

Einfluss der Kühlung auf sensorische Eigenschaften von Austern (*Ostrea edulis*)

Zusammenfassung

In Austernmustern (*Ostrea edulis*) wurden sensorische Eigenschaften nach der Bewahrung auf Temperaturen von 4°C, 7°C und 15°C in verschiedenen Zeitabschnitten (ein, drei, fünf, sieben, neun und 11 Tage) bewertet. Die Qualitätsindikatoren für Krebstiere (Gehäuseaussehen, Farbe des flüssigen Inhaltes der Muschel, Essstell, Konsistenz und Geruch) wurden mit 0–3 Punkten bewertet. Die Veränderung der sensorischen Eigenschaften auf den Austernmustern gelagert bei Temperaturen von 4°C und 7°C erfolgten am siebten Tag, während die Veränderungen auf den Austernmustern gelagert bei Temperatur von 15°C am fünften Tag beobachtet wurden.

Schlüsselwörter: Auster, Kühlung, sensorische Eigenschaften

Influenza del raffreddamento sulle caratteristiche sensoriche di ostriche (*Ostrea edulis*)

Sommario

Nei campioni di ostriche (*Ostrea edulis*) sono qualificate le caratteristiche sensoriche dopo l'immagazzinamento sulle temperature di 4°C, 7°C e 15°C durante diversi periodi del tempo (uno, tre, cinque, sette, nove e undici giorni). Gli indicatori di qualità di bivalvi (aspetto di crosta, colore del contenuto liquido, della sua parte mangiabile, consistenza e odore) sono stati valutati da 0 a 3 punti. I cambi delle caratteristiche sensoriche sui campioni immagazzinati sulle temperature di 4°C e 7°C sono apparsi il settimo giorno, e sulla temperatura di 15°C i cambiamenti sono stati notati il quinto giorno d'immagazzinamento.

Parole chiave: ostriche, raffreddamento, caratteristiche sensoriche

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Ensuring quality in primary production of meat

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professional paper

Summary

This paper gives an overview of the importance of setting up a system based on the principles of hazard analysis and critical control points (HACCP). In the Republic of Croatia today, the Food Act (OG 46/07) requires food businesses to establish a quality control system based on the HACCP principles. The system presents the application of preventative measures which reduces the concept of risk analysis to the lowest possible level. Preventative measures, if effectively applied to known critical points, reduce the likelihood or appearance of risk to an acceptable level.

The HACCP system consists of seven principles, and its implementation is carried out in twelve steps. Directly after the establishment of the system, it is necessary to educate and train the employees. However, a long-term functioning of the system can only be ensured through the regular revision of documentation and the HACCP plans in order to keep it up to date with any changes that have taken place.

Key words: quality, quality control, HACCP.

Introduction

The term "food safety" becomes more frequent every day and it implies health safety and suitability of food for human nutrition in accordance with its purpose. Considering the given definition, safe food is possible to be produced by ensuring adequate hygienic conditions in the production plant and a complete monitoring of the production process in order to enable a timely response at possible appearance of a problem. Therefore, many legal regulations whose implementation should ensure the production of safe food have been adopted in the Republic of Croatia in the last couple of years in the aim of their approximation with the ones in force in the EU countries. In doing so, a commitment often appears to establish and implement a system based on the principles of hazard analysis and critical control points (Hazard Analysis Critical Control Point – HACCP) by all food business entities (FBE), except for those

on the level of primary production.

A proper application of HACCP system requires existing scientifically documented procedures and preventative measures to be efficiently applied to the known critical control points (CCP). Determining critical control points in the aim of implementation at the level of primary production/farms is possible for chemical, physical and certain biological dangers, but it is considered to be insufficient for all microbiological dangers. Therefore, most of the activities which are carried out on farms are based on prerequisite programs which offer basic environmental conditions and businesses necessary for the production of safe food.

