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Challenges in risk assessment: quantitative risk assessment

Liesbeth Jacxsens[a,*] , Mieke Uyttendaele[a], Bruno De Meulenaer[b]

[a]*Laboratory of Food Microbiology and Food Preservation, Department of Food Safety and Food Quality, Faculty of Bio-Science Engineering, Ghent University, Coupure Links 653, 9000, Ghent, Belgium*
[b]*NutriFOODchem, Department of Food Safety and Food Quality, Faculty of Bio-Science Engineering, Ghent University, Coupure Links 653, 9000, Ghent, Belgium*

Abstract

The process of risk analysis consists out of three components, risk assessment, risk management and risk communication. These components are internationally well spread by Codex Alimentarius Commission as being the basis for setting science based standards, criteria on food safety hazards, e.g. setting maximum limits of mycotoxins in foodstuffs. However, the technical component risk assessment is hard to elaborate and to understand. Key in a risk assessment is the translation of biological or chemical pathways into a mathematical framework. Within the International Training Program 'ITP food safety, quality assurance and risk analysis' of Ghent University, department of Food Safety and Food Quality, we developed for low and middle income countries and emerging countries a training module on risk assessment. In where (semi-) quantitative probabilistic risk assessment calculations or qualitative risk rankings are trained for both microbial and chemical food safety hazards along the agro-food chain. This presentation will explain these methodologies demonstrated with examples from former ITP trainees.

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Keywords: Risk assessment; international; risk analysis; probabilistic

* Corresponding author. Tel.: +32 9 264 60 85
E-mail address: liesbeth.jacxsens@ugent.be

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1. Introduction

Risk-analysis is the process of 3 distinct but closely connected components: risk assessment, risk management and risk communication (Fig.1.). Risk assessment as such exists out of Hazard identification: During the hazard identification, biological, chemical, and physical agents that may cause adverse health effects and which may be present in a particular food or group of foods, are identified; Exposure assessment: Exposure assessment is defined as the qualitative and/or quantitative evaluation of the likely intake of the hazard via food or environment as well as exposure from other sources, if relevant; Hazard characterization: in the process of the hazard characterization, the nature of the adverse health effects or negative effects on the environment associated with the hazard is evaluated in a qualitative and/or quantitative way (dose-response relationship) and Risk characterization: During the risk characterization, all the evidence from the previous three steps is combined in order to obtain a risk estimate (i.e. an estimate of the likelihood and severity of the adverse health effects / negative effect on the environment that would occur in a given population with associated uncertainties) and respond to the questions posed by the risk managers.

The process of risk assessment can be performed qualitative (risk ranking) or quantitative (deterministic or probabilistic), depending on the nature of data available and also the questions to be answered. With quantitative risk assessment, the risk on infection caused by microbiological hazards or impact on human health of chemical hazards can be calculated for a certain population, or subpopulation (e.g. infants, elderly). Scenario analysis leads to the evaluation of several 'what if' interventions along the agro-food chain on the exposure e.g. what if a sorting is conducted of the nuts in the companies to remove the molded nuts and to decrease the mycotoxin concentration with 10%. Outcomes of scenario analysis will lead to define the most interesting intervention to reduce the exposure. Sensitivity analysis will give insights in which issues are playing a major role in the contamination and the final exposure (e.g. importance of initial contamination of raw materials, temperature abuse and multiplication of pathogens, consumer behavior, etc.). When no quantitative data are available a risk ranking can be performed, to compare risks from several hazards so no absolute exposure or risk on illness will in this case be the outcome. But by comparing e.g. pathogens on fruits and vegetables, a priority can be set on which pathogen/commodity the highest priority has to be set [1].

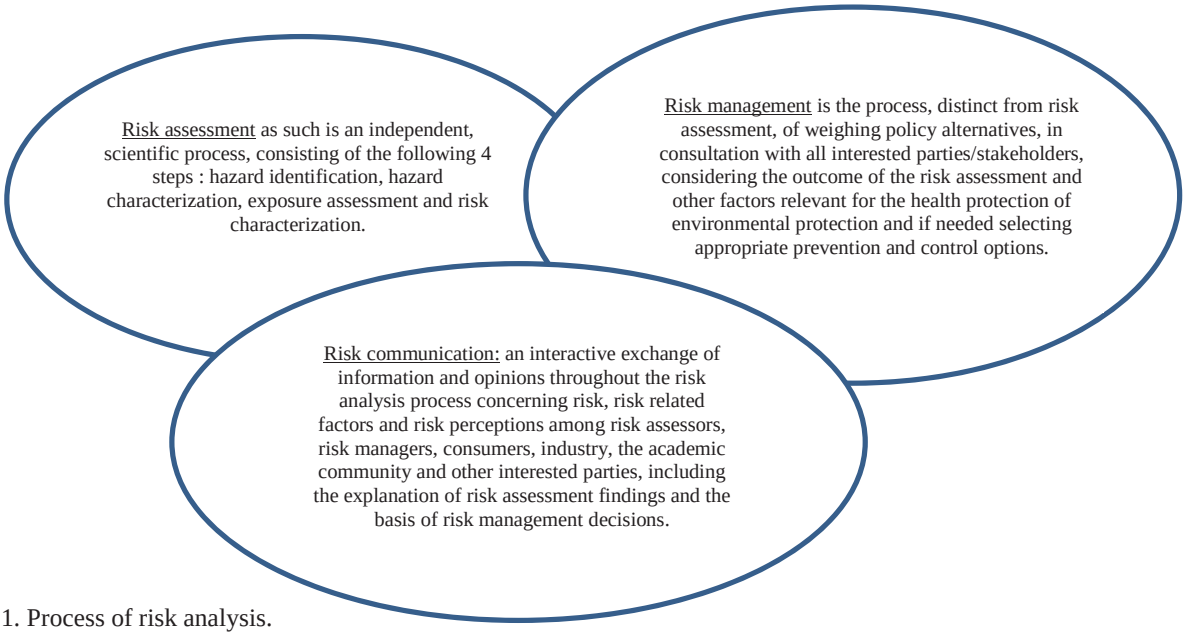

Fig. 1. Process of risk analysis.

1. Methodology