Outlook

Handbook of Indigenous Foods Involving Alkaline Fermentation
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To achieve the requirements for future markets that were mentioned in the previous chapter, research and development will be essential at various levels of application. A wealth of data describing microbial and chemical aspects of composition and changes taking place during fermentations is available.

The creation of a comprehensive authentic database is needed to understand the trends in the production of alkaline-fermented foods (AFFs) and to fix the reasons for no growth or decline in consumption of AFFs in some countries (Borresen et al., 2012; Ojiako et al., 2012). This is because the actual amounts of foods consumed usually are not known and some of the data are questionable.

Authenticity comprises a definition of a process or product that can be used for marketing and for protecting it from copying. Such definition includes the basics of ingredients, their provenance, the locality or region where the product is prepared, and the detailed process. Modern analytical techniques allow profiling of microbiota (Casey et al., 2008) and chemical composition, and multivariate analysis software allows comparison of profiles (Le et al., 2011). For future markets, such authenticity should be nurtured, and it should be "packaged," which comprises product safety, shelf life, and convenience at an affordable price. The development of convenient, durable, and safe authentic products is a challenge that can only be successfully overcome by an interdisciplinary approach.

It is remarkable how little specific mention is made about the taste aspects of AFFs. Although the smells are often described as strong, pungent, sweet, sometimes even as offensive, the smell does not necessarily contribute to the flavor of a cooked dish. For example, some of the African products such as iru or soumbala and bikalga have a

characteristic but not very pleasant smell. However, during cooking, much of this smell disappears, and then the question remains: what does the odor contribute to the taste of the cooked dish? A short survey among the contributing authors revealed that "umami," meaty, cheesy, sometimes fishy tastes are perceived as characteristic for the African products. On the other hand, the fermented fish products are primarily described as salty, "umami," enhancing the taste of prepared dishes. It is obvious that considerable work remains to identify the chemical components that determine the taste principles of specific fermented products. This knowledge would be extremely useful in the description of product quality traits for protection of their authenticity and to direct quality improvements when using specific microbial starters and/or enzymes.

An important role should be reserved for consumer research to obtain a quantitative understanding of consumers' wishes and perceptions relating to convenience, shelf life, packaging, retailing, and willingness to pay for the product. Preferably such aspects should be combined in mathematical models that facilitate choosing the targets for optimization, such as was done for lafun, a traditional fermented cassava flour in Nigeria (Ojiako et al., 2012).

Knowing the consumers' response is a first step to define modified or novel products. Next, the traditional process needs to be critically reviewed, remodeled where needed, taking into account aspects such as optimum use of water and energy consumption (Carvajal-Larenas et al., 2013). When the production needs up-scaling, an economical study and business plan require specific expertise.

From the food science and technology point of view, more expansion of existing knowledge is needed to understand mechanisms underlying the evolution of product quality. How can robust starter cultures be selected and used to achieve predictable and controllable fermentation outcomes? Can the proteolytic enzymes in these fermentations be purified and characterized so that the process conditions can be optimized? Can added purified enzymes be used to enhance the fermentation outcome? How can final products be portioned, packaged, and distributed for retail?

An integral part of developing processing lines is related to quality and hygiene. Good manufacturing practice (GMP) (Amoa-Awua et al., 2007) comprises specifications of ingredient grades, operational

care, etc., to achieve high-quality products. For each product, GMP needs to be defined and documented for future evaluation.

Good hygienic practice (GHP) includes all operational care ensuring that the product is protected from chemical and microbiological contamination. Although general principles of GHP are available, these must be "translated" to specific products and processes to enable their implementation. Again, these practices must be documented to enable future reviewing and evaluation.

Hazard analysis and critical control points (HACCP) (Lee, 2010) aims specifically at microbiological safety of the final product to be obtained, through a proactive control of critical steps in the process. HACCP has been described as a management tool, but the establishment of a HACCP protocol for a specific product or process requires knowledge from various disciplines including epidemiology, microbiology, process engineering, and food science. A protocol describes the process and all its ingredients, operations, and its organization. Steps are identified that aim at reducing microbial load, and simple in-line measures are defined that need to be performed and documented at prescribed intervals. Such documentation enables trend analyses of the process performance and allows assurance of product safety so that unpleasant surprises at the final product stage can be minimized.

Another important aspect is the functional aspect of AFFs: some health aspects have been tested well, but others are still in early phases of in vitro or animal experimentation. To make claims, more double-blind, placebo-controlled human experiments should be undertaken for the effects and mechanisms of action need to be elucidated.

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