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Effect of Post-Cooking Holding Time on Consumer Taste Panel Ratings of Enhanced Pork Loins

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Summary and Implications

Sensory evaluation of food products is a valuable means of learning about their characteristics. Consumer taste panels are regularly used to evaluate properties of meat products such as pork loins. The objective of this research was to evaluate the effect of post-cooking holding time on the taste panel ratings of enhanced pork. The loins used in this project were enhanced with varying percentages (close to 10 %) of solutions containing water, salt, phosphates and natural juices or flavors. The loins came from 10 different suppliers and were served in randomly allotted groups of seven, throughout twenty, one-hour taste panel sessions. The meat was cooked, diced and kept in double boilers in order to maintain a steady temperature of approximately 122°F throughout the duration of the one-hour taste panel. Eight-point hedonic scales were used for juiciness, tenderness, flavor and overall acceptability. The order in which the panelists attended the taste panel throughout the hour was recorded. Significant first-degree interactions between time and tenderness, juiciness, flavor and overall acceptability were found. As expected, the ratings given by the panelists to the meat decreased as post-cooking holding time in the double boilers increased. Empirically, holding time should be minimized and samples should be replaced after no more than 30 minutes. Results showed that current American Meat Science Association (AMSA) guidelines for meat evaluation should be revised whereby samples are cooked while the taste panel is conducted. As such, it is important that proper facilities be used and positive air flow in the panel booths be maintained to minimize any carry-over effects from the aroma of cooking meat.

Introduction

In current taste panel practices samples are cooked, cut and kept warm in double boilers until they are served to panelists, according to AMSA Research Guidelines (AMSA, 1995). People that come at the end of a taste panel session get meat that has been in the double boilers for an hour.

It is rational to speculate about the physical and chemical transformations that the meat undergoes in the time that it is kept warm in double boilers throughout the hour that taste panels last. These alterations in the products' organoleptic properties may have an impact on the panelists' ratings with respect to juiciness, tenderness, flavor and overall acceptability.

Previous research has shown lower sample temperatures have significantly deleterious effects on flavor and juiciness of the product being tested. They recommended maintaining 122°F sample temperature in the double boilers, but no effort was made to look at the effects of holding time.

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Materials and Methods

Chop preparation

Commercially available loins (n=14) from each of 10 different suppliers were shipped fresh to the University of Nebraska meat laboratory and randomly numbered. They were cut into 1-inch thick chops, wrapped in freezer paper and frozen according to slaughter dates in order to obtain similar aging times (15 and 30 days respectively for each supplier).

Four chops per loin were thawed at 38-42° F for 24 hours and cooked to an internal core temperature of 165°F on Farberware Open Hearth Broilers. Samples were diced and placed in double boilers so that they would all be in the boilers by the time the taste panel began. The temperature was maintained about 122°F in the boilers throughout the taste panel.

Sensory evaluation

Panels (n = 20) were conducted six times per week. Each panel lasted for one hour and was composed of seven suppliers. Attendance was voluntary but rewarded with a piece of candy after the evaluation and a cash-prize drawing at the end of each week.

Random attendees (n= 26 to 35) evaluated seven samples per taste panel session and rated them on eight-point hedonic scales for juiciness, tenderness, flavor and overall acceptability. The sampling was done in individual booths with red lights and each panelist was given a cup of water and unlimited time for the evaluation. The order of the panelists was also recorded. Sampling order was later converted to a function of time and the panelists were separated into 6 specific time groups for the analysis. In this way, time group one contained the first one-sixth of the attendees and group six, the final one-sixth.

These groups approximate the time samples were held after cooking. Panelists did not necessarily arrive at equal time intervals. However, the time required by individual panelists for the actual sensory evaluation makes the order of evaluation a reasonable approximation of post-cooking holding time.

Statistical Analyses

The MIXED procedure of SAS was used to analyze the data as an unbalanced incomplete block, blocking by panel number and brand, with time as a covariate. Panel and panel by brand interaction were included as random effects. Second and third degree interactions for the effect of time were explored, but only the linear effect of time was found to be significant.

Table 1. Significance levels (P value) and linear effects of time on taste panel tenderness, juiciness, flavor and overall acceptability scores.

	Traits evaluated			
Item	Juiciness	Tenderness	Flavor	Overall Acceptability
Levels of significance	0.0155	0.0004	< 0.0001	< 0.0001
Linear effect of time (taste panel units/hr)	-0.17	-0.25	-0.36	-0.34

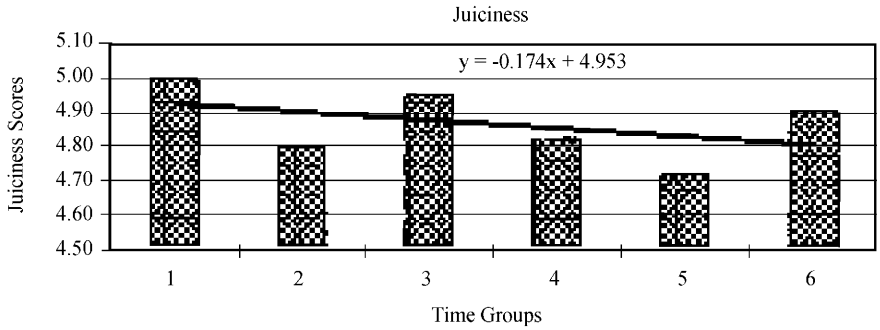

Figure 1. Effect of time (in groups of 10-minute intervals) on taste panel juiciness scores.

