

FOOD QUALITY AND SAFETY ASSURANCE IN TERMS OF LOSS AND WASTE LIMITATION

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Abstract. One of the greatest challenges of 21st century is satisfying the food needs of the fast growing population of the world. Food must fulfill quality and safety standards. The access to safe and appropriate food is not the same everywhere. Food excess and, in consequence, food waste is present in many regions of the world. This study is meant to explain the causes of food waste on the basis of the author's own research and study results of other scientists. The lack of authenticity and falsification belong to the new factors endangering food safety and food waste related thereto. This analysis proves that the authenticity of food improves its safety through the implementation of quality management systems, the appropriate system of food labelling and food identification by means of applicable law regulations, supervision and control systems. Main aim of this study is to address why, even though there are so many quality standards and systems, a significant problem with food loss and waste constantly occurs. Waste-causing factors have been determined on the example of bread and the handling of unconsumed bread has been attempted in this study. Waste limiting actions are necessary as food production is significantly overburdening the natural environment and generating an increasing amount of waste, hazardous to the clean air.

Key words: food safety, food waste, food loss

INTRODUCTION

Apart from other needs, food consumption and the need of safety are on the top of the needs hierarchy of the

human being. Nutrition is an undeniable condition of human existence which has determined human development over the centuries. Food is the source of energy, nutritional and growth components influencing the health, mentality and behaviour of the human.

The progressing globalization has caused a number of changes also in the field of food production and consumption. Next to some beneficial changes, we also observe some disadvantageous changes, such as the particular competition between food manufacturers and food consumers resulting in food overproduction leading to waste and, consequently, causing harm to the natural environment, state budget and private households.

The objective of this study is to present certain issues regarding the food safety assurance in terms of limiting its loss and waste. The basis of the civilization development is the providing the quality of life with full respect to the natural environment.

FOOD QUALITY AND SAFETY

The term “food” has been defined by the Regulation EC No. 178/2002 as follows: “Food” (or “foodstuff”) means any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans”.

The notion of “food” is very broad within this definition. There is only one condition to qualify a substance or product as food: intention to be, or reasonable

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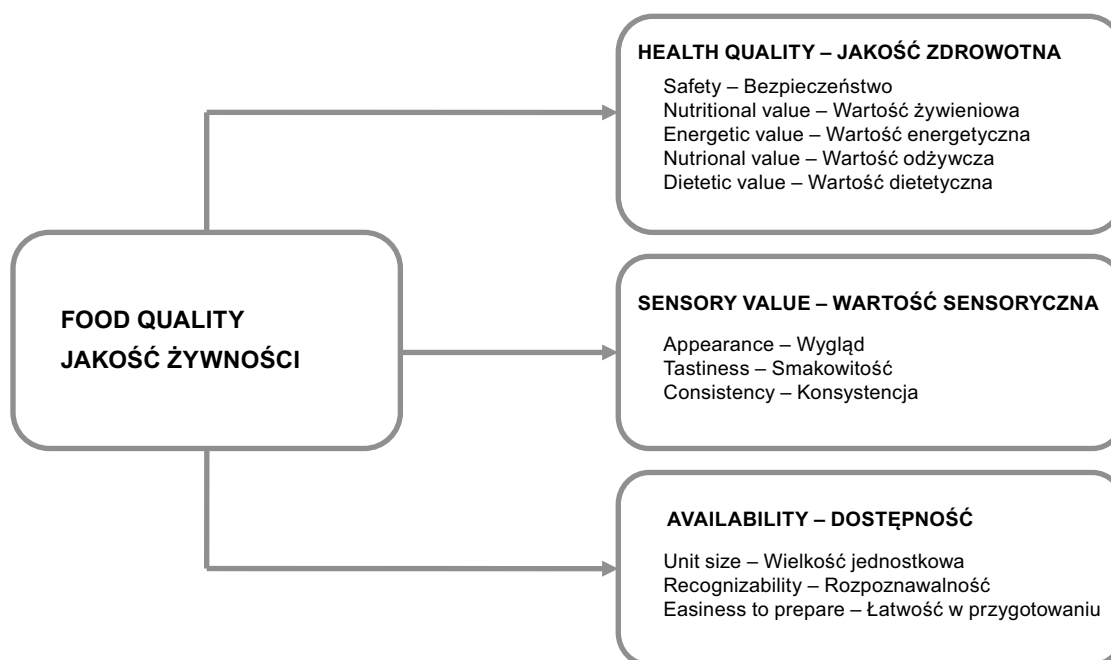


Fig. 1. Structural elements of food quality

Source: Śmiechowska, 2013.

