sciences*. He has served as the head of the Department of Food Chemistry and Analysis, Dean of the Faculty of Food and Biochemical Technology in Prague, and Vice-Chairman of the Czechoslovak Academy of Agriculture. In 1972 he received the State Prize for Research, and in 1982 he was awarded both the Gold Medal from the Czechoslovak Academy of Agriculture and the Silver Medal of Professor Jaroslav Heyrovsky from the Czechoslovak Academy of Science.

Professor Davídek has published more than 330 papers and is the author of 16 books published variously in Czech, English, German, and Polish. He has also delivered more than 350 lectures at scientific conferences and symposiums. He often works as a chairman at the International meetings organized by the Food Chemistry Division of FECS (Euro Food, Chemical Reactions in Foods, and so on). His research interest focuses on food quality, food analysis, Maillard reactions, the formation of sensory active compounds, food additives, and natural toxic compounds.