The first legal requirement for the introduction of procedures based on the principles of HACCP system in the Republic of Croatia has been proscribed by the Regulation on the implementation of obligatory measures in approved facilities in order

to reduce microbial and other contamination of meat, meat products and other products of animal origin intended for human consumption (Anonymous, 1997). By provisions of the Food Act 2003 (Anonymous, 2003), this requirement has been expanded to all food business entities (FBE), but since it was impossible to be enforced, the intended date of entry into force (15 July 2006) was prolonged up to 1 January 2009. A legal framework which, among other things, defines application, monitoring of the application and the revision of procedures based on the principles of HACCP system, has in the meantime been approximated with the *acquis communautaire* of the EU in the Food Act 2007 (Anonymous, 2007a), the Ordinance on the hygiene of food of animal origin (Anonymous, 2007b), the Ordinance on official controls performed to ensure the verification of compliance with food and feed laws, as well as animal health and animal welfare rules, and the Ordinance on official controls of prod-

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ucts of animal origin (Anonymous, 2007d).

Livestock production has experienced significant changes during the last couple of decades. Due to the fact that economic margins between costs and revenues were decreased, the process of production intensification in conjunction with the application of new technologies and the ways animals are kept for farming purposes, has increased the productivity. Such developmental changes are especially expressed in countries like the Netherlands, which is a great exporter of livestock and products of animal origin (Noordhuizen et al., 1983). Still, along with the positive effects of intensive production, the unwanted ones are also noted; for example, the increase in the risk of a disease outbreak and its fast spreading within a farm because of kept animal density, as well as the increase in the general sensitivity of animals to diseases and the effect of stress (Broom, 1996). The appearance of a disease represents an economic question in the process of transforming resources or factors of production to products, goods and services available to consumers (Mc Inerney, 1988); the first ones are related to expenses and the last ones to the loss of value/ quality for the consumer.

The significance of livestock production is triple:

- Economic – productivity achieved through the revenue of agricultural farms and a national product with establishing an export status
- Public health – ensuring quality of products and health safety of food in the entire chain of production
- Sociological – meeting different demands and interests of consumers related to production modes, animal health and welfare, and environmental issues.

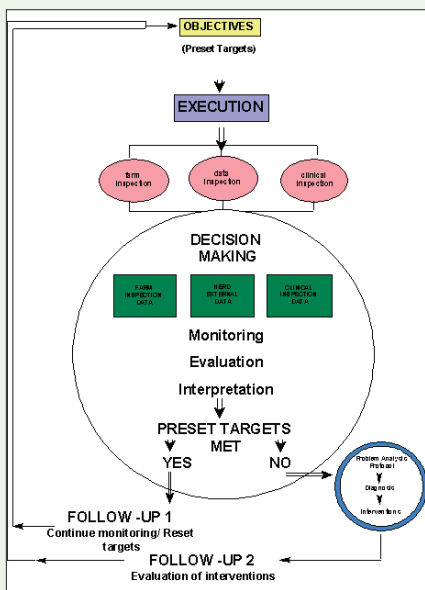


Figure 1 Standard protocol for preserving animal health and managing production.

Applying quality management system in the improvement of animal health status

Curative component of veterinary medicine was, and it still is, the main approach of veterinary profession when it comes to individual cases of animal disease. It is of crucial importance in the aim of recognizing and making a timely diagnosis, treatment or eradication of a disease, especially considering those markedly contagious and exotic ones which are a threat to large geographical areas.

During decades, such purely cura-

tive approach was being replaced by the preventive one which doesn't have individual animals in focus, but a herd/ flock. So, a preventative approach is noticeable in markedly intensive farming through conducting schemes of vaccination and medication.

The development of programs related to reproduction and health problems in intensive farming of cattle and pigs begins with the application of preventative approach, and they primarily address farm management. The development of programs related to reproduction

and health problems in intensive farming of cattle and pigs, which are primarily addressed to farm management, begins with the application of the preventative approach. The role of veterinarians in such programs is mostly advisory; they collect, monitor and analyze data on the condition and achievements of the herd by paying special attention to those animals or groups of animals which do not achieve expected results (De Kruijff, 1975; Ellis and Eslemont, 1979; Hoogerbrugge et al., 1979; Buurman et al., 1987; Noordhuizen and Frankena, 1998).

