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Editorial

Quality and Safety Issues Related with the Presence of Biogenic Amines in Foods

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Received: April 11, 2017; **Published:** April 28, 2017

Biogenic amines (BAs) are mainly produced in food during the microbial decarboxylation of free amino acids. In recent years, some studies clearly indicated that they can be also take origin during thermal processes of foods as a result of the oxidative decarboxylation of the corresponding amino acid precursor [1-3]. The Strecker degradation seems to be responsible for the formation of BAs in the way of thermal decarboxylation of amino acids in the presence of α-dicarbonyl compounds formed during the Maillard reaction or lipid peroxidation products suggesting a new 'thermogenic' formation pathway of BAs in foods [4-6].

As the consumption of food containing large amounts of these amines can have toxicological consequences it is generally assumed that they should not be allowed to accumulate. These compounds can represent a serious health hazard for humans (in particular histamine and tyramine) when present in food in significant amounts, or ingested in the presence of potentiating factors, such as amine oxidase-inhibiting drugs (MAOI), alcohol and gastrointestinal diseases [7]. In fact, although several biogenic amines can play important roles in many human physiological functions [8] their presence in foods is always undesirable because if adsorbed at too high concentration, they may induce, headaches, respiratory distress, heart palpitations, hypo- or hypertension and several allergenic disorders [9].

The main prerequisites for the presence of BAs in foods include the availability of free amino acids, the presence of microorganisms producing BA enzymes (mainly from raw materials and/or added starter cultures) and conditions allowing their growth (particularly temperature, pH), as well as conditions affecting the enzyme production and activity (particularly low pH). It follows that BAs can accumulate in a wide variety of foods and beverages being thermo-stable and not inactivated by heat treatments used in food processing and preparation. The presence of BAs in non-fermented foods generally indicates inadequate or prolonged storage; on the other hand, their presence in fermented foods could be unavoidable due to the diffusion of decarboxylases among lactic acid bacteria. It follows that the reasons for the determination of BAs in foods are twofold: first their potential toxicity; second the possibility of using them as food quality markers as their concentration can be related with the hygienic-sanitary quality of the process and with the freshness of the raw materials and the processed products.

As the presence of BAs has great impact on food quality and safety, considerable research has been undertaken in recent years to evaluate the presence of these compounds in various fermented, seasoned or conserved foodstuffs [10,11] and efforts to reduce the occurrence of BAs deserve a priority and justify the challenge to the food industry to provide products with BA levels as low as possible. As aminogenesis is the result of complex phenomena affected by multiple factors, specific product/processor measures should be designed assessing and considering the particularities of the product, production process, and processing environment characteristics. Unfortunately, a common rule cannot be defined for each type of product because each food type needs specific formulation and processing parameters, which have to be assessed on a case-by-case basis. On the other hand, although the influence of all these factors is not always well characterised, they constitute the basis of the mitigation options to prevent or limit BA accumulation in foods. As formation of biogenic amines occur during food processing and storage as a result of bacterial activities, higher amounts of certain amines may be found in foods as a consequence of the use of poor quality raw materials, microbial contamination and inappropriate conditions during food processing, as well as microbial contamination and inadequate conditions during storage. Optimal intervention strategies to avoid the accumulation of BAs

in foods should start from the accurate knowledge of the type of product and its productive process. In particular, fermentation provides the conditions indicated earlier allowing intensive microbial activity and therefore represents a key factor for BA accumulation in foods. In this sense, microorganisms should be appropriately selected for each type of product and variety (i.e., substrate) taking into account their technological competence (competitiveness, influence on organoleptic characteristics, etc.) and safety requirements, including the inability to produce BAs.

To this regard, as temperature is the major factor for controlling aminogenesis, traditionally, BAs formation in food has been prevented, primarily by limiting microbial growth through chilling and freezing. However, secondary control measures to avoid amine synthesis or to reduce their levels once formed need to be considered as alternatives. Such approaches may include hydrostatic pressures, irradiation, controlled atmosphere packaging or the use of food additives. Moreover, a variety of techniques can be combined together to control the microbial growth and enzyme activity during processing and storage for better shelf life extension and food safety [12].

It follows that improving the knowledge of BAs concentrations in relation to product formulation and processing will provide a more accurate insight into the parameters affecting the formation of BAs in the final product. This ultimately will lead to a more precise estimate of dietary intake of BAs from food products and may be helpful for the risk for consumer's health mitigation.

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Volume 8 Issue 5 April 2017