EDUCATIONAL MATERIAL FOR PROCESSING OF MEAT SAUSAGE AND A VEGAN ANALOGUE

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I. INTRODUCTION

Cooked sausage products as all foodstuffs are exposed to microbiological contamination if the storage of the raw materials or the processing are poorly managed [1]. Vegan sausages usually contain less salt and preservatives ($NaNO_2$) than conventional meat sausages. Thus, the risk of microbial growth of both total bacteria and specific pathogens are greater for vegan sausages than for common meat sausages [2, 3]. A significant part of the food supply in the developed countries depends on processed food which must be produced safely. According to the Brand Reputation through Compliance Global Standards (BRCGS) Food Safety Issue 9 the food safety culture should be developed based on the companies' competencies [4]. In this study, *Listeria innocua* was used as a surrogate to study pathogenic growth of *Listeria monocytogenes*.

II. MATERIALS AND METHODS

A sausage processing video was compiled for the ERASMUS+ Sector Skills Alliance project European Qualifications & Competences for the Vegan Food Industry EQVEGAN (621581-EPP-1-2020-1-PT-EPPKA2-SSA-EQVEGAN). The shooting of the video about vegan and meat sausage processing was carried out at SEDU (the Vocational education centre in Seinäjoki). It will be distributed through the project for training in European Skills, Competences, Qualifications and Occupations (ESCO) profiles. Both vegan and meat sausages were processed (Fig. 1). This video describes the processing factors affecting the quality of vegan and meat sausages. Both sausage batters were prepared with the same equipment. In the sausage processing, the comminution was carried out in a bowl chopper (Seydelmann Group, Stuttgart Germany), stuffing with an automated stuffing machine (Handtmann Group, Biberach an der Riss Germany), cooking and smoking with a cooking cabinet (Inject Star Maschinenbau GmbH, Hagenbrunn Austria).

The vegan and meat sausage procedures followed conventional batch processing. The prepared batters were stuffed into permeable cellulose casing (28 mm, 120 cm^3, ViskoTeepak N.V, Lommel Belgium). The cooking and smoking program was the same for both sausages except for the temperature. A routine cooking process (76°C) is adequate to kill most of the spoilage bacteria [2, 5]. The final temperatures for vegan sausages were 88°C and for meat-based sausages 73°C. Natural smoke was produced using alder wood chips. Half of each of the batches were cooled in a cooling cabinet (6°C) and the other half at room temperature (19°C). Finally, all samples were stored in a freezer (- 40°C) before culturing.

Microbiological examination was carried out for both vegan and meat sausages cooled at room temperature and in cooling cabinet after the cooking process. The number of total bacteria was determined using the pour plate method for all sample types. Vegan sausages in three replicates were additionally inoculated with *L. innocua.*

III. RESULTS AND DISCUSSION

The vegan sausages inoculated with small amounts of *L. innocua* were microbiologically spoiled when stored at low temperatures: 3.0-4.5°C and 5.5-7.5°C. The longer the storage the more growth there was. As the market for plant-based products is growing [6], educational material, e.g., video, is needed for a correct handling of various vegan foods. The manufacturing process of vegan and meat-based sausages were documented as a video for educational purposes [7]. All process steps in manufacturing of both vegan and meat-based sausages were explained both orally and with text. The sausage processing video will be used as learning material for students, industrial operators learning vegan processes and industrial management.

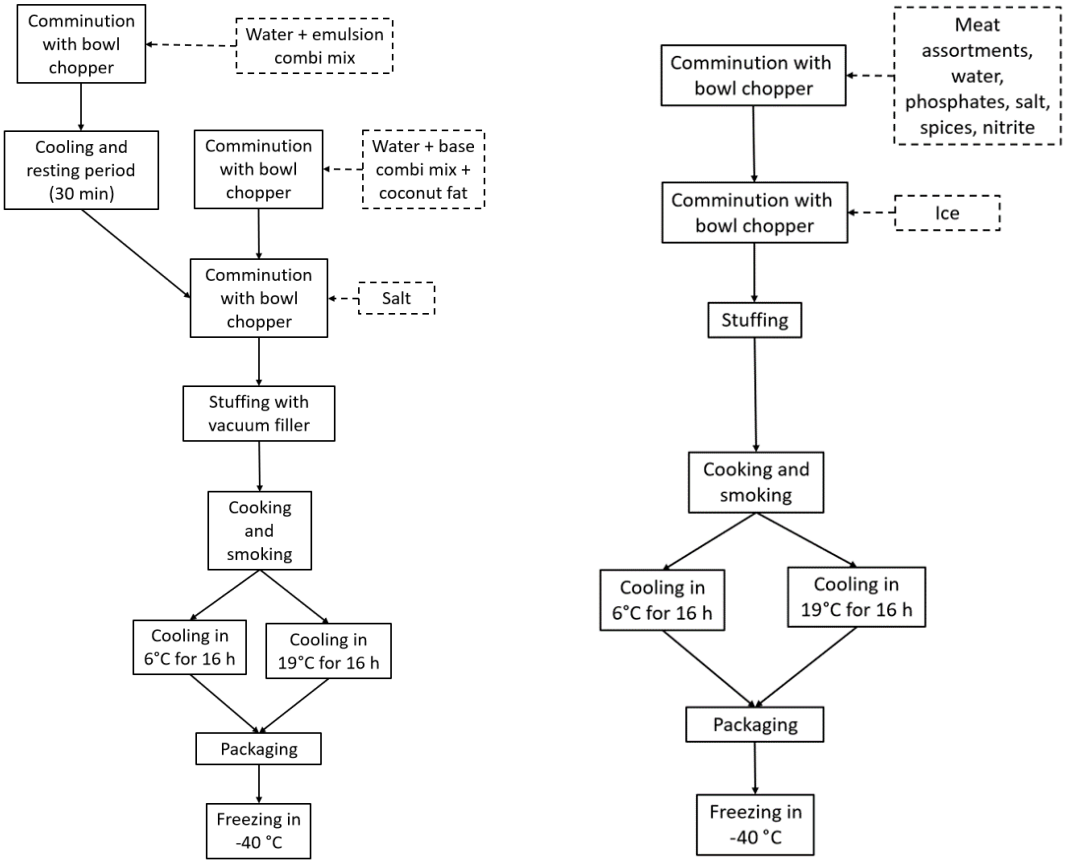

Figure 1. Process flow chart of sausage processing: a) vegan sausage b) meat sausage processing.

IV. CONCLUSION

Learning material is needed for persons developing vegan foods. This educational video is important for training in vegan food industry. The microbiological results showed that the total bacteria count of the vegan- and meat-based sausages was very low. It can be concluded that sausage processing is safe.

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