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Measuring the safety of the food chain in Belgium: Development of a barometer

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ABSTRACT

This paper describes the development of a concept to measure the safety of the food chain in Belgium based on the 'Pressure–State–Response' model. The actual measurement tool or barometer consists of a measurement of the 'State' based on a set of indicators. The present paper discusses the elaboration of a set of 30 food safety indicators (FSIs) as the basis of the food safety barometer. These indicators were weighted by expert opinion in order to determine their relative weight to be considered in the barometer. Food safety was reflected in a composite and agreed upon set of indicators related to i) the compliance to action limits/criteria for selected chemical and microbial hazards, ii) the implementation of preventive and control measures to mitigate food safety throughout the food chain from farm to fork and iii) the reported number of foodborne outbreaks and reported cases of some selected zoonotic agents (*Salmonella* sp. and *Listeria monocytogenes*). As food safety remains an abstract term and no quantitative value could be attributed (also due to lack of quantitative food safety objectives), the option was taken to document the status of food safety in a relative manner by comparing the results of the set of indicators of the current year with the previous year. By comparing the years 2007, 2008 and 2009 it was concluded that the status of the global food safety in Belgium was high and an upward trend could be observed. Statistical analysis on each of the individual indicators was performed, however since at present a restricted data set is available (2009 versus 2008 and 2008 versus 2007) no trend analysis could yet be performed. The barometer provides a helicopter view of the status of food safety in Belgium and is a tool to communicate in an intelligible, comprehensible manner on aspects of food safety to consumers and other stakeholders in the food chain. The methodology and results of the survey for the 'Pressure' and 'Response' collection from the Belgian stakeholders in the food chain will be discussed in another manuscript.

1. Introduction

The last decade, major reforms concerning the management of the safety of the food chain, were implemented on European and national level (e.g. EU regulation 178/2002 also referred to as the General Food Law, establishment of EFSA, re-organization of several national food agencies). These reforms have demanded great efforts from the stakeholders of the food chain (e.g. public authorities, the agro-food industry, farmers, …). In Belgium, the Advisory Committee of the FASFC (the Belgian Federal Agency of the Safety of the Food Chain), in which all stakeholders of the food chain are represented, raised the question to measure the impact of the current FASFC food safety policy. Moreover, the 2009–2011 business plan of the FASFC mentions the need to identify a set of indicators to measure and follow-up the safety within the food chain (Houins, 2009).

To our knowledge, measuring food safety has been limited up till now to company level in order to evaluate food safety management system performances (Jacxsens et al., 2009; Jacxsens et al., 2010; Luning et al., 2011), and has not been applied to the complete food chain at country level. A report on healthy diet and safe food was issued in 2006 by RIVM in the Netherlands on request of the Ministry of Health, Welfare and Sport (Kreijl, van Knaap, & Raaij, 2006). It is a valuable comprehensive report which offers an overview of knowledge at the time concerning the effects of diet and foods upon health but does not respond to the question raised by FASFC to develop a tool, a barometer, to measure the safety of the food chain on a yearly basis and to enable trend analysis.

Abbreviations: FASFC, Belgian Federal Agency of the Safety of the Food Chain; FSI, Food Safety Indicator; PSR, Pressure–State–Response.

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The idea to develop a barometer should be situated within the context of the prevailing trend towards identifying measurable objectives, indicators, assessments, score systems and the like (Kaplan, 2001; Dess & Robinson, 1984; Saraph, Benson, & Schroeder, 1989). This idea is also inspired by the introduction of similar notions in other social domains, such as social welfare (the Belgian inter-federal poverty barometer—State Secretary for fight against poverty, FPS Social integration, FPS Social security, & FPS Economy, 2009) and environment (the durability barometer—Task force durable development, 2009). The barometer to be developed is not an instrument to assess the performance of the competent authorities in general, neither of the FASFC in particular. The barometer should enable to communicate in an intelligible, comprehensible manner on the safety of the food chain in Belgium to stakeholders in the food chain (farmers, processors, distribution) and in particular to consumers and trade partners.

In agreement with the core competence of the FASFC it was decided that nutritional aspects of food and feed (energy intake, nutritional composition, balanced dietary pattern) and general quality aspects of food (e.g. organoleptic qualities, ease of use) are not taken into consideration in the development of the barometer, this in contrast with the 2006 issued RIVM report "our food, our health" which has a wider scope to public health issues related to food consumption (Kreijl et al., 2006). As a consequence, the barometer presented in this study is limited to aspects relating to the presence and control of chemical, physical, and microbiological hazards within the food chain from farm to fork.

