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Food safety in developing countries: Moving beyond exports

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ABSTRACT

Food safety is linked to food security through health and livelihoods, and improving food safety is necessary to address food security. An international consensus has emerged that the best way to address food safety is through a risk-based, farm-to-table approach that focuses on cost-effective prevention. In developing countries, this approach has been implemented in supply chains for high-value markets, particularly exports. Evidence shows that improvements are possible where market incentives exist, and where market institutions can ensure that risk reduction practices are followed. To address food safety for food insecure consumers in developing countries, public efforts should focus on the most important risks and cost-effective controls, provide support for capacity building and supply chain coordination, and improve incentives for food safety management.

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1. Introduction

Food safety is recognized as an integral part of food security. As stated in the 1996 World Food Summit declaration, "Food security exists when all people, at all times, have physical, social and economic access to sufficient, **safe** and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (UN/FAO, 1996). Food safety is recognized as part of the enabling environment for reducing hunger and malnutrition in the 2014 Framework for Action adopted at the Second International Conference on Nutrition (WHO/FAO, 2014).

The inclusion of food safety as one supporting element in addressing food security and nutrition results from the complex relationship between food and health. Unsafe food causes both acute and chronic illness, and reduces the bioavailability of nutrients, particularly for vulnerable consumers (Chan, 2014). The presence of food hazards can also lead to food losses and reduced food availability for food insecure populations. In addition, food safety also increasingly plays a role in producer livelihoods, as smallholders seek to meet requirements in high value markets. In recognition of food safety's importance to sustainable development, WHO has dedicated the 2015 Global Health Day to food safety (Chan, 2014).

Given the recognized importance of improved food safety for food security, it is relevant to understand how it can be addressed for food insecure populations. The last two decades have seen remarkable progress in the application of science and management to this issue, but these achievements have yet to be fully realized for domestic food supplies in developing countries. This article reviews what is known about best practices for addressing food safety in order to see how they may be utilized to address food safety for food insecure populations.

1.1. Food safety has received growing international attention during the past two decades

Food safety has received increased international attention in public regulation, private supply chain coordination, and international trade for the past two decades. The emergence of new and more stringent food safety standards in most industrialized countries is the result of several factors, including the growth in trade of perishable and high value products; advances in hazard detection and epidemiology; high profile health scares; scientific and regulatory consensus on best approaches to risk management; and the recognition of global standards and approaches under the WTO. More stringent regulatory standards have emerged in high income countries alongside more rigorous private requirements for food suppliers to high income retail markets. Growth in high value exports from developing countries has been accompanied by increased attention to food safety standards in high income markets (Maertens et al., 2009).

At the same time, food safety has received increased attention as an important public health issue in developing countries. Food safety risks contribute to the burden of illness in developing countries. For example, foodborne pathogens are an important cause of diarrheal disease, which is estimated to cause 2.2 million deaths every year (WHO, 2014). While the understanding of foodborne risk exposure and incidence of illness is still limited, various studies suggest that microbial hazards are important in

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a wide range of foods, eg. kale in Kenya (Kuto et al., 2012) and milk in East Africa (Grace et al., 2008a). Another important food hazard is mycotoxins, the naturally occurring toxins associated with fungi on many important food staples. For example, aflatoxin exposure through food consumption, which is more prevalent in many tropical countries, is associated with liver cancer, immune suppression and higher rates of illness, as well as child stunting (Unnevehr and Grace, 2013). WHO is engaged in a multi-year process to estimate the global burden of illness from foodborne disease, with results expected in 2015 (Chan, 2014).

The remainder of this article explores how to address food safety in developing country food supply chains through three perspectives. First, the internationally accepted frameworks that inform food safety policy design are reviewed, as these provide the foundation for any actions in developing countries. Second, the evidence regarding developing country food safety management for high value markets is reviewed for the lessons it provides regarding expansion of food safety improvements. Third, the prospects for food safety improvement that addresses domestic public health in developing countries are considered. Concluding comments consider research needs.

2. Food safety policy design

Unsafe food contains hazards that can make people sick, either immediately or by increasing the likelihood of chronic disease. Some hazards that have been addressed by public policies include: microbial pathogens; zoonotic diseases; parasites; adulterants; mycotoxins; antibiotic drug residues; pesticide residues; and heavy metals. Each of these potential hazards has different sources, poses different kinds health risks, and carries different challenges for identification and control. Yet there are common paradigms used to design policy interventions and management systems.

