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Foodborne Diseases and Food Goods' Microbiological Risk Rankings in Environments with Limited Data

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Introduction

A significant factor in the global burden of foodborne illness is unsafe food. The World Health Organization (WHO) estimated in 2010 those 31 foodborne biological hazards-28 microbial pathogens and 3 chemicals-caused 600 million foodborne illnesses and the loss of 33 million years of healthy life worldwide. Due to the large number of pathogen-food product combinations that can cause foodborne illnesses, it is necessary to prioritize the combinations that are most likely to pose the greatest risk for foodborne health for the purposes of surveillance and control. In order to transparently and based on the best available evidence assess risk and prioritize hazards, various frameworks have been proposed and are widely used [1].

Description

Using qualitative descriptors like "Low," "Moderate," or "High" to describe, in non-numerical terms, the degree of belief regarding the occurrence of relevant events (such as whether a pathogen present in food survives a processing step) and the final risk estimate, the risk posed by various pathogen-product combinations can be estimated quantitatively using deterministic or probabilistic microbial risk assessment models. Foodborne risk estimation also makes use of so-called semi-quantitative approaches, in which a scoring system is used to establish a logical and explicit hierarchy among the non-numerical descriptions of probability, impact, and severity. When data are insufficient for quantitative assessments and expert knowledge is deemed suitable to allow differentiation between risk categories, qualitative risk assessment frameworks are the usual choice. Data availability is one of the primary considerations when selecting a specific approach. The literature contains a number of examples of qualitative or semi-quantitative risk ranking of foodborne pathogens and food products. The ranking of meat-borne pathogens in intensive pork production, the ranking of chemical hazards (antibiotics) in food, and the ranking of particular hazard-food combinations are all examples. France has recently proposed a risk ranking framework for emerging dietary practices' food safety risks [2,3].

A suitable framework for dealing with limited data availability is qualitative risk assessment because it involves a reasoned, cited, and logical discussion of the available evidence regarding a risk. In the context of food safety, existing frameworks, on the other hand, rely on assigning qualitative probabilities to the frequency of the pathogen in the food or its source based on the evidence or expert opinion that is currently available. We argue that there are often insufficient data on the frequency of pathogens in food in low- and middle-income countries (LMICs) for qualitative probabilities to be assigned. Prioritization tools that do not rely on prior data or knowledge of the frequency of the pathogen's presentation are urgently needed because foodborne illnesses are most prevalent in LMICs, where such food survey data tend to be particularly scarce or absent. In the absence of data on pathogen frequency in food products, we propose a framework for systematically and transparently assessing foodborne risk in the food or its source (such as an animal). The method is based on the known characteristics of the pathogen, the intrinsic and extrinsic properties of food products, their processing steps, and cultural practices that are known to facilitate or prevent pathogen survival or growth. It also takes into account the different socioeconomic and regulatory environments in which the various Food Business Operators (FBOs) operate. In situations where strategic resource allocation is most needed, a qualitative assessment that is independent of pathogen frequency estimates may permit systematic prioritization. In situations where estimates of pathogen frequency are only available from inadequate studies or from uninformed opinions and are, as a result, highly speculative, this approach will eliminate the need to rely on them [4].

According to Blackmore et al., the majority of the milk produced in AP is consumed within the household, with the remainder being sold through various channels involving a variety of actors operating, like in many other LMICs, under various levels of arrangements, either in law or in practice, along a formal-informal spectrum. A stakeholder workshop was held with the actors or their representatives at each stage of the dairy supply chain in order to comprehend the dairy supply chain in AP and the quantity of milk flowing through the various routes along the value chain. The workshop's goals were as follows: i) Create a map of the dairy industry's supply chains in AP; ii) Identify the key players involved in each stage of the chain, as well as any agencies or regulations that might have an impact on their actions; and iii) Collect data on important consumer habits.

Discussion

A hierarchical tree displaying connections between dairy products or groups of dairy products based on the variables mentioned in 2.3.4 was created using Hierarchical Clustering on Principal Components (HCPC). The principal components obtained through Multiple Correspondence Analysis (MCA) served as the foundation for the hierarchical classification of dairy products because all variables were categorical (Greenacre & Blasius, 2006). In a nutshell, MCA creates synthetic independent dimensions to describe the relationships between the levels of the variables used to describe the objects (i.e., the products) in order to provide a graphical representation of the data. As a result, these dimensions are projected onto the dairy products at a distance that maximizes the variability of the projected points (projected inertia). Consequently, if two products share a significant number of characteristics, they will be displayed close to one another, whereas if they have very different profiles, they will be displayed far apart. The MCA was started with all the dimensions and the best partitioning of the hierarchical tree. The final number of clusters for dairy products was chosen to be "n," which is the number of clusters for which the loss of inertia from "n" to "n+1" is minimal. A dendrogram, or visual representation, of the similarities and differences between groups of dairy products in terms of characteristics that support or hinder microbial growth and survival was provided by the cluster analysis results.

In settings where data on the frequency and concentration of pathogens in foods are largely absent, the purpose of this study was to propose a method for systematic risk ranking of foodborne pathogens and food products. Even assigning qualitative probabilities to the bare minimum of events occurring along the risk pathways leading up to consumption would be highly speculative and unjustified in these circumstances, such as the probability that the food product

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will be contaminated or that the pathogen will survive processing. The fact that this strategy is entirely based on information and existing knowledge that can be easily gathered in any setting is its primary advantage. However, one drawback is that the prioritization may be achieved with a low level of resolution, resulting in the identification of a group of pathogens or products that pose the greatest threat to customers. The decision to use probability scales ranging from "Low" to "High" for pathogens and "Extremely low" to "High" for products was a compromise between the level of discrimination that could be realistically achieved from the information that was available and the level of practically informative resolution that was desired for the final outputs [5].

Conclusion

However, this qualitative prioritization of groups of pathogens and products can be extremely informative to support decision-making if supported by rigorous, comprehensive, and logical reasoning; The food system is complicated, and food-safety decisions must be made, especially if resources for preventing foodborne diseases are limited. Applying this risk ranking method to the complex dairy sector of AP has demonstrated its potential, where milk flows through a network of formal and informal FBOs to provide consumers with a wide range of dairy products. Indeed, comprehensively identifying the food products to be considered is a crucial step in adopting this risk assessment framework. Therefore, it is essential to engage local stakeholders in order to ensure that typical products, which may be prevalent in the region but not elsewhere, are appropriately taken into consideration.

Acknowledgement

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Conflict of Interest

None.

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