EFFECTS OF FINISH ON THE PALATABILITY OF PORK

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Kauffman (1960) and Carpenter (1961) each gave an excellent paper to this Conference in the past two years on the general subject of pork palatability. In an effort to avoid repetition only those results from various research workers which have been completed recently will be given. There appears to be two major schools of thought concerning the finish of pork carcasses. The one extreme would encourage the production of leaner and leaner hogs even if all palatability factors would have to be discarded to accomplish this task. The other extreme would not encourage the production of leaner hogs unless the same amount of marbling, etc. could be maintained even if it meant the production of exactly the same type of hogs we are now producing.

Volk (1960) made a study on 216 pork loins which were divided into three groups of 72 loins each. The three groups consisted of (1) firm and abundantly marbled loins, (2) firm and sparsely marbled loins, and (3) soft and sparsely marbled loins. The loins were evaluated for palatability by both a trained taste panel and by 108 families. The trained taste panel was able to identify extremes in the degree of marbling but not firmness of the loin chops. The trained taste panel although able to identify extremes in the marbled and non-marbled chops the preferences were divided almost evenly.

The results of the family panel showed that 187 preferred the firm and abundantly marbled chops vs. 183 preferred the firm, sparsely marbled chops when these two comparisons were made. When the firm and abundantly marbled loins were compared to the soft and sparsely marbled loins the preferences were 192 vs. 190. When the firm and sparsely marbled loins were compared to the soft and sparsely marbled loins the preferences were 189 vs. 201. The consumer panel did not indicate a significant preference for any one of the three groups of loins.

Ramsey and Cole (1962) made a study of selected pork characteristics on 67 carcasses. Some of the simple correlation coefficients are presented in Table 1.

Table 1. Simple correlation coefficients between selected pork characteristics

Characteristics	"r" Back thickness	"r" Marbling score
Marbling score	0.45	----
Shear value	-.16	-.02
Taste Panel scores		
Tenderness	-.08	-.19
Juiciness	0.15	0.48**
Flavor	-.11	0.09
Cooking losses		
Evaporation	-.55**	-.60**
Drip	0.43	-.01

** = $P<.01$

It may be noted that backfat thickness was not significantly related to tenderness, shear, flavor or juiciness. Backfat thickness was related to cooking losses but it should be pointed out that as backfat thickness increased evaporation losses decreased while drip losses increased. Marbling scores were not related to tenderness or flavor but were related to juiciness. The "r^2" value would indicate that marbling would account for 23 percent of the variation in juiciness. These same workers reported that they have found pork which greatly lack tenderness but this lack of tenderness was not necessarily related to finish. They believe that it may be related to specific breeds.

Pearson (1962) reported a study in which hogs were slaughtered at 110, 140, 170, and 200 pounds with 20 animals in each group, no significant differences were found between the amount of marbling and the various weight groups. There was a considerable increase in backfat thickness and other measures of fatness as weight increased. He also reported that no significant differences were found for tenderness, juiciness or flavor for any of the various weight groups.

Harrington and Pearson (1962), in a study on 36 port loins, found a correlation coefficient of -.67 between marbling score and chew counts and a "r" value of -.57 between percent intramuscular fat and chew counts.

Judge et al. (1960) classed 54 pork loins subjectively on the basis of color, marbling, and firmness. Taste panel and chemical analyses were also conducted. The relationships are presented in Table 2.

It is observed that no significant relationships existed between firmness and percent fat, tenderness, juiciness, or flavor. No significant relationships were found between marbling scores and either tenderness or flavor. The "r" value of .40 between marbling and juiciness would indicate that 16% of the variation in juiciness could be attributed to marbling. It would be interesting to speculate on the significant relationship between color and tenderness.

Table 2. Correlation coefficients between physical, chemical and organoleptic characteristics

Item	Tenderness	Juiciness	Flavor
Color	0.30*	-.25	-.16
Marbling	-.07	0.40**	0.13
Firmness	0.05	-.21	0.07
% Fat	-.03	0.13	0.10

* P<.05
**P<.01

Batcher and Dawson (1960) calculated correlation coefficients between a number of quality measurement and various muscles of 12 hog carcasses. A few of the "r" values for the Longissimus dorsi are as follows: 0.86 between marbling scores and juiciness, 0.80 between marbling scores and fat content, .91 between tenderness scores and fat content. It should be pointed out that the preceding values were calculated from data obtained from only eight carcasses which had a wide range in average backfat thickness and marbling scores.