One of such programs of farm production management was presented in the book by Brand et al. (1996). That program's characteristic is to center all predicted veterinary and zootechnic activity around the standard protocol. The main elements of the procedure consist of the set targets, collected data (anamnesis, clinical examination and actions, inspection of the farm), calculations and estimation of the data on achievements, aberration determination and conducted routine activities, whereas following measures represent an analytic cycle of problem determination, the analysis of possible causes, the total synthesis and evaluation. Figure 1 presents a general standard protocol.

In modern pig farming in the Republic of Croatia, such example has been shown in the Croatian reference book *Basics of pig farming in family farms intended for family farms* for pig farming (Cvetić, 2002). The handbook describes the basics of pig farming production, pig breeds, the problems which appear in such farming related to reproduction, feeding, diseases and zoo-hygiene.

Qualitative data on the most significant factors which took part in a disease appearance are obtained by a farm inspection, whereas in order to obtain quantitative data, it is neces-

sary to conduct additional epidemiological researches on a higher breeding population in order to identify risk factors which contributed to the appearance of the disease (Noordhuizen et al., 1992).

It is obvious from the listed that a "search" for the causative agents of the appearing aberrations starts only after they are noticed, and that a real preventative approach focused on the risk management of the appearance of the disease instead of on vaccination or control measures, hasn't become a reality yet.

Considering the fact that health condition of a herd/ flock has a direct influence on the quality of animals and products after slaughter (Tieken, 1974; Van Dijk et al., 1984; Den Ouden, 1996), it seems logical that the problem area of animal health at the level of primary production has to be included in procedures of ensuring quality in a further food production chain. Animal health management in relation to the quality of products consists of three functions: planning, control and improvement and the instrument of quality management of health care at the level of primary production should meet two basic requirements:

- to ensure simple and clear procedures for the removal and control of risks for the appearance of a disease for each farmer
- to enable a farmer to prove the conduction of procedures to the "third party" in order to confirm animal's health status

Quality and quality management in production

When we speak of quality, we differentiate eight basic dimensions (Evan and Lindsay, 1996): performance, features, reliability, conformance, durability, serviceability, aesthetics and perceived quality (Garvin, 1984). The importance of each indi-

vidual characteristic depends on its position in the production chain, but also on the consumer's perception. Quality can be defined as "the totality of features and characteristic of a product or service that bear on its ability to satisfy given needs" (Evans and Lindsay, 1996). In other words it means that consumers' demands should be "transferred" to production process and product specification, and that technical and managing activities should be related to them because they are the main driving force of production.

From the point of view of breeders of pigs, cattle and poultry, who are a part of an integrated chain of food production, there should be consciousness of the market they produce for, and it should be aimed for market segments which are at the end of production chain. The reason for such opinion lies in the fact that each link of the production chain depends on demands and requests of customers and it sets additional requests and the dynamics of a demand for the previous link. Basically, breeders should have such an attitude which is focused on the total concept of quality management and not exclusively towards strict economic principles. Taking a long-term view, quality brings a higher return of investment (Evans and Lindsay, 1996).

Some concepts and methods for quality management have been described in professional literature (Jurran, 1989; Lock, 1990; Hudson, 1991; Teboul, 1991; Evans and Lindsay, 1996) as Good Manufacturing Practice (GMP), Hazard Analysis Critical Control Point (HACCP), International Organization for Standardization (ISO) and Total Quality Management (TQM). The choice of management system depends on the goals, and differences between those systems relate to the focus of quality management on production, i.e. process lev-

el, convenient system approach (top-down or bottom-up) and different system demands, such as simplicity, labor input, possibility of adopting, necessary documentation, evidence on control activities and connection with ensuring quality in an integrated chain of food production (Noordhuizen and Welpelo, 1996).

