

2017 Reciprocal Meat Conference – Meat and Poultry Quality

Meat and Muscle Biology™



Effects of Pre-Rigor Deboning and Vacuum Storage on Sensory Attributes of Cooked Beef Sausage

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Keywords: beef, cooked sausage, descriptive sensory, prerigor
Meat and Muscle Biology 1(3):66

doi:10.221751/rmc2017.060

Objectives

The objective of this study was to evaluate effects of pre-rigor deboning and vacuum storage on quality characteristics of sausage batter and cooked beef sausage.

Materials and Methods

Five 24-mo-old Holstein steers were slaughtered and the left chuck primals were deboned, coarsely ground through 1.25-cm plate, chilled to 2°C within 15 min of deboning, and salted (1.5%) within 2 h post-mortem (pre-rigor treatment– PRE); whereas the right chuck primals were deboned at 72 h post-mortem (post-rigor treatment– POST), coarsely ground, and stored at 2°C. Ground beef was pre-blended with 0.25% phosphate and other ingredients before being processed into sausage batter on d 6 post-mortem, during which POST meat was salted separately from batter formulation. Sausage batter was stuffed into 32-mm edible collagen casings (DeWied International Inc., San Antonio, TX) and sausage links were cooked to an internal temperature of 73.9°C, vacuum-packaged, and stored for 30, 60, 90, and 120 d at 4°C. Samples of coarsely ground lean (GB), salted lean (SB), batter (BB), and sausage at the end of storage periods were collected, frozen in liquid nitrogen, homogenized into fine powder, and stored at –80°C for chemical analysis. Proximate analysis was conducted using NIR spectrophotometer (FoodScan Pro/Lab, Type 7880; Foss, Eden Prairie, MN). Myoglobin forms and surface color were determined by reflectance spectroscopy with illuminant A at 10° angle (MiniScan EZ 4500L, Hunter Associates Laboratory, Inc., Reston, VA). Metmyoglobin reducing activity (μM of metmyoglobin reduced/min/g of muscle) was determined by reacting extracted muscle reductases with equine skeletal metmyoglobin and measuring deoxymyoglobin at 580 nm.

Descriptive sensory attributes of cooked sausages were also evaluated. A randomized complete block design with a split-plot in time was analyzed by the GLIMMIX procedure of SAS (SAS Inst. Inc., Cary, NC) with 0.05 level of significance unless otherwise noted.

Results

Deboning time had no effect on chemical attributes of sausages, except for pH, which was greater ($P < 0.001$) for PRE GB (6.8) than for POST GB (5.8). Lightness of BB (52.7) was greater ($P = 0.005$) than that of GB (47.6); whereas redness was greater ($P < 0.001$) for GB (27.8) than that for BB (15.3). Percentage of metmyoglobin was greater ($P < 0.001$) in BB (47.1) than that in GB (31.2); whereas those of deoxymyoglobin and oxymyoglobin were greater ($P \leq 0.007$) in GB (8.2 and 60.6) than those in BB (1.5 and 51.3), respectively. Trained panelists did not detect any treatment difference in all sensory attributes, except for saltiness, which was greater ($P = 0.053$) in POST sausage than in PRE sausage. However, aroma intensity and chewiness were increased ($P \leq 0.019$) on d 90 and 120 compared with d 30 and 60; whereas beef complex and umami flavor were decreased ($P \leq 0.060$) on d 90 and 120 compared to d 30 and 60. Sweetness and juiciness of sausages were decreased on d 60, 90, and 120 compared with d 30 ($P \leq 0.012$). Off-odor intensity and sourness were increased ($P \leq 0.019$) on d 90 and 120 compared with d 30 and 60.

Conclusion

These findings indicated that, despite having a greater pH, pre-rigor beef provide no technological advantage to cooked sausage when phosphate was used. Moreover, cooked sausages can be refrigerated in vacuum-package for up to 60 d without deterioration of sensory quality.