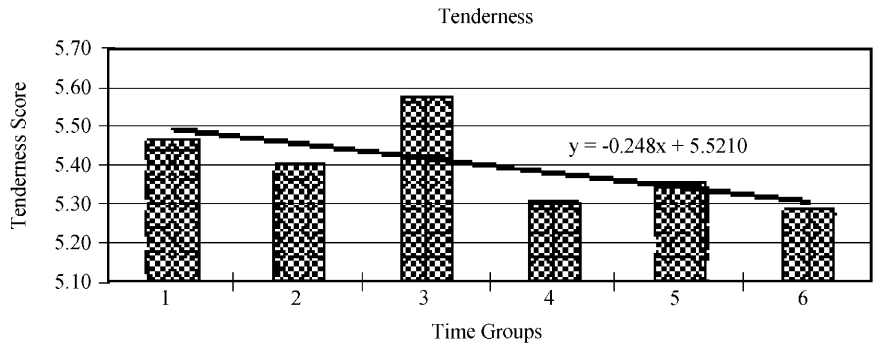

Figure 2. Effect of time (in groups of 10-minute intervals) on taste panel tenderness scores.

Results and Discussion

The linear effect of time was highly significant for all four sensory traits evaluated. The most negative impact was for flavor scores (Table 1). Overall acceptability scores were also significantly reduced by post-cooking holding time. Tenderness was negatively influenced as well and the trait least affected was juiciness.

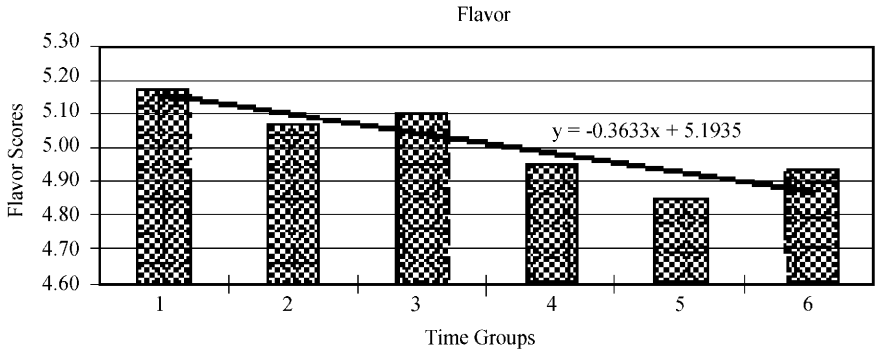

Figure 3. Effect of time (in groups of 10-minute intervals) on taste panel flavor scores.

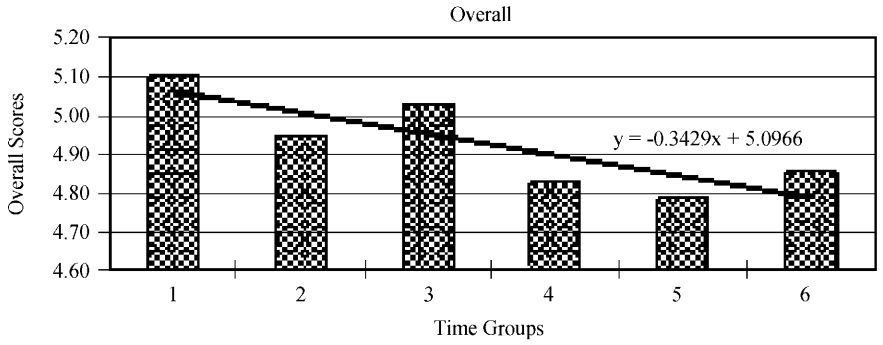

Figure 4. Effect of time (in groups of 10-minute intervals) on taste panel overall scores.

Flavor and overall acceptability mean scores dropped by 0.36 and 0.34 taste panel score points, respectively, throughout the duration of the taste panel sessions (one hour); juiciness and tenderness were lowered by 0.17 and 0.25 taste panel score points, respectively.

Panelists may have been less sensitive to differences in juiciness because of the enhancement solution injected into the product. The extra water in the product and the ingredients in the solution (such as the phosphates) likely enabled the product to be more efficient at retaining water despite the length of time held in the double boilers.

Since tenderness ratings are closely related to juiciness, it's possible the ability of the product to retain extra moisture also helped to prevent the meat from becoming tougher over time spent in the double boilers.

These data are only valid for enhanced pork samples, since it is reasonable to speculate that other species or products not processed with enhancement technologies will behave differently.

Flavor was the trait most seriously affected as the samples aged in the boilers. The transformation of compounds that give meat its characteristic flavor are likely responsible for the lower ratings that develop during post-cooking holding time.

The overall acceptability score is the sum of all of the previously mentioned effects, so it is expected that this trait carries with it the effects of many of the others.

Figures 1 through 4 show the effect of time on the mean taste panel palatability scores (juiciness, tenderness, flavor and palatability), with time being separated into six, ten-minute continuous intervals. Regression lines were fitted to each chart and the prediction equations are shown even though the variation is large.

Conclusion

These data indicate a decline in sensory ratings occurs over time during post-cooking holding time in double boilers. Empirically, holding time should be minimized and samples should be replaced after no more than 30 minutes. This will entail a change in protocol whereby samples are cooked while the taste panel is conducted. A such, it is important that proper facilities be used and positive air flow in the panel booths be maintained to minimize any carry-over effects from the aroma of cooking.

It must be noted, however, that these results are exclusive to the product tested and it is not appropriate to extrapolate these data to products from different species or processed with different technologies.

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