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Drying of pastirma by two microwave based technologies: Physical, biochemical, microbiological and sensory aspects (#249)

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Notes

Introduction

Microwave drying of foods is an appealing alternative to conventional drying techniques because it shortens processing time and reduces energy consumption. Combining microwave drying with vacuum drying promotes synergism, i.e. resulting in a process which is more efficient if only one of them is used. In other words, this combination renders a more efficient process in terms of energy consumption and drying times. This synergism takes place because of the low processing temperature (vacuum drying) and rapid volumetric heating (microwaves).

Pastırma is a traditional highly consumed Turkish dried-cured meat product where traditional processing could be modified by other treatments proven to be effective on the manufacturing of other meat-based products. The most time consuming step in pastırma manufacturing is drying, which significantly affects the entire process in terms of final product characteristics as well as costs. Thus, the aim in this study was to replace the conventional pastırma drying process by microwave drying or by combining microwave and vacuum drying seeking reducing processing times and better quality attributes of the final product.

Methods

Beef *M. longissimus dorsi* muscles weighing around 500 g were randomly divided into three groups, one of which was a traditionally processed pastırma used as control (C), while for the other two were dried either by microwave (M) (at 250 W) for 3.5 hr or by a microwave-vacuum combination (MV) (at 250 W, 500 mmHg) for 3hr. The total processing time for C was 21 days while for M and MV groups was 9 days plus 3.5 hr and 9 days plus 3 hr, respectively.

After verifying that the two new approaches were successful to attain similar product characteristics to the C group with shorter drying times, the following analyses were conducted to evaluate product characteristics: proximate composition; pH value; counts of total aerobic mesophilic bacteria (TAMB), total psychrotrophic bacteria (TPB), lactic acid bacteria (LAB), *Micrococcus*/*Staphylococcus* spp. (MS), *Enterobacteriaceae*, total coliforms/*E. coli* and total yeast-molds (YM); CIE lightness-L*, redness-a* and yellowness-b* color values; texture profile (hardness, cohesiveness, springiness, gumminess and chewiness); and sarcoplasmic and myofibrillar protein profiles by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE). A consumer acceptability test was also conducted. An analysis of variance using the SAS system 9 was applied to data from two replicates, and Duncan's Multiple Comparison test was used for mean separation ($p<0.05$). The Friedman test was utilized for statistical analysis of data from consumer acceptability test.

Results

M and MV groups had significantly higher moisture content and lower protein, ash and sodium chloride contents than the C ($p<0.05$). The pH values of C, M and MV were 5.72, 5.82 and 5.88, respectively which differed only between C and MV. Drying with M and MV resulted in higher L*, a* and b* values than the C group ($p<0.05$) while there was no difference ($p>0.05$) in color values between M and MV groups.Pastırma dried with M exhibited higher ($p<0.05$) gumminess (101.1) and hardness (136.3 N) than MV (gumminess, 73.2 and hardness, 102.3 N) and C ones (gumminess, 69.7 and hardness, 91.1 N) indicating that the MV combination resulted in similar texture characteristics to C.

In SDS-PAGE sarcoplasmic protein profile, similar patterns were observed in M and MV groups whereas the intensities of the bands in C did not differ from the ones for the raw meat and were greater than those of the other two; i.e. M and MV groups (Figure 1). In myofibrillar protein profile, less degradation was detected in M group than MV and C groups.

In C group, initial TAMB, TPB, LAB, MS and YM counts increased after production ($p<0.05$). It is noteworthy to mention that YM count was significantly lower ($p<0.05$) in M and MV than C.

A consumer acceptability test was conducted in both, uncooked and cooked pastırma. While uncooked C, M and MV groups had similar scores ($p>0.05$) in terms of appearance, color, odor, taste, texture and overall acceptability, in cooked pastırma, the M and MV samples generally received higher scores ($p<0.05$) than the C except for odor which did not differ among all the groups ($p>0.05$).

Conclusion

A specially designed equipment for microwave and microwave-vacuum drying was successfully used for pastırma manufacturing. These new approaches resulted in around 12 days reduction in drying time without nega-

tively affecting the final product overall characteristics. In some cases, the novel pastırmas had even better characteristics in terms of sensory attributes, instrumental color values, lower yeast/molds counts. Therefore, microwave and microwave-vacuum drying technologies are sound alternatives to manufacture pastırmas because they are more efficient in terms of energy consumption and processing times resulting in overall lower costs and eco-friendlier than the conventional process.
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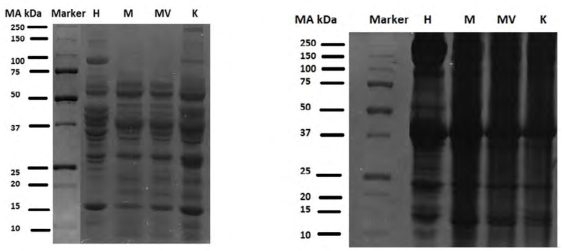

Figure 1. SDS-PAGE Sarcoplasmic and myofibrillar protein profiles of pastırma Sarcoplasmic (on the left) and myofibrillar (on the right) protein profiles of pastırma obtained by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE). MA: molecular weight, H: Raw material, M: Microwave drying, MV: Microwave-vacuum drying, K: Control.

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