CONSUMERS AWARENESS: THE IMPORTANCE OF INFANT FOOD MICROBIAL SAFETY (Part 2)

Facts: Ensuring the microbial safety of infant food

- Food safety management systems /Informing consumers of bias and limitations of traditional microbiological analysis
- SAFFI: an effective approach to ensure microbial safety for infant food

CONSUMERS UPDATES
SAFFI facts and briefing sheet n.9 (August 2023)

SAFFI
Safe Food for Infants in the EU and China

FOOD SAFETY MANAGEMENT SYSTEMS (keeping food free from biological hazards)

To meet the rigorous food safety standards demanded by modern consumers and, most importantly, to safeguard consumer health from potential foodborne hazards, the food industry employs proactive, science-based approaches in the production and distribution of food products. In today's food industry, relying solely on end-product testing to ensure food safety is neither practical nor effective, given the vast quantities of food produced and the globalization of the food market. Moreover, this approach falls short in identifying potential food safety risks that can arise during the various stages of food production.

Consequently, the food industry, along with competent authorities and regulatory bodies, has adopted a risk-based approach to food safety, closely aligned with the principles of Hazard Analysis Critical Control Points (HACCP). This approach involves identifying potential hazards—whether chemical, biological, or physical—that may arise at any point along the food production chain. Appropriate control measures are then implemented to either mitigate or prevent the occurrence of these hazards. Simultaneously, procedures are established to verify the effectiveness of the HACCP system and ensure that potential hazards are being adequately controlled, resulting in the production of safe food products.

Integral to the HACCP system are Good Hygiene Practices (GHP), encompassing all fundamental measures and conditions applied at every stage of the food chain to ensure the production of safe and suitable food. To validate the efficacy of the processes designed to produce safe food, it is advisable to conduct microbiological analyses of foodstuffs. Within this framework, microbiological criteria have been established. These criteria serve two primary purposes: first, to differentiate safe from unsafe foods, and second, to assess the proper or problematic functioning of the production process.

For food products prepared and marketed in Europe, EU Regulation 1441/2007 delineates the specific microbiological criteria that must be met.

INFORMING CONSUMERS OF BIAS AND LIMITATIONS OF TRADITIONAL MICROBIOLOGICAL ANALYSIS

Traditional microbiological analyses, which rely on culture media, have played a vital role in detecting and studying microorganisms in food. However, they come with inherent limitations. This analytical approach is culture-dependent, meaning it can only identify microorganisms that are capable of actively multiplying in synthetic microbiological media at the time of analysis. Nevertheless, under specific circumstances, especially under stressful conditions, microbial cells can remain viable but unable to multiply. This state is known as the Viable but Non-Culturable State (VBNC). It is entirely possible that during food production, microorganisms encounter stressful conditions that lead them into this VBNC state.

Furthermore, the composition of the culture medium, as well as the overall growth conditions, must be conducive to the growth of a particular microorganism. If the conditions do not favor the growth of a specific microbial group, perhaps due to the absence of an essential nutrient, the analysis will yield a false negative result, indicating the microorganism's absence in the sample, even

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though it may be present but undetectable by the employed method. Additionally, when a sample contains various microbial groups at differing concentrations, traditional culture-dependent methods will primarily detect the most abundant populations, unless selective conditions are deliberately applied during the culturing process. This inherent bias in culture-dependent microorganism detection can lead to a skewed understanding of the microbial composition within the sample being analyzed.

SAFFI: AN EFFECTIVE APPROACH TO ENSURE MICROBIAL SAFETY FOR INFANT FOOD

The SAFFI project is dedicated to enhancing the microbial safety of infant food by providing valuable insights to both the food industry and regulatory authorities concerning the prevalence and behavior of pathogens. The overarching theme guiding these efforts is the application of a methodologic approach called "omics" (see note below). The project is designed to accomplish two distinct yet complementary objectives.

The first objective centers on conducting an extensive survey of the microbiota present in raw materials, intermediates, final products, and, significantly, the production environment under real-world conditions. To achieve this, we have launched an intensive sampling campaign that spans various seasons throughout the year. The focus is on collecting samples that can be correlated in terms of time and space. Moreover, we are diligently gathering relevant metadata, with particular emphasis on the physicochemical parameters of the samples. These samples are subjected to analysis using optimized protocols, employing both a traditional, culture-dependent approach and a culture-independent, omics-based approach. This comprehensive approach will yield a detailed description of the microbiota. We will then be able to correlate the presence or absence of pathogenic microorganisms with specific microbiota characteristics in the samples, as well as their distribution over time and space. Additionally, this information will enable us to identify potential routes of contamination within the processing plant. Such insights are vital for adopting a preventive approach grounded in data and knowledge specific to a given production environment. Furthermore, this information can be integrated into a more refined risk assessment for infant formulae.

The second objective entails an investigation into the behavior of Listeria monocytogenes, selected as a model foodborne pathogen. We aim to simulate the food production process under in vitro conditions and closely examine how this microorganism responds to various stress conditions relevant to food production. Omics approaches will also be utilized for this purpose. Ultimately, we may identify biomarkers of adaptation or robustness that could serve a predictive role. This knowledge will be invaluable during the exposure assessment phase of risk assessment.

Infant microbial food safety is of paramount importance, and over the past two decades, significant strides have been made in enhancing it. The adoption of the Hazard Analysis Critical Control Points (HACCP) approach, Good Hygiene Practices (GHP), and the implementation of specific guidelines for infant formula producers have played a pivotal role in elevating the safety standards of these products.

NOTE: What is "omics": The branches of science known informally as omics are various disciplines in biology whose names end in the suffix -omics, such as genomics, proteomics, metabolomics, metagenomics, phenomics and transcriptomics. Omics aims at the collective characterization and quantification of pools of biological molecules that translate into the structure, function, and dynamics of an organism or organisms.

The related suffix -ome is used to address the objects of study of such fields, such as the genome, proteome or metabolome respectively. The suffix -ome as used in molecular biology refers to a totality of some sort; it is an example of a "neo-suffix" formed by abstraction from various Greek terms in -ωμα, a sequence that does not form an identifiable suffix in Greek.

Functional genomics aims at identifying the functions of as many genes as possible of a given organism. It combines different -omics techniques such as transcriptomics and proteomics with saturated mutant collections.

SAFFI: THE SINO-EUROPEAN CONSORTIUM PARTNER CENTERS

Coordination: French National Research Institute for Agriculture, Food and Environment (INRAE),

- Five international infant food companies (Friesland Campina, HiPP, YIOTIS, Beingmate, YFFC)
- Two food safety authority institutions (ZAIQ and ANSES)
- Three European technological SMEs (CremeGlobal, Computomics, BDS)
- The Union of 49 National European Societies of Pediatric (EPA-UNEPSA)
- Seven leading European and Chinese academic institutions (WU, UNITO, IRTA, IVV; ZJU, ZAAS, JAAS)

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