

Effect of Breed on Palatability of Dry-Cured Ham

S.J. Wells, S.J. Moeller, H.N. Zerby, K.M. Irvin

Abstract:

The objective of the study was to assess the impact of genetic background (treatment) on palatability characteristics and overall consumer acceptability of dry-cured ham. Bone-in hams derived from purebred Berkshire (N = 10), Berkshire x Landrace (N = 10) and purebred Landrace (N = 10) swine were used in the study. Hams were subjected to the dry-curing process including a dry-rubbing with a mixture of salt, sodium nitrate, and brown sugar on days 1, 3 and 7 of the first week of curing. Hams were smoked to a dark mahogany color and dry-aged for a period of one year. Following the dry-aging, hams were soaked for 24 hours in water for re-hydration, cooked in simmering water to an internal temperature of 70° C, allowed to cool to 4° C, and reheated to 60° C at serving. A consumer panel (N = 60) was used to assess overall liking and intensity level of tenderness, juiciness, flavor, and saltiness. A series of questions relating each characteristic relative to the consumer's ideal was also reported. Consumers were provided samples from each genetic line with sample order randomly assigned. Results indicated that no differences were observed between the genetic backgrounds (treatments) for overall liking when assessments were averaged across all consumers, but there was a tendency for subgroups of consumers to like one of the three genetic lines. In response to this finding, the data were analyzed in three subgroups based upon the consumer's identified favorite ham. Results indicated a difference ($P < 0.05$) was observed when comparing the consumer's favorite and the other two treatments within each subgroup. While no difference ($P > 0.05$) was found between samples for intensity of saltiness, juiciness, and flavor, the Berkshire × Landrace ham was less tender ($P < 0.05$) than the Landrace ham. When compared to the consumer's ideal intensities, no difference was found between any treatment and the consumer's stated ideal intensity for saltiness. However, all treatments had lower ($P < 0.05$) than the ideal intensity for juiciness and tenderness, but only the Berkshire × Landrace ham was observed to be lower ($P < 0.05$) than the ideal intensity for flavor. The three consumer subgroups showed no significant differences in their intensity assessments, suggesting that the major driver of liking within each of the three subgroups was not measured in the study.

Key Words: dry-cured ham, pork, Berkshire, Landrace, tenderness, flavor, quality

Introduction

Value-added products are a growing market sector of the pork industry. As one of the original value-added products, dry cured ham still holds a significant place within the industry. These products are of significance to the industry because they fulfill the demand of a small group of people who are willing to pay a greater price for the somewhat tedious and time consuming

process of curing the hams. However, in return for the premium price, these consumers expect to receive a premium quality product.

As the swine industry focused on production efficiency and producing a higher percent lean product during the past two decades, the industry neglected to include palatability as a major component of genetic selection criteria. Meat quality plays a huge role in the eating satisfaction experienced by the consumer. Characteristics such as intramuscular fat, color, drip loss, and firmness are indicators of quality. These quality indicators are often antagonistically correlated with production efficiency. For example, as backfat thickness decreases, intramuscular fat levels decrease resulting in a less flavorful and often drier pork product. Thus, the transition to production of more efficient hogs and leaner carcasses has led to a greater percent of carcasses possessing less than desirable or even inferior pork eating quality.

Each breed of swine brings different attributes to the industry. For example, Berkshire hogs are known for high marbling within the meat, a darker, more desirable color, and a greater muscle pH. On the other hand, Landrace hogs are valued by the industry for their maternal and performance characteristics. However, each breed also has some negative characteristics. Berkshires are slow growing and typically yield a lower percent lean, while Landrace have recognizably lower quality (less marbling, paler color, and lower pH of the muscle). Because there are quality and palatability differences among breeds of swine, it is relevant to look for differences in consumer appeal of pork products between divergent breeds of swine.

Cured hams can be manufactured from fresh hams of any type of pork. However, as Berkshires tend to produce more desirable quality attributes, Berkshire hams should subsequently produce a more desirable, premium-quality, dry-cured ham for the niche or value-added markets.

Experimental Focus

The dry curing process is over 2000 years old and has evolved into dozens of distinct styles. There are several variables that contribute to the type of dry-cured ham. Processing procedures vary among different countries. Also, some curing styles depend on the breeding or feeding of the hog. It is believed that the breed of swine influences the quality of the end product. With that in mind, it is relevant to evaluate breed effects and their influence as a variable that may influence the quality of a dry-cured ham. It will be valuable to determine if consumers are able to identify quality differences in dry-cured hams that are associated with differences in genetic background of pig. In the United States, research indicates that the Berkshire and Duroc breeds offer a more desirable end product than other breeds of swine (National Pork Board, 2002), while Landrace and Yorkshire are known for prolificacy and rapid growth. Furthermore, it may be feasible to capitalize on breed complementarity by producing crossbred pigs through mating of Berkshire sires with Landrace dams. The crossbred pig, following the breed characteristics of the Landrace mother may be a more efficient converter of feed into pork, while maintaining the desired quality attributes of the Berkshire through the sire breed. If the crossbred pigs provide an efficient, high quality product there may be an opportunity to increase in profit potential for through niche marketing. We hypothesize that dry-cured ham from the purebred Berkshire and hams from Berkshire-sired pigs will have superior palatability when compared with dry-cured

ham from Landrace pigs, due in part to the known differences in fresh ham quality traits among the different breeds and breed combinations.

Objective

To determine if there are differences in palatability of dry-cured hams produced from purebred Berkshires, purebred Landrace, or Berkshire sire by Landrace dam crossbred pigs.