Kauffman et al. (1961) reported a study on the effect of price of customer purchases of pork chops with various amounts of marbling. The chops were displayed in a meat market at five different price margins and with each margin testing 40 customers. In addition, take-home taste test was included to measure the effect of marbling on palatability. Results indicated that a definite preference for unmarbled chops existed among the purchasers; that marbled chops must be considerably reduced in price to induce buyers to purchase the same. They found that although the taste reaction to marbled cuts indicated a preference for them over the unmarbled chops, this preference was not carried over to the purchase counter.

Mullins et al. (1961) distributed hams, loins, picnics, Boston butts and bacons to family panels for rating the acceptability of these cuts from hogs weighing 160 to 220 pounds alive. They found that general acceptability was very good in both weight groups. Those cuts which rated the lowest on acceptability were consistently criticized as being too fat.

Birmingham et al. (1954) studied the consumer acceptance of hams, loins, chops, and sliced bacon from Choice No. 1 carcasses (average backfat 1.66 inches) as compared to Medium carcasses (average backfat 1.44 inches). A total of 311 respondents completed the study. The percent of consumers preference of the grade for the various cuts are presented in Table 3.

Table 3. Grade of pork cuts preferred before cooking

Cut	Choice #1	Medium	No preference or no answer
Bacon	42.4	54.6	3.0
Ham	47.4	48.7	3.9
Chop	38.5	55.4	6.1

A decided majority preferred the bacon and loin chops from the Medium carcasses. There was only a small difference in preference for the grade of hams. Perhaps in the case of hams the average consumer was not able to note differences between grades after the appropriate trimming. The percent of respondents who changed their grade preference after cooking is presented in Table 4.

Table 4. Percent of respondents who changed preference after cooking

Cut	Chose No. 1 fresh but changed to Medium after cooking	Chose Medium fresh but changed to No. 1 after cooking
Bacon	43.0	32.8
Ham	48.1	34.3
Chops	39.1	36.5

It may be noted that a much greater percentage of the consumers changed their preference from the Choice No. 1 cuts to the Medium cuts than from the Medium cuts to the Choice No. 1 cuts.

Murphy and Carlin (1961) conducted a study on 96 paired loins from hog carcasses that varied in backfat thickness from 1.0 to 2.3 inches. Marbling was subjectively scored on a five point scale. A taste panel scored tenderness, juiciness, and flavor. In addition, the Warner-Bratzler shear was used to test for tenderness. The results of this study may be summarized as follows: (1) degree of marbling increased only slightly as backfat increased; (2) drip cooking losses increased and evaporation cooking

losses decreased as backfat increased. Average total cooking losses were approximately one-third of the raw weight regardless of the amount of backfat on the pork carcasses; (3) the amount of backfat on the carcasses do not have a significant effect on tenderness, juiciness or flavor of braised pork chops; (4) marbling had a highly significant positive effect on both tenderness and juiciness but no effect on flavor.

Van Stavern (1962) reported the following correlation coefficients calculated from data of 87 pork carcasses; average backfat thickness X iodine number of Longissimus dorsi = -.32; percent fat trim X iodine number of Longissimus dorsi = -.28. Both of the preceding coefficients were highly significant. It would be interesting to know if the effect of decreased carcass fat causing an increase in the unsaturation of the fat was due to a genetic effect or to a nutritional effect.