Rys. 1. Elementy składowe jakości żywności

Źródło: Śmiechowska, 2013.

expectation to be ingested by humans (Kołożyn-Krajewska and Sikora, 2010).

Food safety is a broad term which influences many factors such as the quality of environment, humans, food additives, packaging, manufacturing equipment, method of manufacturing and many other. Many authors in the field of quality management focus on food safety as an essential element of food quality (Fig. 1).

Food safety is an element of food quality according to the definition of latter (Fig. 1). However, due to the significance of this problem as well as legal regulations, food safety is mentioned as equal with its quality as “food quality and safety”.

European Union food law regulations are very complex and they include different aspects regarding raw materials, their processing and the trade of ready food products.

The framework regulation of the new food law of the European Union is the Regulation (EC) No. 178/2002 of the European Parliament and of the Council of 28th January 2002 which determines the general regulations and requirements regarding the food law.

The Regulation (EC) No. 178/2002 is the fundamental document with regard to food law of the European Union, which (among others): defines the terms regarding food; establishes the Rapid Alert System for Food and Feed (RASFF); prohibits the introduction of dangerous and adulterated food on the market; holds the food manufacturers liable for the safety of the manufactured food; imposes the obligation of introducing the traceability procedures, i.e. the procedure of identification of a given product (one step ahead and one step back); obliges the food manufacturers to recall from the food market any products which do not meet the food safety requirements; introduces the obligation to apply the law of food safety also to the products imported to or exported from the territory of the Community (Gajda-Wyrębek, 2009).

The three following Regulations, No. 852/2004, No. 853/2004 and No. 854/2004 of the European Parliament and of the Council (EC) constitute the hygiene rules, which enabled to introduce the common requirement for any matters regarding the foodstuff. It was considered necessary to adopt an integrated approach in order to

provide food safety from the stage of the primary manufacture to the stage of placing the product on the market (from farm to fork). Any entrepreneur in the food sector should ensure that the food safety, in terms of production chain and food distribution, will be preserved (Gajda-Wyrębek, 2009; Korzycka-Iwanow, 2007).

The basic document that defines food safety in Poland is the *Ustawa...*, 2006. This act defines food security as all conditions necessary to be fulfilled and concerning in particular: applied additives and flavours, levels of pollutants, pesticides residues, food irradiation conditions, organoleptic factors, and actions that must be undertaken at all stages of food production and trade in order to secure human health and life (*Ustawa...*, 2006).

The food safety is examined by the inspection authorities. Statutory supervision over food safety in Poland is exercised by inspections: State Sanitary Inspection, Veterinary Inspection, Main Inspectorate of Plant Health And Seed Inspection, Agricultural and Food Quality Inspection, Office of Competition and Consumer Protection, and Trade Inspection. The results of their activities depend on, among others, the act upon which the authority was established or its mission. The efficiency and effectiveness of these institutions are also influenced by the method of their organization, their field structures and funds granted to the institution. The official quality inspection is not only beneficial to consumers, but it also provides information for any further links of the supply chain about the correctness of their activities, confirming that the food, throughout its all way from the manufacturer to the consumer is safe and beneficial for both the consumers and the economy.

The role of media may be sometimes not understandable, as the media present the irregularities regarding the manufacturing, distribution, storage or processing food products in an inappropriate way. Any fault found only confirms the rightness of establishment of such inspection authorities and provides evidence of the effective performance of their duties (Śmiechowska, 2013).

THE CAUSES OF FOOD WASTE

The increasing globalization has caused a number of important changes in terms of, but not limited to, food production and consumption. Unfortunately, next to some positive effects such as opening new sales markets, increasing the availability of food products, it has caused

a whole range of negative changes (Adamczyk, 2012; Kowalczyk, 2009). It is also observed that the consumers' attitude and expectations regarding food consumption have been changing due to various factors, which do not always have the health-promoting nature (Gulbicka, 2007; Kwasek, 2010).

Globalization has caused disparities resulting in the excessive production (overproduction) in the developed countries and the quantitative and qualitative shortage of food in the countries of the low gross national income per capita. The process also leads to further social stratification and therefore to unequal access to various goods, including food product (Sadowski, 2013).

