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DEVELOPMENT AND CONSUMER ACCEPTANCE OF PRE-COOKED LAMB LEG ROASTS

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Introduction

With the ever-increasing trend of both females and males working outside of the home, a demand for convenience and a fast, palatable meal has been on the rise (Salvage, 1999). The red meat industry, especially the beef and pork industries, has taken steps to develop products that are not only low in fat, but also quick, easy, and convenient to prepare to accommodate the changing lifestyles of consumers (Nayga, 1993). Between 1970 and 1989 red meat consumption in the United States fell, especially lamb, decreasing by nearly 50% (Nayga, 1993). It is obvious that the lamb industry needs to regain market share and needs to find a way to rebuild consumer confidence in lamb products.

The biggest change in retail markets between 1988 and 1998 is toward convenience items (Nunes, 1998). Unfortunately, little effort has been focused on pre-cooking lamb. With most supermarkets now having a variety of ready-to-eat foods and frozen prepared foods ready for heating (Nayga, 1993), a pre-cooked lamb product seems to be economically marketable and sustainable. The field of ready-to-eat products has been expanded greatly over the past few years in order to meet the convenience demands of consumers. Therefore, the lamb industry needs a product that can achieve market share in home meal replacement to increase the consumption of lamb and reverse the negative opinion that some consumers have about the overall eating satisfaction of lamb.

Objectives

The objective of this study was to determine the most acceptable reheating method and the spices and flavorings most acceptable with lamb to develop a palatable, convenient, pre-cooked lamb leg roast.

Methodology

Preparing the Roasts

Lamb legs (n = 60) were purchased from Pak Marketing in San Angelo, Texas. First, the patella was removed from the legs and any excess subcutaneous fat was trimmed. The legs were cut into four 3.81 cm roasts with a bandsaw for a total of 240 uniform roasts.

All roasts were then trimmed free of any external fat and the seam fat containing the poplitenal lymph node was removed. All roasts were injected using a Gunther Pickler Injector (model P1632, Koch Supplies, Inc., Kansas City, MO) with a 15% injection of a brine mixture of water, phosphate, and salt. The control roasts were injected in order to allocate consistency between all roasts upon reheating. After the roasts were injected, they were allowed to drain. Three spice blends were formulated (60 roasts/spice blend), and 60 roasts were used as a control group. The roasts were assigned to one of four treatments: control (CON), Italian, Mexican, and prime rib. Roasts within each leg were randomly assigned to one of four treatment groups to achieve an equal number of roasts from each leg location within each treatment. The roasts were cooked and smoked in a smokehouse (model 1000, Alkar Corporation, Lodi, WI) to an internal temperature of approximately 63°C to achieve a medium-rare degree of doneness (AMSA, 1995). After cooking, the roasts were chilled to 2°C, vacuum packed, and frozen at -10°C.

Trained Sensory Panel

Trained sensory panel analysis was conducted on 120 roasts (30 roasts/treatment) to determine the ideal reheating method and to detect differences between spices for differing palatability characteristics. The roasts were thawed and reheated one of three ways (10 roasts/treatment/reheat method); conventional oven, microwave, and boiling to an internal temperature of approximately 63°C. A conventional oven was preheated to 163°C, four roasts were placed in an aluminum pan, and 250 mL of distilled water was placed in the bottom of the pan. Two roasts were placed on paper plates, covered with wax paper, and reheated in a microwave (model JES1036PWH, General Electric, Louisville, KY). Boiling involved placing each individual roast into unsealed cryovac bags and placing them into pots containing two liters of distilled water. Roasts were cut into 1 cm × 1 cm × 3.81 cm pieces and placed into serving pans to keep them warm. Samples were served warm to a seven-member panel trained according to Cross et al. (1978). Panelist evaluated the samples based on an 8-point hedonic scale involving initial and sustained juiciness, initial and sustained tenderness, flavor intensity, characteristic lamb flavor, and overall acceptability (8 = extremely juicy, tender, intense, characteristic lamb flavor, and like extremely; 1 = extremely dry, tough, bland, uncharacteristic lamb flavor, and dislike extremely). Panelist also evaluated the samples for warmed over flavor based on a 5-point hedonic scale (1 = no WOF; 5 = extreme WOF). Samples were served under red lights to mask color differences and panelists were given apple juice and water to cleanse their palates between samples. Results from the trained panel were used to determine the most appropriate reheating method for the consumer panel.

Consumer Panel

The remaining 30 roasts per treatment were used for consumer panels. Consumer panels were conducted to determine which spice blend was preferred. Each consumer (n = 199) tasted samples from each treatment. Roasts were thawed and then reheated for 3.5 min using a microwave (model JES1036PWH, General Electric, Louisville, KY). Roasts were cut into 1.5 cm × 1.5 cm × 3.81 cm pieces and placed into serving pans to keep them warm. Panelist tasted each sample to determine juiciness, tenderness, flavor, and overall liking (6-point scale from “like extremely” to “dislike extremely”). The last

attribute of the samples panelist were asked to evaluate was the likelihood to buy the roast (5-point scale from “definitely would buy” to “definitely would not buy”) if it was available in a grocery store. After tasting all four samples, consumers were asked which sample was preferred the least and the most. In addition, consumers were asked to answer demographic questions including: marital status, gender, ethnicity, age, household income level, and how many times they have consumed lamb in the last month.

