

International 58th Meat Industry Conference “Meat Safety and Quality: Where it goes?”

## Microbiological and chemical evaluation of dried smoked meat product

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### Abstract

The aim of this study was to determine the chemical and microbiological quality of an artisanal dried smoked meat product, manufactured in a domestic household. At the end of production, the average moisture content was 37.83%, salt 5.07%, while water activity was 0.89. Yeast counts were approximately  $1.0 \times 10^7$  cfu/g while mould counts were  $1.2 \times 10^6$  cfu/g. Two commonly present *Penicillium* species were identified: *P. aurantiogriseum* and *P. commune*. Our results suggest that the artisan manufacturers of these types of meat product should take steps to ensure a higher quality of their products.

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### 1. Introduction

Dried smoked meat products are produced and consumed in different countries throughout the world<sup>1</sup>. The production of smoked meat products combined with the use of salting, drying and smoking methods has a long tradition<sup>2</sup>. Dried smoked meat products are characterized by low water activity ( $a_w$ ) and high salt concentrations<sup>4</sup>. The primary objective of meat salting process in dry-curing is salt penetration into the muscle tissue, where salt, as

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humectants, reduces  $a_w$  providing initial preservation effect during the first stage of production<sup>2</sup>. However, if the production process is poorly managed, uncontrolled fungi (yeast and mould) growth on the surface of the dried smoked meat products can cause significant quality problems. As some moulds are mycotoxigenic, their growth on the dried smoked meat products could also pose a serious health risk<sup>5</sup>. Many studies have shown that xerotolerant and xerophilic fungi, species of *Aspergillus*, *Eurotium* and *Penicillium* are associated with dried smoked meat products in different parts of the world<sup>6,7,8</sup> and develop in the reduced moisture content of the substrate. “Storage” moulds prefer a lower moisture content of the substrate (13-18%,  $<0.75 a_w$ ) (dried fruit, milk in powder, grains and bakery products) and higher temperatures, so therefore, are the most frequently isolated from stored products<sup>9</sup>. The moulds are frequently referred to as cause for food spoilage leading to quality reduction and a major economic loss for the producers<sup>10,11</sup>. Identification of moulds associated with  $a_w$ , moisture and salt contents typical for smoked dried meat products is a starting point to understand importance of the production of safe and durable products.

The aim of this study was to examine the chemical and microbiological quality of a domestically-produced dried smoked meat product.

## 2. Material and methods



Fig. 1. Dried smoked meat product.

A dried smoked meat product, manufactured in a domestic setting by an artisan producer was selected (Fig. 1).

Moisture and NaCl contents were quantified according to the ISO recommended standards 1442:1997<sup>12</sup> and 1841-1:1996<sup>13</sup>, respectively.  $a_w$  of the samples was measured using a water activity measurement device (TESTO 650, Germany) with an accuracy of  $\pm 0.001$  at 25°C.

The total numbers of yeasts and moulds were determined according to the SRPS ISO 21527-2<sup>14</sup>. Inoculated agar plates were incubated at 25°C. The results were read after five and seven days. Counts were performed in triplicate.

Monocultivation of moulds was conducted by transferring conidia and hypha fragments from mould colonies onto Czapek yeast (autolisate) extract agar (CYA) (NaNO<sub>3</sub> 3 g, K<sub>2</sub>HPO<sub>4</sub> 1g, KCl 0.5 g, MgSO<sub>4</sub>·7H<sub>2</sub>O 0.5 g, FeSO<sub>4</sub>·7H<sub>2</sub>O 0.01g, yeast extract 5 g, sucrose 30 g, solution of microelements 1ml (ZnSO<sub>4</sub>·7H<sub>2</sub>O 1 g, CuSO<sub>4</sub>·7H<sub>2</sub>O 0.5 g, distilled water 100 ml), agar 20 g, distilled water 1000 ml). The criteria described by Samson et al.<sup>10,11</sup> and Pitt & Hocking<sup>15</sup> were used for species identification.

All data are presented as mean values. Analysis of variance and Duncan's multiple range tests were performed using the software package Statistica 10 for Windows, Stat Soft, Tulsa, Oklahoma, USA, 2009. Differences were considered significant at  $p < 0.05$ .

## 3. Results and discussion

Results of the chemical analyses of the dried smoked meat product are presented in Table 1. The  $a_w$ , moisture and NaCl content after drying period showed the usual trends observed in this type of product. After the drying period,

when the product was ready for consumption, it had low moisture content, from 37.80-37.85%, and a corresponding low  $a_w$ , ranging from 0.84 to 0.89. The salt content ranged from 5.00 to 5.12%. These values were in agreement with those generally found for various traditional and industrial dried smoked meat product<sup>2,16,17</sup>.

Table 1. Chemical analyses of the dried smoked meat product yeasts and moulds species.

Sample	Moisture content (%)	NaCl content (%)	$a_w$
Dried smoked meat product	37.83 ± 0.12	5.07 ± 0.05	0.89 ± 0.01

Results are given as mean ± standard deviation ( $n = 3$ ).



Fig. 2. Total count plates of yeast and moulds derived from the dried meat product.

In the dried smoked meat product, moulds numbered (on average)  $1.2 \times 10^6$  cfu/g, while yeast numbers were a log higher ( $1.0 \times 10^7$  cfu/g). Counts of yeasts and moulds showed a strong predominance of yeasts as compared to moulds in the product [Table 2, Fig. 1]. Two main species of *Penicillium* were most frequently isolated; *P. aurantiogriseum* and *P. commune*. *Penicillium* species has a potential to grow in the most of foods. *Penicillium* species isolated from examined samples were potential mycotoxin producers. During standard food microbiological examination, *P. aurantiogriseum* is the most frequently isolated species in our region. These species grow under a wide temperature interval, from -2 to 30°C (the optimal temperature is 23°C), and besides also require a minimal  $a_w$  value of 0.81. *P. aurantiogriseum* is known as a producer of various toxic compounds, such as: penicillic acid, penitrem A, cyclopiazonic acid, ochratoxin A. *P. commune* is also known to produce various toxic compounds, such as cyclopiazonic acid, rugulovasine A and B, cyclopaldic acid. *Penicillium commune* has also been implicated as a cause of “phenol defect” in Italian hams during ripening<sup>10,11,15</sup>.

#### 4. Conclusion

- Growth of the mycotoxigenic fungi on dry-cured meat product poses a potential health risk for consumers.
- Thus fungal species on dry-cured meats must be correctly identified if the presence of possibly mycotoxigenic species and risks from their mycotoxins are to be recognized.

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