

PS5.04 Identification and assessment of potential vulnerabilities in the poultry meat production chain to dangerous agents and substances 252.00

Fredi Schwägele (1) fredi.schwaegele@mri.bund.de, Sabine Andrée (1), Nelson Beraquet (2), Mariana Castrillon (2) Clare Winkel (3), Dave Garforth (3), Hilde Cnossen (4), Niels Luijckx (4), Gashaw Ayalew (5)

(1)Max Rubner-Institut, Kulmbach, Germany

(2)ITAL, Campinas, Brasil

(3)IFQC, Ireland

(4)TNO, Zeist, The Netherlands

(5)University College Dublin, Ireland

Abstract—The specific targeted European research project Σ Chain (2006) addresses existing as well as potential vulnerabilities within food chains. One of the food chains within the focus of Σ Chain is dealing with poultry meat. Fundamental for the assessment of potential vulnerabilities in the chain is basic knowledge of production processes. To this end the poultry meat production chain as well as the feed chain was mapped. Contaminants or groups of contaminants likely or possibly entering the chain were identified. Information about entry points to the chain, spreading, control measures, corrective actions, sampling and detection methods were added. Information loss and loss of traceability was considered as having significant influence on the potential vulnerability of chain steps to contamination. Therefore the documentation flow accompanying the product was assessed and allocated to process steps. Physical and electronic tags were reviewed. Prioritization of the identified potential vulnerabilities was accomplished using a modified FMEA (Failure Mode & Effects Analysis) method.

Fredi C. Schwägele and Sabine Andrée are with the Max Rubner-Institut, Location Kulmbach, Analysis Division, Kulmbach, Germany (corresponding author phone: +49 9221 803 200; fax+49 9221 803 303; e-mail: fredi.schwaegele@mri.bund.de, sabine.andree@mri.bund.de).

Nelson Beraquet and Mariana Castrillon are with the Instituto de Tecnologia de Alimentos, Campinas, Brazil (e-mail: beraquet@ital.sp.gov.br).

Clare Winkel was and Dave Garforth is with IFQC Ltd., Dundalk Co. Louth, Ireland (e-mail: davegarforth@ifqc.ie).

Hilde J. Cnossen and Niels B. Lucas Luijckx is with TNO Quality of Life, Zeist, The Netherlands (e-mail: hilde.cnossen@tno.nl, niels.lucasluijckx@tno.nl).

Gashaw Ayalew is with the National University of Ireland, Dublin, Ireland (e-mail: gashaw.ayalew@ucd.ie).

Index Terms— poultry meat, food safety, feed safety, contamination.

I. INTRODUCTION

Food production chains are becoming increasingly complex. Every link in the chain must be as strong as the others if the health and well-being of the consumer is to be adequately protected. The specific targeted European research project Σ Chain (2006) [1] addresses existing as well as potential vulnerabilities within food chains. One of the food chains within the focus of Σ Chain is dealing with poultry meat.

During the last years the development of poultry production was extremely dynamic. The increasing per capita consumption of poultry meat led to a continuous increase in production volume. In the same time the organization of the poultry meat production chain changed rapidly.

On the one hand integrated production systems were created meeting the requirements of retailers and consumers for safe and high quality products.

On the other hand the globalization of the market led to increasingly long and even global production and supply chains in poultry meat production. The chain is becoming increasingly complex.

Long geographic or even cross border steps in the production chain may be vulnerable to loss in information about the production history or origin of the product and as a consequence may result in higher vulnerability (through inadequate control) of the chain to contamination, be it accidental or intentional

II. MATERIALS AND METHODS

A. Chain Mapping

Food production chains are understood as the collective links of production (including raw material production), processing and distribution of food, including global trade and import, storage, transport, sale or supply to the final consumer. The food and feed production chain map is the graphical representation of these links. Steps in the food production chain map are

shown with symbolic shapes, and the mass flow in the process is indicated with arrows connecting the symbols.

The poultry meat production chain was mapped. Flow charts were designed to identify the single steps in the chain. Following the consideration, that a substantial number of contaminants may enter the poultry meat production chain via the feed chain, the latter was mapped, too.

B. Contaminants

Basing on a consensus expert decision a set of “priority contaminants” was defined and used further in this study.

These “priority contaminants” consist of chemical contaminants such as PCDD/F, PCB and veterinary drugs as well as biological contaminants e.g. *salmonella* spp., *campylobacter* spp., *listeria monocytogenes* and *E. coli* (VTEC).

For each of these “priority contaminants” the entry points in the chain were identified. Subsequently the dynamics of the contaminants in the chain e.g. growth, spreading, reduction or exit were examined taking into account the actual situation with current control measures.

C. Vulnerability

Vulnerability has been defined as a weakness in the system that can result in harm to the system or its operations, especially when this weakness is exploited by a hostile person or organization or when it is present in conjunction with particular events or circumstances. Two categories are noted:

- Susceptibility to contamination;
- State of being vulnerable or exposed.

Within the scope of ΣChain this definition is applied to the food production chain, in relation to contamination with agents, hazardous to human health.

For the sake of the current study vulnerability was understood as lack of traceability whereas the implementation of this traceability was understood as a combination of:

- The documentation flow accompanying the product along the chain
- Appropriate physical and electronic tags including the information about their application
- Analytical methods to detect relevant contaminants including information about appropriateness and application

D. FMEA

Failure Mode and Effect Analysis (FMEA) methodology is a systematic process meant for reliability analysis. It is a tool to assure product quality. It improves operational performance of the production cycles and reduces their overall risk level. The FMEA methodology was developed and implemented for the first time in 1949 by the United States Army. In the 1970s its application field extended to general manufacturing. Today FMEA method is mainly applied in industrial production of machinery and electronic components, but also in food industry [2].

Vulnerabilities identified are rated according to three criteria, severity, likelihood (of occurrence) and detectability. Severity is the rating of the hazard associated with the vulnerability, in the sense of damage to public health. The likelihood of occurrence indicates the frequency of a vulnerability event happening. Detectability or likelihood of detection/recognition refers to whether the vulnerability or event happening will be noticed or detected given the current control measures.

III. RESULTS AND DISCUSSION

Applying the above outlined procedure the poultry meat production chain including the respective feed chain was assessed for potential vulnerable chain steps to contamination.

Potentially vulnerable (to contamination) chain steps were found in the feed as well as in the food production chain.

Basically the possible entry- and/or multiplication points of the “priority contaminants” were regarded as potentially vulnerable.

Additionally the consideration that at the intersection points of internal traceability systems the actual product traceability is not only depending on the effectiveness of the single systems but also on their compatibility and a lack of compatibility will lead to an incomplete information transfer and thereby to a gap in product traceability led to the fact that chain steps with an inherent change of responsibility for or ownership of the product were considered as potentially vulnerable, too.

IV. CONCLUSION

The absolute result of the described assessment procedure makes no claim to be universally valid for each and every poultry meat production chain. Rather the found potential vulnerabilities bear witness to the applicability of the method described.

ACKNOWLEDGEMENT

This study was supported by the European Commission, project ΣChain, Contract no.: FP6 – 518451.

REFERENCES

- [1] ΣChain (2006): 6th Framework Programme (EC) Project. Developing a Stakeholders' Guide on the vulnerability of food and feed chains to dangerous agents and substances. (FP6 – 518451) Available: <http://www.sigmachain.eu>
- [2] Scipioni, A., Saccarola, G., Centazzo, A. & Arena, F. (2002). FMEA methodology design, implementation and integration with HACCP system in a food company. Food Control, 13, 495 - 501