STUDY ON SELECTION OF SUITABLE MEAT SURFACE STARTERS FOR PRODUCING DRY FERMENTED SAUSAGE IN VIETNAM

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Abstract – Dry fermented sausage is one of the most popular fermented meat products in the world because of its good taste, firm texture and high nutritional value. In Vietnam, this product is mainly imported and at high prices and is not widely produced. This research studied a selection of meat surface staters suitable for producing dry fermented sausages in Vietnam. By assessing quality of the sausage through chemical and physical indicators (pH, NH_3, moisture, water activity, texture), microbiological criteria (lactic acid bacteria, *Staphylococcus aureus*, *Enterobacteriacea*) and sensory criteria using various starters, the meat surface starters are selected - TEXEL ® NEO1-DANISCO (LM2), were found to be suitable for fermentation, ripening, drying and also, creating a delicious taste and suitable for producing dry fermented sausages in Vietnam.

Key Words – Dry fermented sausages, meat surface starter, ripening.

I. INTRODUCTION

Dry fermented sausage is a fermented meat product that is well known throughout the world, fermented sausage products include Salami (Hungary), Peperoni (Italy), and Saucisson (France). This product develops a delicious taste and a firm, elastic and smooth texture after a long fermentation process in addition to drying and ripening in a controlled environment (temperature and humidity). In addition, the role of the microflora is crucial to the formation of flavor and regulation of moisture removal resulting in desired texture of the product. Many microbiological starters have been studied worldwide for their use in the fermentation of sausage; these bacteria include strains such as *Lactobacillus sakei, Lactobacillus plantarum.* Bacteria ferment and produce lactic acid within the product, inhibit harmful microorganisms, reduce nitrate to nitrite and also form a typical reddish pink color [1]. Some strains of beneficial moulds and yeasts such as *Penicillium nalgiovensis, Penicillium candidum,* and *Debaryomyces hansenii* are surface fermented strains, and have a role in inhibiting disadvantageous black and green molds, which densely cover the surface and help to regulate the slow moisture removal process to create a firm texture of the product. In addition, these strains also provide a plentiful protease system for proteolysis, lipolysis, forming delicious taste and breaking down peroxide, reducing rancidity [2], [3], [4]. In this study, we would like to select meat surface starters to produce high quality dry fermented sausages in Vietnam.

II. MATERIALS AND METHODS

- Meat maturation starters: *L. plantarum* H1.40 isolated from Vietnamese fermented pork (nem chua) producing bacteriocin [5]; TEXEL SA 306 (DANISCO) is a mixture of three strains (*L. sakei, S. carnosus, S. xylosus*) which are a group of strains commonly used for fermented sausage in the world.
- Meat surface starter: TEXEL® LEM 50 I (DANISCO) is a mixture of *Penicillium nalgiovensis, Debaryomyces hansenii* (LM1) and TEXEL® NEO1 (DANISCO) is a mixture of two strains *Penicillium nalgiovensis, Penicillium candidum* (LM2).

Pork and beef were ground using a 7 - 8 mm plate diameter. The seasoning were prepared in a mixer with meat maturation starters for at least 5 minutes before adding to the ground meat. The mixture was stuffed directly into 30 mm diameter collagen casings and then they were sprayed with a meat surface starter and fermented for 4 days at 22°C, relative humidity of 92%. The sample was dried and ripened 20 days at 18-16^{o}C with the relative humidity decreasing from 90 to 80%.

Isolation and enumeration of *Enterobacteriaceae* was carried out according to international standard method F18-1 (UK, 2005).
Determination of pH according to the TCVN 4835: 2002 (ISO 2917: 1999).
Determination of a_w by Water activity meter (CH8953 Lachen, Lab Master-a_w - Novasina, Switzerland).
Compress force was measured using a Spherrical stainless 5mm (P/5S) - Texture Analyser TA.XT Plus.
Shear force was measured using a Warner Bratzler - Texture Analyser TA.XT Plus.
Sensory attributes such as colour, flavor, texture, taste, and juiciness of the fermented sausages samples were evaluated as recommended by Hedonic rating test.

