Fayoum University
Faculty of Agriculture

Microbiological and chemical studies on the quality of fermented sausage

By

Aya Mohamed Farouq Ismail

B.Sc. Agric. Sci. (Food Sci. and Technol.)

Fac. Agric., Fayoum Univ. (2019)

Athesis submitted in partial fulfillment

of

the requirements for the degree of

Master

in

Agricultural Sciences

(Food industry)

Food Science and Technology Department

Faculty of Agriculture

Fayoum University

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Summary and conclusion

Probiotic microbiota was able to grow in meat products' suitable environments, and lately, efforts have been made to use probiotic bacteria to produce fermented meat products. However, there may be technical challenges that must be overcome in order to produce probiotic meat products. These hurdles include the inherent microflora of meat, the requirement for additives, and the lack of natural sugars. Probiotic bacterial strains that are suitable for use in the production of dry-fermented meat products must be able to endure the conditions present in fermented products. They should be able to outcompete other microorganisms present in the final product.

Additionally, the product should maintain its sensory qualities. The process of ripening and keeping sausage has a direct impact on its quality. The procedure encourages the growth of probiotic microorganisms, which affects this kind of meat product's sensory and nutritional properties, safety, and other features, and meat probiotics may work their benefits through a variety of methods.

Thus, the purpose of this study was to provide additional insight into:

1. Effect of adding probiotic strains such as lactic acid bacteria and bifidobacteria to fermented sausage, Lactobacillus. acidophilus, Lactobacillus paracasei, and Bifidobacterium bifidum were selected as single starters.

2. Replace the used fat with dried Jerusalem artichoke tubers.

2.1 Replace fat by 10%-20%-40% for each strain used.

3. Providing Support for the product with milk permeate.

Using these cultures could be an alternative method to increase product safety and shelf life, which would decrease the need for chemical additives in food storage and preservation.

The main points that could be used to summarize the results obtained were as follows:

1. Changes in pH values of fermented sausage samples during the storage period were studied, and according to the obtained results, the pH values of fermented sausages significantly decreased at the first 14 days in all batches ($P < 0.05$). The initial pH value was about 4–4.9. After 14 days of fermentation in the treatments, the pH of the control, A10, A20, A40, P10, P20, P40, and B10, B20, and B40 were reduced to 5.05, 4.09, 4.91, 5.00, 4.82, 4.74, 4.87, 4.16, 4.30, and 4.00, respectively. LAB caused the pH values to decrease in fermented sausage more than in the control sample. At the end of the storage period, pH values increased for all fermented sausage treatments, with an average between 4.65 and 6.20. This phenomenon might be attributed to the generation of non-protein nitrogen in the meat by the proteolytic process, which would inhibit the decrease in pH through buffering the lactic acid.

2. The acidity of sausages fermented with *L. acidophilus* was higher than that of sausages fermented with *L. paracasei* and *B. bifidum*. The final acidity of the finished products was recorded at 0.68–0.70% lactic acid by L. acidophilus, 0.61–0.65% lactic acid by *L. paracasei*, and 0.59–0.61% lactic acid by *B. bifidum* These results might refer to pH value and acidity are typically indicators of fermented meat products.

3. The results of moisture content of the fermented sausage were presented in table (9) and figure (3), and indicated that moisture content in all treatments steadily decreased with increasing ripening period.

4. fat content of fermented sausages treatments had significant differences at the fresh time because of the fat replacement process by

JAP which was applied at all treatments containing JAP in different concentrations. Fat content slightly increased throughout ripening period by decreasing moisture content in all sausage treatments.

5. the protein content of all treatments gradually increased by increasing ripening period. The higher protein content 17.6% was recorded by A40, which containing the highest concentration of JAP, at the fresh time of the ripening period. Also, A40 was recorded the higher protein content at the end of ripening period, and was 18.0%. Whereas, the lower protein contents 15.8% and 16.4% were recorded by C sample, which not containing JAP, at the fresh time and the end of the ripening period, respectively.

6. that no significant differences in the ash content were detected between all treatments of fermented sausage at the fresh time of ripening period. The higher percentage of the ash content was recorded by A40, P40, and B40, with values of 2.84, 2.83 and 3.0% respectively.