The world is overwhelmed by a specific kind of a consumption race – in food production, sale and consumption. Whereby the food production and sale is possible to grow, it must be remembered that food consumption, especially in the developed countries, is not unlimited. Its limitations result from, but are not limited to, the societies' growing awareness of health hazards related to excessive consumption. In consequence, some food has begun to be lost and even wasted.

The aspects influencing the reduction of food amount are as follows:

- natural loss – due to the storage conditions,
- losses – resulting from inappropriate handling of food products and mistakes made during production, processing, transportation and storage,
- waste – the result of the inappropriate distribution, transportation, storage and preparation of food (Papargyropoulou et al., 2014).

The results of the scientific research (water footprint, carbon footprint) show that the food production imposes a great burden on the natural environment (Konieczny et al., 2013). The severity of the phenomenon of food waste has been also highlighted as a result of the implementation of the act on maintenance of the municipality/commune in a clean and orderly condition. The act imposed the obligation of separate collection of household waste, including the biodegradable waste (*Ustawa...*, 1996 and *Ustawa...*, 2012).

It should also be noted that the globalization of the food production and consumption is increasingly affected by the phenomenon of food adulteration and the lack of food authenticity, which may also influence the amount of the wasted food, as in the majority of cases, the purchased non-authentic food is not accepted by a consumer (Śmiechowska, 2013). The safety and

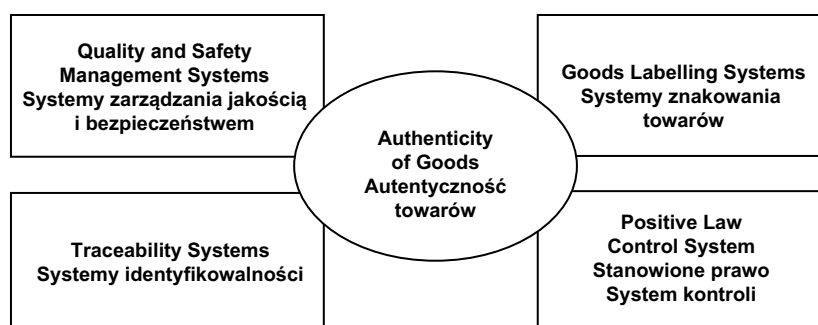


Fig. 2. Assurance of Authenticity of Goods

Source: own study.

Rys. 2. Zapewnienie autentyczności towarów

Źródło: opracowanie własne.

authenticity of food products are provided by the quality and safety assurance systems, goods labelling and securing systems, traceability systems and control systems (Fig. 2).

The problem of the food authenticity has a broader sense and it influences a number of other issues such as: the image of the company, the perception of the brand, pricing of products, the objective quality of a product, the correlation between the price and the quality of a product, which, if related to the product authenticity, may be used for positioning the given company on the market. The guarantee of authenticity of a product results in the increase of the clients' trust for the company and for a given product, and it also leads to the segmentation of the market. Product authenticity may be also used as the element of marketing and it may boost up the profits of an entrepreneurship.

UNDERTAKINGS TOWARDS LIMITING THE FOOD LOSS AND WASTE

Food safety and quality management systems maintain the level of food quality and its compliance with standards. These systems continue to develop and undergo continuous improvement, starting from obligatory ones through optional and the supplementary ones (Fig. 3). The target of any food standards is establishing a food safety assessment system having homogenous requirements and audit procedures whereas the audit results will be recognized mutually by all the participants of food supply chain (Czupryna and Maleszka, 2008). The number of systems is growing and, in this situation,

the authorities try to limit the quality management systems to minimum, so that an integrated system could provide effective performance.

In spite of the sophisticated food quality and safety assurance system the world continues to receive information about incompliances in the food production and handling. Several serious incidents have taken place over the last few years, such as: BSE epidemic (*Bovine Spongiform Encephalopathy*) with British Isles cattle (Wilesmith et al., 1988). In 1999 the world heard about the discovery of dioxin in poultry and eggs in Belgium (Covaci et al., 2008). Other news which faltered the balance of food quality and safety were the bird flu and swine flu epidemics and death cases in Germany due to poisoning with *E. coli* EHEC (Sebastian et al., 2009; Rheinbaben and Schwarzkopf, 2012). Some cases of deadly poisoning with high proof alcohol drinks which were contaminated with methanol took place in several European countries, including Czech Republic and Poland in 2012. Over fifty deadly poisoning cases were recorded. The contaminated alcohol was introduced to the market in standard, labelled glass bottles with the required marking. The alcohol was sold in legal sale and service stores and not, like in the cases of contaminated alcohol distribution, on fair markets and local stands. The authorities of Czech Republic sent this information to the European system RASFF – Rapid Alert System for Food and Feed (Rządowe Centrum Bezpieczeństwa, 2013).