2.1. An economic perspective can inform food safety policy design

The economic perspective on food safety provides an important foundation for policy design. The justification for government intervention to address food safety is the market failure arising from imperfect information. For most food safety hazards, consumers have no information about their presence in specific food products, and thus cannot reward producers for supplying safer food. For naturally occurring hazards, producers may also have little idea of what hazards are in their products, and thus may not be able to respond to demand for improved safety. This information problem leads to a market failure in the provision of food safety. In the absence of effective market incentives for the provision of safe food, public intervention may be warranted to protect public health. Such intervention may take the form of minimum safety standards enforced through monitoring and penalties for non-compliance.

Market failure alone does not justify public intervention, as these must also pass a cost-benefit test. The economic benefits of improved food safety are reduction in lost productivity and life from foodborne illness. For example, recent estimates suggest that foodborne illness results in between $14 and $152 billion in lost productivity and life in the U.S. (Hoffmann and Anekwe, 2013). These can be compared to the industry costs of meeting food safety regulatory requirements. For example, Crutchfield et al. (1997) showed that U.S. industry costs of controlling microbial pathogens in meat were much smaller than the value of improved human health resulting from these mandated controls. Thus, public intervention to improve food safety can result in net economic benefits.

Control measures may also have consequences that vary by firm size, and which policy makers must consider. Such variance occurs because the fixed costs of establishing food safety management can be substantial (Unnevehr and Jensen, 2005). Fixed costs may include the costs of setting up a management or quality control system, training staff in new procedures, and investments in new equipment for reducing risks or monitoring outcomes. A high initial fixed investment can be a heavier burden on small firms or farms, as they will have higher per-unit costs of adoption than larger firms or farms. Thus, smaller producers or processors may find costs prohibitive, and may be at a disadvantage relative to larger producers. Thus, the introduction of food safety controls may influence market structure (ie., the market share of different size firms).

Enforcing standards may not be feasible without improvements in identifying food safety hazards and providing incentives for improved management (or penalties for lack of compliance) (Hennessy et al., 2001). Given the nature of many hazards, which may originate at the farm level or first handler, and may multiply or spread as products are mingled and moved downstream towards the consumer, improved supply chain coordination is also frequently required. That is, it will be necessary for buyers or regulators to verify that risk reduction practices are followed throughout the supply chain. Such verification may require new market institutions such as cost-sharing between buyers and producers, third-party auditing and certification, and improved testing for hazards and diversion of hazardous products to lower risk uses. These kinds of market changes support a risk-based, farm to table approach, which is discussed next.

2.2. There is international consensus that food safety risks are best approached through a risk analysis framework

Although food safety regulation in high income countries dates back to the early twentieth century, reforms since the 1990s reflect better scientific understanding of foodborne risks and approaches to risk management. In the 1980s and early 1990s, the U.S. National Academies issued a series of reports outlining a risk-based approach to food safety management and regulation, beginning with one on meat inspection in 1985 (National Research Council, 1985). Advances in foodborne illness epidemiology along with a better understanding of risk assessment informed this new approach.

Although the approach is now well-known, it is useful to give a brief review here. Risk analysis includes risk assessment, risk management and risk communication (FAO/WHO, 2006). Risk assessment includes hazard identification and exposure characterization which results in a quantitative estimate of the adverse effects that are likely to occur in a given population. Comparative risk assessment identifies the most important risks, so as to better focus policy efforts. Risk assessment provides the basis for risk management, which involves making decisions about where to reduce risks. Identification of where and how risks are likely to occur shows what kind of intervention might reduce risk most effectively. Risk management also involves making decisions about acceptable levels of risk, which will depend on social norms, public perceptions, and economic costs. The final step is risk communication, which involves public education regarding what is known about hazards and their risks, uncertainties, and the rationale for interventions to reduce risk.

This general risk analysis approach as applied to food safety has evolved to address the unique aspects of food hazards. In particular, food safety policy has embraced the need for a farm to table preventative approach, often characterized as application of the Hazard Analysis Critical Control Points framework to evaluating and controlling risks. The HACCP system was first developed by

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