Since no tools were described in scientific literature to address this question raised by FASFC and its stakeholders, the Scientific Committee of the FASFC, (an independent scientific consultation body), has elaborated an advice on this topic (Scientific Committee, 2010), describing the concept of a tool to measure safety in the food chain. The particular case study of the food safety barometer is being elaborated in the present manuscript.

2. Materials and methods

2.1. Scope of the barometer: defining the "food chain", the "safety of the food chain" and "food safety" and measuring food safety

As internationally validated definitions lacked, the first and crucial step in the development of the barometer was to make up solid definitions of 'food chain' and 'safety of the food chain' and to determine the scope of this barometer. Table 1 gives an overview of the elaborated definitions. The scope of the food safety barometer is limited to aspects relating to the chemical, physical and microbiological hazards within the food chain.

Food safety still maintains a vaguely defined term, perceived differently according to the individual or stakeholder and his particular background knowledge or experience. In addition no specific, quantitative objectives were available concerning food safety or particular aspects (hazards) being part of food safety. As such it was not possible to measure performance of food safety or food safety as a concept in an absolute value on a gradual scale. The business plan 2009–2011 of the FASFC (Houins, 2009) does mention however it aims for a safer food chain. Therefore, it was decided to measure the status of the safety of the food chain on a yearly basis using a set of indicators and to compare the results with previous years. The FASFC is responsible for laying down, implementing and enforcing measures related to the analysis and the management of risks and bases its policy on knowledge and scientific advice but also seeks to be well accepted by the operators and recognised by society. As such also in the concept of the barometer it was the aim to develop a composite and agreed upon tool to measure the safety of the food chain that may serve to communicate on the status of food safety to the broad public and stakeholders in the food chain.

Table 1
Overview of the used definitions (Based on European Parliament & Council, 2002).

Definition
The '*Food chain*' is any and all possible stages that are proceeded ○ during the course of breeding and rearing of animals and growing of crops, starting from the biological material and all necessary raw materials, ○ during the course of production of foodstuffs and feed, from the stage of production up to the stage of consumption.
Safety of the food chain is the general sanitary status of the food chain with regard to biological, chemical or physical hazards (including animal and plant/crop health), for which all respective links within the food chain bear their own responsibility, ensuring that safe food can be offered to the consumer. In this respect plant and animal health are not limited to the aspects that are related to human health.
Food safety is defined as the condition of the foodstuffs in all stages of production, processing and distribution, required to guarantee protection of consumer's health, also taking into account normal circumstances of use and information available for the foodstuffs concerned. Food safety thus means the absence of biological, chemical or physical agents (hazards) in concentrations/quantities that can cause adverse health effects.

The initiative for development of this barometer was taken by the Scientific Committee of the FASFC but by exchange and feedback obtained by the risk managers of the FASFC and the stakeholders of the food chain (represented in the Advisory Committee of the FASFC) in the development of the barometer, also the expectations of the society as a whole towards the safety of the food chain were taken into account and reflected in the set of indicators defined.

2.2. Adoption of a concept: the Pressure–State–Response (PSR) concept and its application to the food chain

The Pressure–State–Response (PSR) concept was selected as a starting point for establishing the research model. The PSR concept was used in the 1980s by the OECD for the classification of environmental indicators into three different categories: Pressure, State, and Response (Van Gerven, Block, Geens, Cornelis, & Vandecasteele, 2007; OECD framework for environmental indicators, 2010). The PSR concept is based on the principle of causal relationship, occurring when activities or incidents exert a pressure on a system, thereby causing a change in the state of the system. Society reacts to these changes and will ultimately have to take decisions (response) (OECD framework for environmental indicators, 2010).

Pressure is exerted by numerous general forces, processes or mechanisms operating within society (e.g.: globalisation, demographic changes, new technologies, climate change, economic crisis, new consumption patterns, …). These pressures have an impact on the food chain and may possibly modify its state or in other words its safety. The pressure on the food chain involves economical, sociological, technological and environmental factors and international requirements. These factors are often referred to as belonging to the so-called 'PEST', PESTLE (Political, Economic, Social, Technological, Legal, Environmental) or STEEP (Social, Technological, Economic, Ecological and Political) framework, a denomination that is frequently used in management circles (Carruthers, 2009; Value based management, 2010). Mapping the pressures that act on the food chain at the present moment will assist in understanding the context in which stakeholders in the food chain have to act and thus reveal the drivers or bottlenecks that may have impact on the status of the safety of the food chain in the (near) future.

The *State* is a measure for the safety of the food chain at the end of a determined period (e.g. one year). In the present application it was decided to basically relate the status of the safety of the food chain to the presence of hazards within the food chain and the implementation