Statistical Analysis

Data from the trained sensory panel were analyzed using the GLM procedure of SAS, as a 3 x 4 factorial design (3 cooking methods and 4 spice blends) with individual roast as the experimental unit.

Data from the consumer panel were analyzed using the GLM procedure of SAS as a completely randomized design with spice blend as the treatment and individual roast sample as the experimental unit. Comparisons of frequencies from consumer panelists’ responses were tested for significance ($\alpha \leq 0.05$) using Chi-Square tests.

Results & Discussion

Trained Sensory Panel

No differences ($P > 0.05$) were found between reheating methods for initial and sustained juiciness and tenderness, flavor intensity, characteristic lamb flavor, overall acceptability, and WOF. This result is similar to Boles and Parrish (1990), who found microwave reheated pre-cooked pork roasts to be palatable. In contrast with the results of the current study, Lyon and Ang (1990) found that pre-cooked chicken patties varied in their off-flavor development when heated in either a microwave or a convection oven. This could be because lamb contains fewer polyunsaturated fatty acids and the chicken patties were refrigerated and the roasts for this study were vacuum packaged and frozen. No differences ($P > 0.05$) were found for initial and sustained juiciness and tenderness, flavor intensity, characteristic lamb flavor, overall acceptability, and WOF with a spice × reheating method interaction. A significant difference existed between spices for initial and sustained juiciness and tenderness, flavor intensity, characteristic lamb flavor, overall acceptability, and WOF. For both initial and sustained juiciness, prime rib was the juiciest ($P < 0.05$), followed by Italian, Mexican, and the CON. According to Romans et al. (2001), the addition of phosphates helps to maintain a juicy product. Therefore, no differences should have been detected between spices for juiciness since all roasts were injected with the same brine percentage. Prime rib was more tender ($P < 0.05$) compared to the Mexican and the CON; and the CON was the toughest ($P < 0.05$) when compared to other treatments for both initial and sustained tenderness. The most intense flavor, characteristic lamb flavor, and WOF were associated with the CON group when compared to other treatments ($P < 0.05$). Smith et al. (1984) reported adding phosphates to pre-cooked roasts decreases the occurrence of an off-flavor development, and Boles and Parrish (1990) discovered when phosphates were added to roasts, they were more palatable. This indicates that the spices and seasonings used were able to mask lamb

flavor and helped to prevent WOF. Prime rib was rated the most acceptable overall, followed by Italian, Mexican, and the CON group ($P < 0.05$).

Consumer Panel

The 199 consumers who participated in the study showed a wide range of demographic characteristics. The percentages and numbers are based on all data provided; however, not all of the participants provided complete demographics. Sixty-seven percent of those surveyed were male while 33% were female. Sixty-eight percent of the consumers were married, and 32% were single. The most common ethnic groups represented were Caucasian and Hispanic totaling 98%, with Caucasian totaling 91% of the total consumers surveyed. American-Indian and other ethnic groups comprised the other 2%. Because of the overwhelming percentage of Caucasians in the study and the lack of ethnic diversity, the effect of ethnicity on consumer ratings was omitted. Seventy-two percent of consumers surveyed had consumed lamb zero times in the previous month followed by 15% and 7% consuming lamb once and twice respectively in the previous month.

Results from the consumer panel are similar to the results from the trained sensory panel for tenderness, juiciness, flavor, and overall liking of the spice blend treatments. Consumers rated prime rib the most tender, juiciest, most flavorful, and the highest for overall liking ($P < 0.05$) compared to all other treatment groups. The CON was lower ($P < 0.05$) for tenderness, juiciness, flavor, and overall liking compared with other treatments.

No differences ($P > 0.05$) in tenderness, juiciness, flavor, overall liking, and likelihood to buy between the treatments were found based on differences in demographic data (not shown in tabular form). Differences did exist, however, between treatments for all palatability attributes and percentages for each category on the hedonic scale. Prime rib was rated “like extremely” a greater percentage of the time ($P < 0.05$) compared to other treatments for tenderness. Consumers chose “like extremely” a higher ($P < 0.05$) percentage of the time and “like slightly” and “dislike slightly” a lower ($P < 0.05$) percentage of the time for prime rib compared to the other three treatments for juiciness. A higher percentage ($P < 0.05$) existed for the “dislike very much” category for the CON compared to other treatments. The top four categories comprised 88.9%, 94%, 92.5%, and 96% of the CON, Italian, Mexican, and prime rib responses, respectively. Prime rib received a higher ($P < 0.05$) percentage of responses for the “like extremely” category compared to other treatments for flavor. Prime rib was chosen significantly fewer times for “like slightly” compared to other treatments and a lower ($P < 0.05$) percentage of the time for “dislike slightly” and “dislike very much” compared to the CON. Prime rib was rated higher ($P < 0.05$) for “like extremely” compared to other treatments for overall liking. These results reinforce Cassard et al. (1965) who noted tenderness and flavor were the two most important factors in determining overall lamb satisfaction

Conclusions

The results of this study revealed roasts from lamb legs can be processed and retailed as a pre-cooked product to increase the value of these primal cuts. The addition of

phosphates to a brine injection can possibly help to reduce an off-flavor development during the reheating process. Certain spices have the ability to mask lamb flavor and improve palatability characteristics held in high regard to consumers.

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