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Linking food waste prevention, energy consumption and microbial food safety: the next challenge of food policy?

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Food safety has governed food policy for decades. More recently, concerns about sustainability of food chains have emerged. Food sustainability is becoming an increasingly important issue because food systems are not sustainable in terms of consumption of resources, their impact on ecosystems or their effect on health and social equality. A focus is given on how microbial food safety, energy consumption and food waste impact food policy. Potential contradictions between the different aspects of food policy are also reviewed and discussed.

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Introduction

Consumers are continuing to demand fresh and processed foods that are safe to eat, convenient to consume, contribute to the health and well-being, are of high sensory quality and are affordable. This demand for foods with various qualities will continue to grow as the world's population and wealth are expected to increase.

Food safety, that is, the assurance that food will not cause harm to the consumer when it is prepared and consumed according to its intended use, is still a global issue that affects the health of populations in both industrialized and developing countries [1,2].

Another consumer demand of increasing importance is that food products take an increasingly important place, is that the food products should be produced in an environmentally sustainable way [3]. This demand places governmental institutions in charge of food policies in addressing environmental issues in regulations, as well as in exerting pressure on food manufacturers to adopt sustainable manufacturing processes. The establishment of food policy for sustainable food consumption as a whole is difficult as food sustainability covers many different areas. Among the objectives that have been put forward in recent years, the present review focuses on energy consumption and food waste. Energy consumption linked to food production and storage is seen as important in the context of climate change [4]. The reduction of food waste has emerged because it can help to ensure food security and to diminish environmental burdens [5].

Food policy instruments and measures have now to target all these aspects. The policy instruments are diverse [6••] as they include information, regulations and standards or tax instrument. One can anticipate that that food policy measures taken for one area may interact with others and, in this context, assessment of the impact of such measures is necessary [7].

This article presents first an overview of the food safety issues or food sustainability challenges that drive food policy interventions. Then the potential contradictions between intervention measures of the different topics targeted by food policy are discussed with a particular focus on the example of the interrelation between energy consumption, food waste and microbial food safety.

Microbial food safety and food policy

The safety of food products is a major topic for defining food policy for decades. The food chain system in place today is far different from that of five decades ago in most developed and developing countries [2,8]. Food safety policy has evolved and adapted in line with the changes in farming and food industry practices, science and technology knowledge, and globalization of food products exchange.

In this context, the Codex Alimentarius takes an important place for establishing food safety standards. Taking the example of the European Union (EU), the first food hygiene rules came in 1964 after the creation of the Codex

Alimentarius. Previous regulations and standards, as current, are strictly based on the entire body established by the Codex Alimentarius. The regulations were initially limited to the requirements for fresh meat and, over the decades, have been extended to other animal foods. In the 1990s, a set of food hygiene guidelines were then published.

Food crises that have occurred over the last 25 years, changing eating habits, the development of new food production process, increased international trade and emerging risks have led consumers through the media to be more sensitive to food safety issues [9]. In this context, risk managers have sought to develop a food safety management system as efficient as possible. In January 2000 the European Commission adopted the 'White paper on food safety' [10]. It has defined a strategy for a coordinated and integrated policy on the entire food production chain, to ensure the most effective food safety standards and the highest level of protection of human health possible. This White Paper is the preamble to the relevant provisions that constitute now the 'Hygiene Package' and defined the main principles: the rules must be applied 'from farm to fork'; each operator of the food chain is responsible for food safety; Member States and their competent authorities are responsible for verifying the correct application of EU legislation and its implementation; dangerous products should not be placed on the market and it is necessary to intervene when it is considered that these non-compliant products are placed on the market; traceability throughout the food production logistic chain should be ensured; the legislation is based on risk analysis. This change in food safety policy is not limited to Europe. In other countries, like China, food scandals that have struck over the past decade have spurred a significant reform of food safety policy [11]. In USA, because of growing public concerns over outbreaks and food safety issues highly covered by the media, the United States Food and Drug Administration (FDA) passed the Food Safety Modernization Act in 2011 [12,13].

In this context, risk analysis has gained international recognition as the most effective tool for managing food safety issues [14]. Risk analysis is used to develop an estimate of the risks to human health and safety, to identify and implement appropriate measures to control the risks, and to communicate with stakeholders about the risks and measures applied. It can be used to support and improve the development of standards, as well as to address food safety issues that result from emerging hazards or breakdowns in food control systems. It provides food safety regulators with the information and evidence they need for effective decision-making, contributing to better food safety outcomes and improvements in public health. The three main components of risk analysis are risk assessment, risk management and risk communication. Risk assessment is considered to be the 'science-based' component of risk analysis. In risk assessment, quantitative risk assessment, rather than qualitative risk assessment, is the widest applied methodology as the outputs can directly be confronted to quantitative objectives defined by risk managers. The agreement on sanitary and phytosanitary (SPS) measures points out that Member States have the right to adopt SPS measures to achieve their self-determined health protection level [15]. This level is defined as 'Appropriate Level of Protection' (ALOP), and it is estimated for the country establishing a sanitary measure to protect the lives or the human health (also applicable for animals, or plants) within its territory. In the context of food safety, an ALOP is a statement of the degree of public health protection that is to be achieved by the food safety systems implemented in a country. It is typically expressed in terms relevant to public health such as a number of cases per 100 000 population per year. Typically, an ALOP would be articulated as a statement related to the disease burden linked to a particular hazard–food combination and its consumption in a country. In order to facilitate risk management, other metrics have also been proposed for risk characterization throughout the food production chain [16]. Food safety objective (FSO) and performance objective (PO), respectively defined as the maximum frequency and/or concentration of a microbiological hazard in a food at the time of consumption and at a specified step in the food chain before time of consumption, are good examples of these metrics.

In practice, the emergence of new hazards, rationalization of costs or the contribution of risk analysis have recently changed regulations, or are expected to do so. Recent examples can be found for illustrating these three levers of changes and adaptations of food safety policy. The recent crisis related to sprouts involving *E. coli* O104: H4 has led to amendment of the Regulation (EC) No 2073/2005. For illustrating rationalization of cost, the example of meat inspection method is of interest. Meat inspection methods can be seen as disproportionate to the risk involved [17] and evolution of Regulation (EC) No 854/2004 is expected. Finally, the assessment conducted by Efsa to measure the impact of the maintenance of the cold chain during storage and transport of meat on microbial risk opens the way for a possible change in temperature laid down in Regulation (EC) No 853/2004 for meat transport [18].

Food sustainability and food policy

Sustainability has taken importance in the food industry. This stems from the observation that food systems in industrialized countries contribute, by diets that are related to them, to the generation of nutritional diseases, despite the unparalleled access to a great diversity of safe food products. Their generalization to the whole planet will exhaust the resources and exacerbate the negative