Series of ISO 9000 norms represent an international consensus on good manufacturing practice. Their first goal is to give guidelines to farms on what comprises an efficient quality management system, which can serve as a framework for permanent improvement. The norm ISO 9004-1 (together with other parts of ISO 9004) gives a guideline on elements of quality management and quality system. Series of ISO 9000 norms also includes models of ensuring quality ISO 9001, ISO 9002 and ISO 9003, according to which a quality system can be evaluated. A farm can conduct an evaluation of quality system by itself, it can ask for it to be done by its end users in order to earn trust in its capability to make products in accordance with their demands, or it can ask for a service of an independent certification institute which will evaluate its quality system and issue a compliance certification with ISO 9000. In September 2005 ISO published an ISO 22000:2005 norm; Food Safety Managing Systems (FSMS) – demands for each subject in food chain. All different subjects can use it and it has been developed by experts in cooperation with Codex Alimentarius commission.

Good manufacturing practice (GMP) represents general rules (scientifically proven best practices) which are not specific for a process or a product. In food production they contain instructions on how to produce certain food by respecting hygienic principles; they are a base for further control levels, and an example of the way how productivity

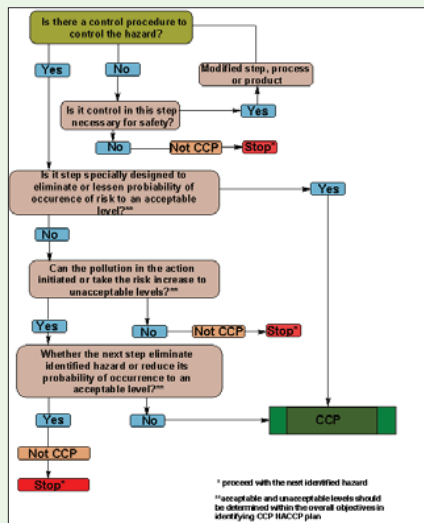


Figure 2 Decision-making tree for establishing critical control points.

and health conditions in the whole production chain are improved by accepting an appropriate attitude.

HACCP system in production

HACCP is a system which is based on conducting a series of procedures of identification and risk assessment related to the process of production, distribution and method of use of a certain food product, with the goal of applying preventative measures which will reduce the risk for food safety to the lowest possible level. Therefore, it is wrong to consider HACCP a system which completely removes a possibility of risk appearance in a product itself, but the possibility of appearance of determined risks is reduced to an acceptable

level by its application (Goodrich et al., 2005). Its practical application has shown itself to be significantly more efficient, determined and more critical in monitoring microbiological, physical and chemical contamination than traditional control procedures of food inspection.

In terms of relation between the microbiological risk control in food production and the one in primary production, HACCP system is completely appropriate for the identification and control of risks in the process of animal health care, because it is specific for individual breeding, it enables each producer an attestation of health status of herd/ flock, it is simple to apply, doesn't require additional efforts in keeping records, and

it ensures a functional connection with existent quality ensuring programs within an integrated chain of food production (Noordhuizen and Welpelo, 1996).

HACCP concept appeared in 1960 during cooperation of NASA and USA military laboratories with the Pillsbury Company. The reason was production of healthy food for astronauts. Since storing conditions are very specific, all food produced for the astronauts was tested for safety in conditions prevailing during space missions, due to which very small quantities of such food remained for their actual consumption. Therefore, it was important to think of a new proactive approach in risk control and risk management, so HACCP appeared. Since 1970s, HACCP has been used widely in food industry, and it is internationally acknowledged nowadays as one of the best systems which enable the production of safe food (Goodrich et al., 2005). It is included in Codex Alimentarius and FDA/USDA and the EU have approved it as a standard for prevention of microbiological risks (Gerigk and Ellerbroek, 1994). Some of the previously mentioned advantages of HACCP system over traditional control systems are the simplicity of control over control parameters and work control on the spot which enables identification and timely removal of existent and predicted risks. By using such an approach, introduction of health safety is already ensured in the stage of product development and corrective measures are conducted in a proactive way, i.e. before serious problems appear. Still, HACCP system doesn't exist for itself, so it requires meeting the requests contained in prerequisite programs before its implementation.

