## Improving the quality of beef from Holstein-Friesian bulls by different marinades

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**Introduction:** Marinating is a technique used to make meat more attractive, mainly by improving its tenderness, taste and aroma (1, 2). The aim of the research was to determine the effect of different commercial marinades on the colour, tenderness, cooking loss and sensory characteristics of the *semimembranosus* beef muscles subjected to sous-vide treatment.

**Materials and methods:** In the study, *semimembranosus* muscles (n = 24), obtained from carcasses of Polish Holstein-Friesian bulls (20.5 ± 2 months) were used. The vacuum-packaged meat was aged for 14 days at 4 ± 1°C. Subsequently, the muscles were split randomly into 4 groups, 6 muscles in each. From each muscle, two 2.5-cm thick steaks weighing approx. 200 g were cut: one steak served as unmarinated control, while the next was selected for one of the commercial marination treatments – Odessa (red pepper, garlic, onion), Mexico (red pepper, tomato), Old Polish (pepper, garlic), and Bordeaux (pepper, red pepper, garlic). The marinated samples were placed in containers for 24 h at 4°C with a marinade solution of 80 g per 1 kg of meat. Then the samples were vacuum-packed and subjected to sous-vide treatment at 60°C for 4 h. After that, the samples subjected to following analyses: colour determination, marinate absorption and cooking loss, Warner-Bratzler shear force and sensory assessment [3]. The proximate composition and pH value of raw meat were analysed as well.

**Results:** The *semimembranosus* muscle used in the study contained approx. 74.7% moisture, 22.4% protein, 1.2% fat, 1.2% ash, and pH 5.6. The marinade absorption ranged from 3.3% (Mexico) to 4.4% (Bordeaux).

All the technological procedures such as marinating and cooking significantly affected all colour parameters ($p<0.001$). Marinating of raw beef caused a decrease in L* and a*, and an increase in b* values. The influence of marinating on the colour of sous-vide beef was clearly showed – marinades decreased L* and increased b* values as compared to the beef subjected to sous-vide without marinating. Marinade type affected all of colour parameters, which resulted from their diverse composition. The highest values of L* were noted in Old Polish and Odessa marinades samples, whereas the highest a* and b* values in Mexico samples.

Marinating reduced cooking loss (about 34.6%; $p<0.001$) and WBSF values of sous-vide beef (about 19.5%; $p<0.001$). The marinate which had the most tenderizing effect was Old Polish, whereas the remaining marinades showed a similar effect. The use of marinating prior to sous-vide treatment beneficially affected all sensory quality attributes, excluding meat aroma intensity and acceptability. The most acceptable taste and the highest score for overall acceptability had Old Polish and Bordeaux marinated beef.

**Conclusion:** Marinating effectively improved the quality of the *semimembranosus* muscles from Holstein-Friesian bulls. The best results were obtained with the Old Polish marinate, which improved the tenderness of the beef by 33.8%. It was confirmed by sensory evaluation results - the beef marinated in this marinade after sous-vide treatment was the most juicy and tender.

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**Literature:**

1. Yusop, S. M., O'Sullivan, M. G., & Kerry, J. P. (2011). Marinating and Enhancement of the Nutritional Content of Processed Meat Products. In: Kerry JP, Kerry JF (eds) Processed Meats: Improving Safety, Nutrition and Quality. Woodhead Publishing, Cambridge, 421–449.
2. Sengun, I. Y., Turp, G. Y., Cicek, S. N., Avci T., Ozturk B., & Kilic G. (2021). Assessment of the effect of marination with organic fruit vinegars on safety and quality of beef. International Journal of Food Microbiology, 336, doi.org/10.1016/j.ijfoodmicro.2020.108904
3. Modzelewska-Kapituła, M., Tkacz, K., & Nogalski, Z. (2021). The influence of muscle, ageing and thermal treatment method on the quality of cooked beef. Journal of Food Science and Technology, doi.org/10.1007/s13197-021-04993-x