III. RESULTS AND DISCUSSION

The role of meat surface starters such as yeasts and moulds are beneficial when adding to fermenting sausages, is reported that the ability of protease biosynthesis for proteolysis to produce products with specific taste and aroma. In addition, these meat surface starters also regulate the moisture removal process when drying, ripening to form adhesive and a firm product [2] [3]. In addition, the climate in Vietnam is hot and is high in humidity, and it is very easy to contaminate with harmful moulds and yeasts during production of dry fermented sausage. Therefore, the selection of meat surface starters suitable for production conditions at large scale in hot climate is very necessary.

Sensory evaluation of dry fermented sausage samples added with different meat surface starters (LM1 and LM2) are shown in Table 1 and Figure 1.

Sample of dry fermented sausages added	**Sensory comments**
LM1- **TEXEL®** **LEM 50 I**	- Outside surface of sausage covered with quite thick layer of meat surface starters, pale white color, with a light yellow streak. - Inside the casing is reddish pink, quite aromatic, firm texture, harmonious taste.
LM2- **TEXEL®** **NEO1**	- Outside surface of sausage covered with quite thick layer of meat surface starters, growing fast, very white color. - Inside the casing is dark red, quite aromatic, firm texture, harmonious taste.

Table 1: Comments on sensory properties of dry fermented sausage samples added different surface starters

Figure 1: Dry fermented sausages with surface starters LM1 (left) to LM2 (right)

The pH value is very important indicator for evaluating the fermentation as well as ripening, drying of dry fermented sausage, whether it is good or not. The results evaluating the effects of meat surface starters LM1 and LM 2 on the pH and a_w values were shown in Figure 2,3.

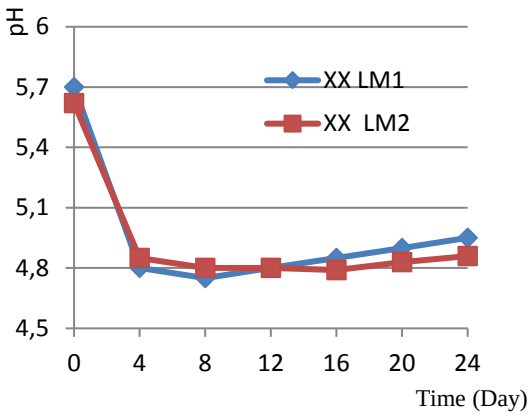

Figure 2: pH of two dry fermented sausage samples added LM1 and LM2

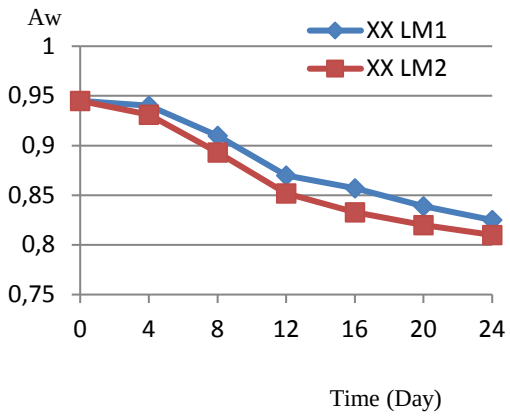

Figure 3: A_w of two dry fermented sausage samples added LM1 and LM2

Two meat surface starters LM1 and LM2 had some effect on the first four days of fermentation and had a exceptional effect on the subsequent 20 days of ripening and drying. The pH value of the sample added with LM2 after 4 days was 4.82 and then quite stable during ripening and drying - compared to the sample added with LM1.
Meat surface starters (yeast, mold) develop on the surface of the product, creating a layer, which facilitates the gradual moisture removal of the product, facilitating the formation of the product texture. Sausages added LM2 exhibited a faster decline in water activity than sample added LM1, which indicating the role of starters (yeast, mold) reported in [3], [4].
Criteria for harmful microorganisms or contamination in dry fermented sausages were evaluated in two dry fermented sausage samples Figure 4 shows that the sample with LM2 addition controls moisture and pathogenic microorganisms better than the sample used LM1

