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Effects of meat replacement by using different plant proteins on quality of emulsion-type sausages (#303)

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Introduction

Plant proteins can be incorporated into meat products for multiple reasons such as the improvement of emulsification, water binding, nutritional value, and reduction of animal protein as well as reduction of raw material costs. Additional the consumers would like tasty products with an additional health benefits and higher sustainability of these meat-plant-protein-mixed products than pure meat products. The objective was to investigate the impact of replacement of meat protein on water binding capacity, texture, and sensory properties. Further, the applicability of locally produced wheat, sunflower, pumpkin, and rapeseed protein in emulsified sausages was analyzed.

Methods

In this study, each plant protein powder were analyzed for its protein content. **Fig. 1** shows an overview of the materials, the manufacturing process, and conducted analyses. The model meat matrices were prepared by replacing of meat protein with the addition of 2 and 4 wt% of plant proteins (each calculated on its protein content) such as wheat, sunflower, pumpkin, and rapeseed into the meat batter, containing lean pork meat and ice in a ratio of 2:1. Added plant proteins were used as substitutes for 15.3 and 30.6 wt% of the meat proteins. For the analyses, the batter was filled into sausage casings and heated (72°C core temperature). A panel of at least 20 assessors did the sensory test. All analyses were carried out in duplicate.

Results

The total protein contents of the sausages with a replacement of meat protein of 2 and 4 wt% by using plant proteins were found between 14.5 and 16.5 g/100 g. The water binding capacities were analyzed to be higher for samples containing plant proteins compared to the control without added plant proteins. The weight losses after heating were significantly different for sunflower, pumpkin, and rapeseed protein (17.0-30.0% ($p \geq 0.05$) compared to the control (38.0 ± 0.7 wt%). Those results were in accordance with the texture analysis, samples with a high weight loss showed a higher firmness. Remarkably, meat matrices prepared with 2 wt% rapeseed protein had a lower weight loss while the firmness did not differ significantly from the control ($p \geq 0.05$). Color measurement ($\Delta E < 1$) and sensory test revealed that regarding the attribute firmness, only meat matrices prepared with 2 wt% wheat protein were rated similar to the control. However, regarding taste, the matrices prepared with plant proteins did not significantly differ from the control ($p > 0.05$). Those results indicate that 2 wt% of wheat and rapeseed proteins are a suitable amount to be added into a meat product as sensory properties were acceptable and functional benefits were enhanced.

Discussion

Previous studies reported comparable values for weight loss and increased processing yields by the addition of plant proteins (Alamanou et al., 1996; Youssef and Barbut, 2011). In this study, the firmness decreased with increasing amounts of added plant protein, which can be explained by the higher water-binding capacity. Wheat or rapeseed proteins with an amount of 2 wt% protein, which corresponds to a meat replacement of 15.3% can be added into a meat product, and results in acceptable sensory properties. The other plant proteins and the higher amount of replacement of meat proteins by using plant proteins did not prove to be promising for the application in sausages. In former studies, the addition of 2 wt% soy protein isolate or 3 wt% lupin protein was stated to cause inacceptable texture and unpleasant sensory attributes in frankfurters or bologna, respectively (Alamanou et al., 1996; Chin et al., 1999).

Conclusion

Wheat or rapeseed proteins with an amount of 2 wt% protein corresponding to a meat replacement of 15.3% can be added into a meat product without significant sensory drawbacks. The visual appearance of the samples prepared with rapeseed and pumpkin differed strongly from the control due to the greenish color, and large bubbles incorporated into the system. Additionally, the functional benefits were partly enhanced and a structuring impact of meat proteins on mixtures with plant proteins could be found.

Literature

Alamanou, S., Bloukas, J., Paneras, E., Doxastakis, G., 1996. Influence of protein isolate from lupin seeds (*Lupinus albus* ssp. Graecus) on processing and quality characteristics of frankfurters. Meat Science 42, 79-93.
Chin, K., Keeton, J., Longnecker, M., Lamkey, J., 1999. Utilization of soy protein isolate and konjac blends in a low-fat bologna (model system). Meat Science 53, 45-57.
Youssef, M., Barbut, S., 2011. Effects of two types of soy protein isolates, native and preheated whey protein isolates on emulsified meat batters prepared at different protein levels. Meat Science 87, 54-60.

Notes

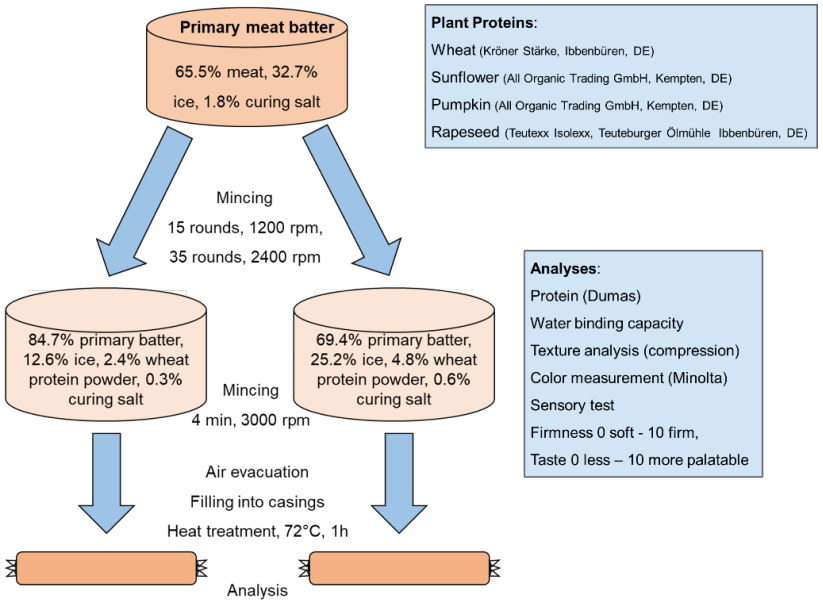

Fig. 1.
Overview of the materials and methods (e.g. wheat protein)

Notes