Saffle and Bratzler (1959) made a study of three groups of pork carcasses (av. backfat of 1.0-1.3, 1.3-1.6, and 1.6-1.9) with 25 carcasses in each of the three groups. Cooking losses were determined for loin chops, ham slices, and bacon slices. Color measurements of the uncooked loin chops were made by the Munsell spinning disk method. Marbling was objectively determined by both specific gravity and ether extract. Tenderness was determined by the Warner-Bratzler shear. A twelve-member taste panel scored the acceptability of loin chops, ham slices, and bacon on a 9-point hedonic scale. Differences in cooking losses were not significant between various finish groups for ham slices or loin chops, however, a significant difference was noted for the bacon slices. Bacon was somewhat of a special case as it is a fat cut, the slices are quite thin and it is cooked to a higher degree; thus, cooking losses increased as finish increased. In the case of the ham slices and loin chops, the cooking drip increased and evaporation losses decreased about the same amount as finish increased resulting in little or no change in the total cooking loss. As the degree of finish increased, the hue of the lean changed from a low yellow-red to a more yellowish-red color. The value increased indicating a lighter color. Analysis of variance showed a highly significant difference between the amount of backfat and taste panel scores for loin chops but no significant difference for either the ham slices or bacon slices. Mean values for the taste panel scores of the loin chops were 6.40, 6.58, and 6.93 from the carcasses which had 1.0-1.3, 1.3-1.6, and 1.6-1.9 inches of average backfat, respectively. Thus, only a mean difference of 0.53 was noted between the group with the least finish as compared with the group with the most finish.

The correlations between shear, extensibility, various measurements of marbling and taste panel scores of the Longissimus dorsi are presented in Table 5.

Table 5. Correlation coefficients between shear, extensibility, specific gravity, % fat, and taste panel scores of Longissimus dorsi

Item	Taste panel r	Shear r	Extensibility r
Specific gravity	-.38	0.42	0.34
Ether extract	0.31	-.48	-.33
Extensibility	-.48	0.59	----
Taste panel	----	-.40	-.48
Ether extract X shear	0.41	----	----

"r" needed for P .01 = .302

Marbling as measured by ether extract or specific gravity would account for only 9.6 to 14.4 percent of the variation in taste panel acceptability. Marbling would account for 10.8 to 23.0 percent of the variation in tenderness as measured by shear or extensibility. The "r^2" value for taste panel X shear and taste panel X extensibility was 16 and 23 percent, respectively.

CONCLUSIONS

The following general conclusions may be made:

1. Backfat thickness has very little effect, if any, on tenderness, juiciness, or taste panel acceptability of pork cuts.

2. The relationship between backfat thickness and amount of marbling is extremely low.

3. Neither backfat thickness nor amount of marbling has any effect on total cooking losses.

4. Neither taste panels nor consumer panels are able to distinguish between firm loins and soft loins.

5. Marbling is more highly associated with juiciness than with tenderness or flavor. Marbling apparently accounts for roughly one-fourth of the total variation in juiciness.

6. The correlation coefficients between marbling and tenderness are highly significant in many cases, however, this relationship is quite low in most of these same comparisons.

7. Consumers at the purchase counter discount pork which has fat and/or has abundant marbling.

I would at this time like to express two personal opinions. The first, tempered with the review of literature presented, is that we can produce leaner hogs than we are now producing and still greatly increase consumer acceptance. I think this is especially true since the relationship between backfat thickness and marbling is extremely low and backfat thickness has little or no effect on tenderness, juiciness or flavor. In addition, the relationship of marbling to the palatability factors is lower than sometimes realized. The second personal opinion, tempered with a degree of experience at past conferences, is that the preceding opinion will open up a discussion of this important area.

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(Applause)

DR. HINER: Thank you Dr. Saffle.

Now if the members who have presented reports, and other members of the Pork Evaluation Committee, will come up to the platform, we will entertain questions from the floor.

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(The following named persons went up to join Drs. Hiner and Saffle:

W. H. Bruner, L. Feinstein,
B. Haasl, R. Ingram, and
W. Y. Varney.)

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DR. HINER: Does anybody have a question they would like to propose to any one of the members seated here?

PROFESSOR BRATZLER: (Michigan State) First of all, Wilbur, I will make an observation, then I will have a question. I got to talk a little bit.

(Laughter)

I have noticed in listening and talking with some of the carcass folk, and so forth, the tendency is for the emphasis on ham and loin percentage of a .95 "r" value, ham and loin as against lean cuts. You keep in mind that you may have over two-thirds of the waste in the two cuts and, of course, we automatically expect a very high correlation. I don't think ham and loin replaces getting cut-out data.