HACCP system consists of seven principles, out of which the first few relate to making a flow diagram which contains all steps of the

production process, risk identification, their complexity and probability, quantification of risks included, choice of critical control points for individual risks and their connection into a joint monitoring system:

- Principle 1 – to identify risks which have to be prevented, removed or decreased to an acceptable level
- Principle 2 – to identify the critical control points (CCP) in places where control is important for prevention or removal of risks or for their decrease to an acceptable level
- Principle 3 – to determine critical limits for CCP which separate acceptable from the unacceptable for prevention, removal or a decrease of identified risks
- Principle 4 – to identify and conduct efficient monitoring system of CCP
- Principle 5 – to determine corrective measures when monitoring system warns that CCP is not under control
- Principle 6 – to determine procedures of evaluation and verification in order to determine effectiveness of implementing measures listed in Principles from 1 to 5
- Principle 7 – to establish documentation concerning all procedures and records appropriate to these principles and their application

The listed principles are combined into three managing activities: risk assessment, risk management and documentation.

HACCP plan is implemented through 12 steps:

1. Assemble HACCP team • If possible, HACCP team includes experts in the field of production and animal food technology, veterinary medicine, microbiology and analytical chemistry. If there are no such experts in the production facility or a company, expert advice

should be asked for from other sources.

2. Describe a product (ingredients, processing, packaging, storage, sustainability) • Products should be grouped in categories, provided that differences in composition or production stages are not a source of additional risks.
3. Identify the intended use • Animal species and categories that the food is intended for should be described, as well as instructions for use (including storage conditions). The intended use should be based on expected use of a product until the end user or consumer. In special cases, sensitive population groups, i.e. institutional food should be taken into account.
4. Creating a flow diagram • A flow diagram should contain all steps in business which relate to a certain product (or a group of products with similar production stages), including interactions and processing.
5. Confirmation of flow diagram • After creating, there follows assessment in the production process and possible corrections.
6. Determining risk and risk analysis • In order for the identification and risk analysis to be conducted properly, it is very important that a flow diagram is aligned with actual operations because risk assessment is based on it. HACCP team should write down all possible risks for each step, according to the extent of primary production, processing, production and distribution until the point of usage. A risk assessment for the identification of HACCP plan should be conducted when risks are such that their elimination or a decrease to an acceptable level is important for the production of safe food. Risks can be microbiological, chemical or physical.
7. Critical Control Points • It is necessary in this stage to recognize

CCP in the production, which are needed for monitoring the noticed hazards (Figure 2). Only those points which are connected to an unacceptable risk and where the risk can't be controlled more successfully in some other stage are taken into account. Food safety relies on recognizing CCP in processing stages; therefore it is necessary first to define an appropriate method for noticing hazards.

- Critical limits • Critical limits should be determined and validated for each CCP. These criteria often include temperature, moisture level, time, but also some sensory indicators such as appearance and structure.
- Implementing a system to control each CCP • Monitoring is a plan of measures or measuring critical control points in relation to its critical limits. Monitoring measures must enable a detection of monitoring loss in critical control points. The data obtained by monitoring must be evaluated by an appointed person who has the knowledge and a permission to initiate corrective activities. All documents and records are signed by the person who conducts monitoring and the person in charge.
- Establishing corrective measures • For each CCP in HACCP system, special corrective measures/activities should be preplanned in order to solve appearing aberrations.
- Establishing verification procedures • For a grade of correctness and efficiency of HACCP system it is necessary to conduct procedures of assessment and monitoring, as well as taking samples for analyses. Assessment frequency should be enough in order to confirm appropriately the efficiency of HACCP system. Examples of assessment procedures include: inspection of HACCP system and

plan, then its records, inspection of aberrations and procedures of solving aberration problems, and confirmation of keeping CCP under supervision.

- Establishing documentation and keeping records • Efficient and orderly keeping of the records is important for the application of HACCP system. Documentation and keeping records should be appropriate for the nature and size of operative procedures and sufficient to help at business. Examples of such documentation are: risk assessment, determining critical control points and their critical limits.