These incidents have confirmed that:

- food supply chain must be tight,
- information about the origin of products and raw materials must be given in the entire logistic chain,

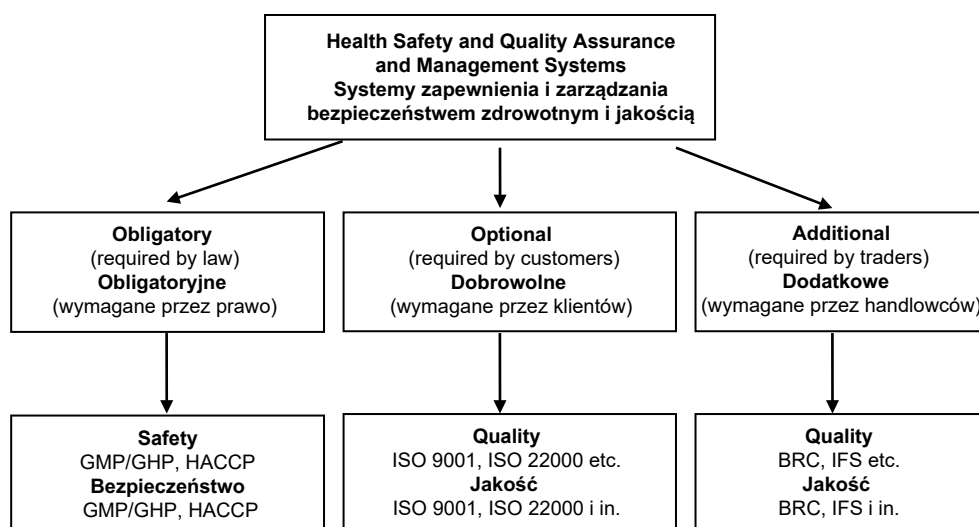


Fig. 3. Obligatory and optional health safety and food quality assurance and management systems
Source: Śmiechowska and Kłobukowski, 2015.

Rys. 3. Obligatoryjne i dobrowolne systemy zapewnienia i zarządzania bezpieczeństwem zdrowotnym i jakością żywności
Źródło: Śmiechowska i Kłobukowski, 2015.

- all documents and records regarding the product and the way it has followed must be stored.

Initially, the development of the quality and safety management system was highly recognized both by manufacturers and food consumers, but with the course of time it resulted in production of global and unified products. Whereas some consumers were satisfied with the fact that their favourite products may be consumed regardless of the location, the others were not. In the course of time, the consumers reacted indifferently to these products and started to search for other products. As a result, new products were introduced on the market, not always approved by consumers, which may also lead to waste of the purchased food. Products compliant with the quality requirements of the producer do not always meet the demands of the consumer. Consumers have begun questioning the quality of products which label information is significantly different from its actual content. Such objections mainly concern meat products, which name contradicts the percentage content of the main component.

The food market, under the pressure of consumers searching for innovative products, turned towards the food *glocalization* expressing in the increase of production of regional, traditional and organic food.

Food waste is a dangerous phenomenon for natural environment for the two following reasons:

- the exploitation of the natural environment, consuming water, energy and resources and tools used in food production,
- emitting waste and harmful substances into the environment as a result of food waste, especially greenhouse gases (Garnett, 2011; Grizzetti et al., 2013; Eriksson et al., 2015).

The largest amount of food waste is generated by:

- private households (42%), whereas 2/3 of this waste could have been avoided. The most popular cause of throwing away food might be the lack of knowledge about handling with a food product, the time if its preparation or storage conditions, which may result in wasted food products;
- manufacturers (39%), that is the companies of the food sector where inappropriately estimated scale of production and the waste of packages or products due to damages result in a high percentage of the wasted food;
- food suppliers (14%), including restaurants and catering companies, where throwing away food is caused by the lack of possibility to choose the size of the ordered meal, the preferences of the consumers or excessive food stock;

- sellers (5%), due to an inappropriate stock management, the lack of marketing strategy or inappropriate food storage.