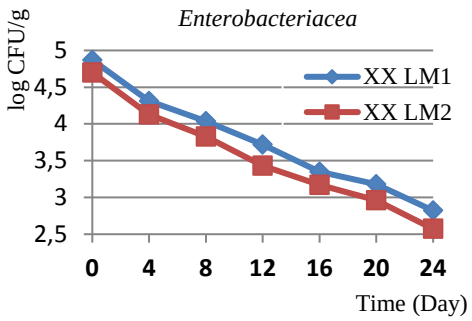

Figure 4: Number of Enterobacteriaceae of two dry fermented sausage samples added LM1 and LM2

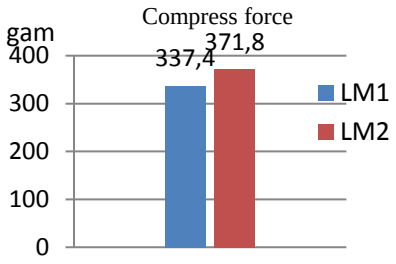

Figure 5: Compress force of two dry fermented sausage samples added LM1 and LM2 after 24 days

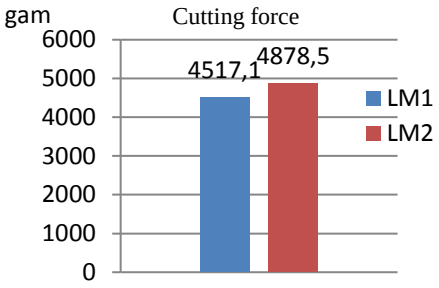

Figure 6: Shear force of two dry fermented sausage samples added LM1 and LM2 after 24 days

To determine the firmness, adhesiveness of sausage samples after fermentation, ripening and drying, we conducted structural measurements of two sausage samples with added meat surface starters LM1 and LM2 with the Texture Analyzer TA.XT plus. The results are shown in Figures 5 and 6.

Results showed that the sausage added LM2 had firmness texture (the compress force of the fermented sausage using LM 2 was 371.8 g, while the sample added LM1 was 337.4 g), and the juiciness texture of LM2 sample is also better than that of LM1 sample (the shear force of fermented sausage sample using LM2 is 4878.5 g, higher than that of LM1 sample 4517.1 g).

Conducting a sensory evaluation of the quality of these two dry fermented sausage samples by a nine-member panel with evaluation method describing product characteristics by profile, results shown in Figure 7.

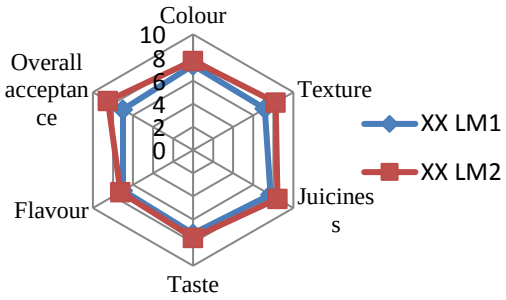

Figure 7: Evaluation of sensory characteristics of two dry fermented sausage samples using LM1 and LM2

The sensory evaluation results showed that the dry fermented sausage samples with starters LM2 were better for all attributes (colour, flavour, texture, taste, and juiciness). Thus, with two dry fermented sausage samples using meat surface starters LM1 and LM2, the samples added LM2 showed better fermentation, ripening and drying than the samples with LM1.

IV. CONCLUSION

Selected meat surface starters (LM2) - TEXEL® NEO1 (Danisco) have the ability of better fermentation, ripening and drying for production of dry fermented sausages suitable for Vietnamese climate conditions. Sausage products used these starters are evaluated as good quality of all physicochemical (pH, water activity) and microbiological parameters (the control of harmful bacteria) as well as sensory quality (colour, texture, juiciness, taste) and they are not inferior to other products on market.

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