Conclusion

The goal of making HACCP documentation and implementing the system itself is in achieving continuous improvement by including all changes in accordance with the changes happening in production itself. In order for the system to be properly kept, it is necessary to educate and train employees at all levels, and not just members of the HACCP team. Furthermore, it is necessary to forward and explain the plan for implementation of HACCP system to people in charge for managing the system of quality management (if there are any), to board members and other persons at management functions, whose participation and dedication is vital for the functioning of the system, whether we talk about financial or any other aspect. It is important to emphasize that a proper long-term functioning of the system can be ensured only through regular conducting of revisions of documentation and HACCP plan, so we would be up to date with the appearing changes (Khandhke and Meyes, 1998).

The provision of the Food Act (Official Gazette of the Republic of Croatia No. 46/07) according to which all entities in food business, except at

the level of primary production, are required to implement a food safety management system which is based on HACCP principles, came into force on 1 January 2009. Most of the activities which are conducted on a farm are based on prerequisite programs which provide basic conditions of the environment and businesses necessary for final production of safe food. But, in the goal of satisfying customers' demands for the products produced according to certain standards, and especially considering animal welfare and ecological demands, it is necessary to combine strategies of animal healthcare with epidemiologic methods of risk management in order to improve the quality of animals and their products.

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Sicherung der Qualität in der primären Fleischerzeugung

Zusammenfassung

In dieser Arbeit ist die Wichtigkeit der Wiederherstellung des Systems dargestellt, das auf den Prinzipien der Gefahranalyse von kritischen Punkten (HACCP) gründet. In der Republik Kroatien verlangt heute das Gesetz über die Nahrung (N.N. 46/07) von den Subjekten in der Geschäftigkeit mit Nahrung die Wiederherstellung des Systems der Verwaltung über die Nahrungssicherheit, das auf HACCP-Prinzipien gründet. Im System ist die Anwendung von Präventivmaßnahmen dargestellt, die das Konzept der Risikoanalyse auf das kleinste Maß vermindern. Die Präventivmaßnahmen, wenn sie wirkungsvoll auf bekannte kritische Punkte angewendet werden, senken die Wahrscheinlichkeit einer Risikoerschneidung auf eine annehmbare Ebene. Das HACCP System besteht aus sieben Prinzipien und seine Implementation wird in zwölf Schritten durchgeführt. Unmittelbar nach der Wiederherstellung des Systems ist eine Edukation erforderlich sowie eine Befähigung der Eingestellten, jedoch kann ein regelrechtes langwieriges Funktionieren des Systems nur durch ein regelmäßiges Revidieren der Dokumentation und des HACCP Plans gesichert werden, so dass sie aktuell mit anderen Änderungen sein können.

Schlüsselwörter: Qualität, Verwaltung über die Qualität, HACCP System

Assicurazione di qualità nella produzione primaria di carne

Sommario

Questo lavoro presenta l'importanza di costituzione del sistema basato sui principi dell'analisi di pericolo e di critici punti di controllo (HACCP). L'odierna Legge ed i regolamenti del settore alimentare (Giornale nazionale, N.N. 46/07) esige dai soggetti in affari con gli alimenti che costituiscano un sistema che regola l'assicurazione alimentare basato sui principi HACCP. Tramite il sistema è stata presentata l'applicazione delle misure di prevenzione che il concetto di analisi dei rischi ridurrà al minimo. Le misure di prevenzione, se correttamente applicate sui punti critici già conosciuti, riducono la probabilità di rischio al livello accettabile. Il sistema HACCP contiene 7 principi e la sua implementation si fa in 12 passi. L'educazione e la preparazione di impiegati è necessaria subito dopo la costituzione del sistema, ma un durevole funzionamento corretto del sistema può essere assicurato solamente tramite una regolare revisione di documenti e del piano HACCP, per essere attuale con i cambiamenti che succedono.

Parole chiave: qualità, gestione della qualità, sistema HACCP

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