The most popular causes of discarding food by consumers are as follows:

- exceeding expiry date (51%),
- inappropriate storage (31%),
- inappropriate quality of food products (26%) (Achremowicz, 2012).

It is surprising that, while maintaining such high food production standards confirmed by numerous certificates and quality marks, consumers continue to question the quality of food products. Are there any solutions which could stop this scenario so disadvantageous for the human being, and, in consequence, to reduce the scale of waste?

The pioneering pilot study on the food waste carried out in 2014 in Poland has shown that the most common product being disposed of is bread (Śmiechowska and Chrzanowska, 2015). Baking as a component of everyday diet is the most susceptible to waste. The studies (based on questionnaires collected in 100 households from diverse rural and urban background) have shown that the nutrition model of the Polish people has changed over the

last few years. The change of life and work conditions have influenced this model to a great extent. Corporations employees and workers of service branch and the self-employed constitute this group of consumers which is currently about 15%, however, with growth tendency.

The research has shown that 45% of consumers dispose of the bought bread and the uneaten rests go to waste disposals. Bread molding during storage (38%) and its fast drying and hardening (29%) are the main drawbacks of bread (Fig. 4). Consumers believe that the quality of bread drops within 1-2 days from the date of purchase. Bread waste should be limited due to the growing costs of production, unnecessary energy and water consumption, increasing amount of waste and environment pollution. Causes of bread waste are differentiated and are the effect of many factors. Some factors have been diagnosed, such as the low quality of the bread, baking bread from frozen dough which quickly loses its taste, wrong adjustment of the size of the bread baked to customers' needs.

38% of consumers process the unconsumed bread into the bread crumbs, 18% make toasts, and 14% prepare baked sandwiches. Still, 21% of the respondents

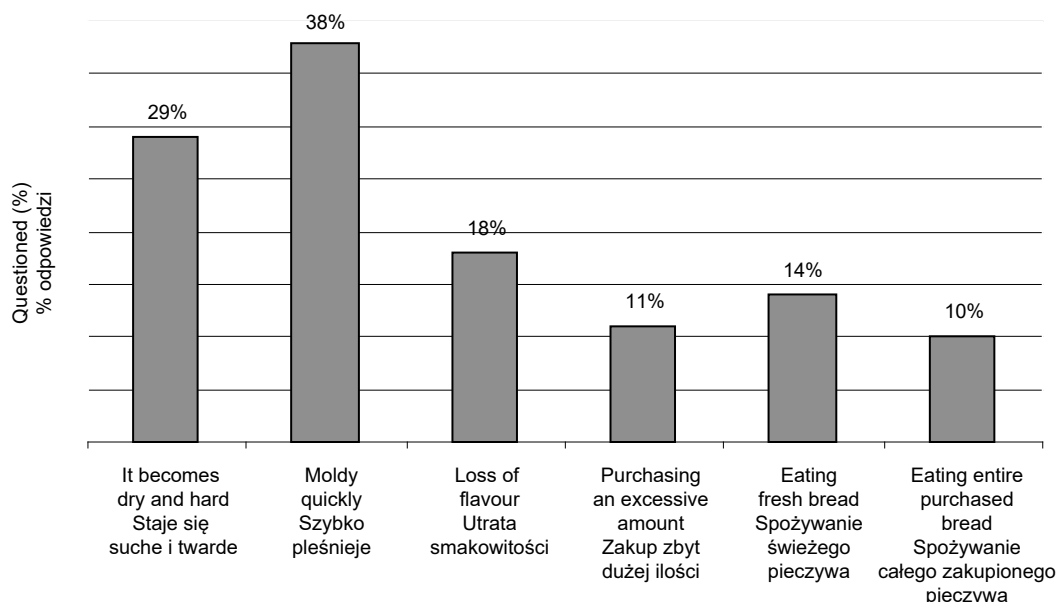


Fig. 4. Reasons for which the respondents dispose of bread

Source: Study based on the author's own research (Śmiechowska and Chrzanowska, 2015)

Rys. 4. Powody, dla których respondenci wyrzucają pieczywo

Źródło: Opracowanie na podstawie badań własnych (Śmiechowska i Chrzanowska, 2015)

feed animals with uneaten bread and these are mostly consumers residing in a farmland or in small villages where animals can be bred.