Materials and Methods

Finishing and Harvesting

The hogs were raised at the OARDC Western Agricultural Research Station, South Charleston, Ohio, in a hoop-type finishing facility. Hogs were from three different breed types; purebred Berkshire (n = 13), purebred Landrace (n = 11), and crossbred, Berkshire sire × Landrace dam (n = 13). Upon reaching finishing weight, the pigs were harvested in the OSU Meat Science Laboratory, Columbus, Ohio. The carcasses were processed and the hams were removed according to the industry standard. The ham from the right side of the carcass was used in the study. Two-thirds of the skin was removed, leaving skin and fat only over the hock portion of the ham, prior to initiating the dry-cure process

Curing and Cooking Process

A standard curing mixture was used. The ingredients included 8 lbs of salt, 3 lbs of brown sugar, and 2 ounces of saltpeter (sodium nitrate) per 100 lbs of meat (Romans, Ziegler, 1952). The salt cure was applied as a surface rub three times over a one week period. Applying the rub on days 1, 3, and 7 allowed for maximum absorption prior to cooking. The cure was spread at a rate

approximately equal to one ounce per pound of ham and applied to the surface, completely covering the ham including all bone. Once the cure was rubbed on, the hams rested in refrigeration for two weeks. At the end of two weeks, the excess curing mixture was brushed off of the hams and they were subjected to smoke for 24 hours or until they reached a deep mahogany color.

Aging Period

After being removed from the smokehouse, the hams went into refrigerated storage one month at 4° C. In the subsequent four months the storage temperature was increased incrementally to a target of approximately 21° C (nearly room temperature) after which the hams were aged for an additional seven months. Over the one year aging period, the hams became dehydrated and mold grew over the exterior of the ham, which is an essential part of the aging process. After the cumulative twelve months of aging, external mold growth was removed, and the hams were coated with olive oil to prevent further external dehydration and mold growth (Figure 1).

Cooking Process and Preparation for Taste Panel Assessment

Upon the completion of the aging process, the *semimembranosis* muscle of each ham was removed and identification maintained. The hams were then simmered in water (93° C) to an internal target temperature of 70° C and allowed to cool under refrigeration. Hams were reheated using moist heat to an internal temperature of 60° C and cut into 18, 3/4 inch thick cubes for serving to an untrained consumer taste panel.

Taste Panel Evaluation

Panelists were provided samples that represented each breed treatment, with a total of six panelists tasting product from an individual ham. In total, sixty panelists were used across the study. Treatments (breed designations) were coded and samples served in random order to assure unbiased responses. Panelists evaluated the dry-cured ham and were asked to rate the hams for: overall liking, intensity of tenderness, intensity of juiciness, intensity of flavor, and intensity of saltiness. In addition, for each attribute evaluated, panelists were asked to describe their ideal intensity level for use in relative comparisons. A traditional, 9-point hedonic scale was used for the consumer panelist to rate overall liking with 1 being extreme dislike and 9 being extreme like. Intensity of each of the other attributes was assessed on a 10-point horizontal category intensity scale. Data were collected using Compusense 5 V.4.6 and analyzed using Mini-tab.

Results

Statistical analyses for sensory attributes are summarized in Table 1. No differences were observed between the hams from the three breed types for the panel characteristic overall liking. For dry-cured ham tenderness, the hams derived from the Berkshire x Landrace crossbred pigs were significantly less tender than ham from Landrace pigs, with ham from the purebred Berkshire numerically intermediate, and not statistically different from the alternative breeds. In addition, all hams from each breed were perceived to be tougher ($P < 0.05$) than the level of tenderness panelists identified as ideal.

Panelists found that the hams from each breed treatment were less juicy ($P < 0.05$) than the level desired and found no difference between the respective breeds for juiciness score. Results for flavor of the hams indicated that hams from only Berkshire \times Landrace breed were less desirable (less flavorful) when compared with the panelists ideal level of flavor, with no differences between the three breed treatments. Panelists did not detect a difference between treatments in ham saltiness, with saltiness rating not different from the panelist's ideal, indicating that panelists felt the salt level was appropriate.

Conclusion

Overall, the data indicate that the breed of origin for dry-cured hams has little if any impact on palatability measures. In general, when compared with a self-identified "ideal level of eating quality", dry-cured hams evaluated in the present study did not meet the panelists' expectations for tenderness or juiciness. As mentioned previously, dry-cured hams are marketed as niche-products that are not readily available to or consumed by the average pork consumer.

Unfamiliarity with the product may have contributed to lower than ideal responses observed in the present study.



Figure 1. Dry-cured ham.

Table 1: Least squares estimates of taste panel ham ratings* and intensity of eating quality attributes for dry-cured hams from three breeds of swine.

Sensory Trait	Breed			Ideal	P-Value
	Berkshire	Landrace	Berkshire x Landrace		
Overall Liking	5.88	5.98	6.05	---	0.87
Tenderness Intensity	4.35 ^{bc}	5.23 ^b	3.92 ^c	6.75 ^a	< 0.0001
Juiciness Intensity	4.23 ^b	4.73 ^b	3.98 ^b	6.72 ^a	< 0.0001
Flavor Intensity	6.05 ^{ab}	6.38 ^{ab}	5.80 ^b	6.67 ^a	0.03
Saltiness Intensity	6.55	6.47	6.67	6.17	0.42

*Within a row, means without a common superscript differ ($P < 0.05$)

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