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ONE-TIME ASSESSMENT OF THE LEVELS OF HAZARDOUS NITROSAMINES IN A PANEL OF FRENCH PROCESSED MEAT PRODUCTS

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I. INTRODUCTION

Nitrosamines are a subgroup of nitroso compounds, which are detected in food products, particularly in nitrited meat products, especially when heated at high temperature (1, 2, 3). These compounds are formed by nitrosation and are implicated in colorectal cancer associated with overconsumption of processed meats (1).
Nitrosation is a reaction between a nitrosating agent and a secondary amine. Nitrosating agents are derived from a source of nitrite, which is provided either by food (water and plants) or by a nitrite additive, added during the manufacture of processed meats. In meat products, biogenic amines and protein degradation products are an important source of amine precursors. Certain conditions, such as long storage time, high temperature and acidic pH are necessary for the nitrosation reaction. This can happen during the production of charcuterie products (fermentation, drying, smoking, heat treatment), during storage and/or preparation before consumption. In recent years, the analysis of nitrosamines in cured meat products has been the subject of work to define the most favorable conditions for their formation (nitrite levels, temperature, pH, etc.) and the level of consumer exposure (1, 2). Among these studies, the majority focus on the analysis of volatile nitrosamines, because they are the most dangerous, and others on non-volatile nitrosamines because they are present in greater quantities (nitrosamine index AT-N NC).

In France, we have very little data on nitrosamine levels in processed meats products. This work aims to measure the prevalence of the 8 most dangerous nitrosamines into a panel of 22 French processed meats products on market, including processed meats as ingredient in assembled products.

II. MATERIALS AND METHODS

This is a one-time assessment of the levels of hazardous nitrosamines in a sample of charcuterie products as prepared by consumers. The panel of products has been chosen according to the formulation (nitrite/nitrate content, spices and herbs) process parameters (pH, cooking or fermentation/drying, smoking) and preparation applied to products (high temperature heating or use as an ingredient (pizza).

A list of 22 different French processed meats have been selected for nitrosamine analyses. For a better control of temperature and traceability, all samples have been sent to Ifip by producers. Ifip followed the cold storage until the end of shelf life and froze all products before sending them to Eurofins for analysis.

The analyses targeted volatile nitrosamines considered carcinogenic or genotoxic. In this survey, analysis have been made by Eurofins Vennecy laboratory (France), using Agilent, model 6495B QQQ and the following method: Liquid extraction, followed by solvent separation by salt addition. QuEChERS purification of the organic phase using C18 and PSA. Measurement using LC-APCI-MS/MS with a reversed-phase column. Accreditation Certificate D-PL-14602-01-00 DAkkS Deutsche Akkreditierungsstelle.

III. RESULTS AND DISCUSSION

No nitrosamine has been detected at the level of 1 µg/Kg in products analyzed under the conditions described.

Description	Over cooking temperature	Over cooking time	NDBA µg/Kg	NDEA µg/Kg	NDMA µg/Kg	NDPA µg/Kg	NMEA µg/Kg	NMOR µg/Kg	NPIP µg/Kg	NPYR µg/Kg
Over-cooked ham	220°C	10 mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Over-cooked bacon	220°C	10 mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Over-cooked chorizo	220°C	10 mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cooked speck ham	220°C	10 mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bacon on pizza	220°C	6 mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chorizo on pizza	220°C	7mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cooked ham on pizza	220°C	7 mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speck ham on Pizza	220°C	7 mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Nitrited bacon on flamenkusche	350°C	2 mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Non-nitrited bacon on flamenkusche	350°C	2 mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Nitrited grilled sausage	220°C	10mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Non-nitrited grilled sausage	220°C	10mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Nitrited over-cooked ham	320°C	2mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Non-nitrited over cooked ham	320C	2mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Nitrited canned pâté	115°C	65mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Gilled Vendée ham	150 °C	2 mn	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Rosette	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dry sausage	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Grilled andouillette	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Andouillette	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Curve nitrated dry sausage	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dry Ardèche ham	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Table 1: Results of 8 volatile nitrosamines analysis into 22 processed meat products of the French market.

These results show that, even for products that meet the conditions for a risk of volatile nitrosamines (added nitrite and or nitrate, grilling at high temperature, smoking, fermented), all results are under the detection level of 1.0 µ/kg for the 8 nitrosamines measured. These results are more favourable than other studies on European meat products (1, 5, ,6, 7).

In France, ingoing levels of nitrite and nitrate are around 40% lower than those allowed in the Regulation (EC) 1333/2008 in force due to a voluntary recent restrictive national use. With a general use of an antioxidant like sodium ascorbate, or sodium erythorbate, this could explain these reassuring results.

IV. CONCLUSION

These results are reassuring and provide useful data for assessing the risk of nitrosamines in processed meats products in France. Thus, according to these results, the risk of nitrosamines appearing in processed meats, even when prepared at high temperatures by grilling, appears low. However, there are other conditions that were not included in this panel, and additional studies would be necessary to strengthen this assessment of the prevalence of nitrosamines.

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