Fashion for making home-made bread and buying bread in small bakeries in the suburbs and villages where the traditional recipes are used, is becoming more and more popular. Consumers believe that bread bought in small traditional local bakeries has delicious taste even several day after the purchase date.

Another form of waste is connected with the implemented HACCP system according to which any food in readiness which has expired must be removed from the bars and restaurants. In many cases fast food chains, in order to imply the extraordinary quality of their food, have significantly shortened the time after which the heated food should be disposed of. This is a specific type of loss which occurs constantly and generates waste. Of course, this does not imply that HACCP should be eliminated.

Research results concerning food waste on the example of baking allow to define actions leading to loss limitation. In the opinion of the authors, these activities should act twofold. Producers should react to consumer studies concerning food quality assessment. They should provide not only food quality and food safety standards, but also comply with the widely understood responsibility and business ethics. Consumers, on the other hand, should adjust to a greater extent the amount of purchased food to their consumption demands, should avoid excessive food storage, and should find use for non-consumed food.

CONCLUSIONS

The objective of this study was to present some of the issues related to food waste in terms of its quality and safety assurance. Progressing civilization and globalization are constantly enhancing waste. The globalization of food production and consumption make food products more available, but on the other hand it causes the disappearance of tradition and it eliminates regional and local food. The implementation of food quality assurance and food safety systems enforce certain food procedures and handling. These rules determine the shelf life of food. They cause, in pursuance of HACCP requirements, that after the expiry date defined by the internal network systems, some meals and dishes are discarded in bars and restaurants. This is a specific type of waste encountered mostly in fast food chains.

The research done in respect of reducing the effects of waste tend, on the one hand, to awaken the ecological consciousness of the societies and to limit the consumerism, on the other hand it is meant to find the mechanisms which will reduce the number of starving people in the world. Consumers promoting new life style and new consumers' behaviours have been attempting to object to waste.

The actions undertaken to reduce the amount of food waste bring some effects, however, this is a long-term process and it requires using different methods of action (Graham-Rowe et al., 2014). Furthermore, the latest research confirms that food waste does not have to linger on waste disposal, but may be a valuable processing resource, as they may be used as a source of valuable micronutrients (Galanakis, 2012).

The problem of food waste is a complex matter, and the difficulties in limitation of this phenomenon result from, but are not limited to, the fact that there are many different causes of its occurrence and also from the conflict of political, economical and social interests.

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ZAPEWNIENIE BEZPIECZEŃSTWA ŻYWNOCI W KONTEKŚCIE OGRANICZENIA STRAT I MARNOTRAWSTWA

Streszczenie. Jednym z największych wyzwań XXI wieku staje się zaspokojenie potrzeb żywnościowych dla szybko rosnącej liczby ludności na świecie. Żywność musi odpowiadać wymaganiom standardów jakości i bezpieczeństwa. Dostęp do żywności bezpiecznej i odpowiedniej jakości nie jest jednakowy. W wielu rejonach świata mamy do czynienia z nadmiarem żywności prowadzącym do jej marnotrawienia. W artykule podjęto próbę wyjaśnienia przyczyn marnotrawstwa żywności na podstawie badań własnych i wyników badań innych autorów. Wśród nowych czynników zagrażających bezpieczeństwu żywności i sprzyjających jej marnotrawstwu jest brak autentyczności i zafałszowania. Z analizy wynika, że autentyczność żywności wzmacnia bezpieczeństwo żywności przez wdrażanie systemów zarządzania jakością, wprowadzenie właściwego systemu znakowania żywności, wdrożenie systemów identyfikowalności za sprawą stanowionego prawa oraz systemów nadzoru i kontroli. Na przykładzie pieczywa określono czynniki sprzyjające jego marnotrawstwu, jak również podjęto próbę właściwego zagospodarowania nieskonsumowanego pieczywa. Przeciwdziałanie marnotrawstwu jest koniecznością, gdyż produkcja żywności w znaczącym stopniu obciąża środowisko naturalne, zwiększając wielkość odpadów i zagrażając czystości powietrza.

Słowa kluczowe: bezpieczeństwo żywności, straty i marnotrawstwo żywności

Accepted for print – Zaakceptowano do druku: 29.03.2016