7. There were no significant differences in TBA of all fermented sausage treatments at the fresh time of ripening period. However, significant differences ($p<0.05$) started to detect at the days of 14, 21 and 28 of ripening period. The higher TBA value was recorded by control sample and reached 1.10 mgMDA/kg at the end of ripening period. Whereas, the lower TBA value was detected by B40 sample and recorded 0.76 mgMDA/kg at the end of ripening period.

8. The higher TVB-N was recorded by control sample and reached 32.3 mg/100 g at the end of ripening period. On the other hand, the lower TVB-N was recorded by the samples P10 and B40 that reached to 25.0 and 25.1 mg/100 g respectively at the end of the ripening period. TVB-N

content of the fermented sausage treatments inoculated with probiotics were significantly lower than that of the control.

9. According to the previously reported data, there were varying levels of biogenic amines in fermented sausage during storage, ranging from none to traces. These findings could be attributable to one or more of the following reasons:

9.1. The superior grade of the raw material utilized

9.2. It was found that the biogenic amine levels in this product, which was reformulated with JA, did not pose a health risk to users.

9.3. While the decarboxylation of free amino acids results in the production of biogenic amines, the presence of these amino acids does not always imply the development of the corresponding biogenic amine, as this is dependent on a number of circumstances. The presence of the microorganisms' amino acid decarboxylase enzyme and its activity in the medium were necessary for the production of amines.

10. the lactobacilli bacteriocins which have a suppressive effect on TVC growth in the final product showed in the sausages, aerobic bacterial growth was prevented by the fermentation process. In addition to using a high concentration of permeate powder could encourage bacterial development. So in a similar vein, adding JA as sugar to the products also encouraged bacterial growth.

11. At fresh time, LC of the starter cultures added to fermented sausage samples (A10, A20, A40, P10, P20, P40, B10, B20 and B40) were significantly higher than that of control sample ($P < 0.001$). Whereas, LC of samples containing lactobacilli ranged from 7.03 to 7.70 log cfu g-1, but the control sample was 4.40 log cfu g-1. The LC of the treatments inoculated with *L. paracasei* and *L. acidophilus* with 40% of JA and Bifido. Bifidum with 20% of JA (P40, A40 and B20) rapidly increased and reached at the 7th day of fermentation up to 10.80,10.40 and 10.40

log cfu g-1 respectively, then continued rised throughout ripening period. At the end of ripening period, LC of samples containing lactobacilli strains significantly increased and ranged from 11.00 to 11.90 log cfu g-1. Whereas, LC of the control sample recorded 7.20 log cfu g-1 at the end of ripening period.

12. the yeast and mold were not detected in all treatments containing probiotic bacteria throughout ripening period exept at the end of the ripening period. Whereas, yeast and mold appeared with no significant counts at the end of ripening period of all samples containing probiotics, except Bifidobacteria samples, in which yeast and mold disappeared or not detected throughout the ripening period. On the other hand, yeast and mold appeared in the control treatment throughout ripening period, and inceased from 1.10 log cfu g-1 at fresh time to 3.70 log cfu g-1 at the end of ripening period. this result may be due the effect of probiotic bacteriocins on yeast and mold growth in the treatments containing probiotic bacteria.

13. At fresh time of the ripening period, Staphylococcus levels ranged from 2.1 to 2.5 log cfu g-1 in all treatments. During the ripening phase, the Staphylococcus count was significantly lower in the samples containing bifidobactia than in the other samples ($P < 0.001$). Staphylococcus is regarded as a bacteria that produces flavour in all processed meat manufacture. High Staphylococcus counts were observed in the A10 and P10 groups in this study at the end of ripening period, which may have enhanced the flavour of the fermented sausage. on the other hand, the highest peak staphylococci count of the control treatment was recorded at 3.0 log cfu g-1 at 21st day of the ripening period, it is worth to mentioned that Staphylococcus aureus was not detected in all fermented sausage samples.

14. That total coliform bacteria group were not detected in all treatments containing probiotic bacteria. But coliforms appeared in the control treatment with very small counts, ranged from 0.3 to 1.3 log cfu/g

The growth of bacteria causing spoilage was stopped because LAB inhibits other harmful and spoilage microorganisms.