

2018

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Recommended Citation

Rice, E. A.; Lerner, A. B.; Price, H. E.; Woodworth, J. C.; Tokach, M. D.; Dritz, S. S.; Goodband, R. D.; DeRouchey, J. M.; Allerson, M. W.; Gonzales, J. M.; and O'Quinn, T. G. (2018) "The Effect of Increased Pork Hot Carcass Weights and Chop Thickness on Consumer Visual Appearance and Purchase Intent Ratings of Top Loin Chops," *Kansas Agricultural Experiment Station Research Reports*: Vol. 4: Iss. 9. <https://doi.org/10.4148/2378-5977.7688>

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Funding Source

Appreciation is expressed to the National Pork Board for funding and to Holden Farms, Inc. (Northfield, MN) for providing the animals, research facilities, and technical support. This project was completed in coordination with the University of Illinois, PIC North America (Hendersonville, TN), and the USDA Meat Animal Research Center (Clay Center, NE).

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The Effect of Increased Pork Hot Carcass Weights and Chop Thickness on Consumer Visual Appearance and Purchase Intent Ratings of Top Loin Chops¹

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Summary

The objective of this study was to evaluate the effect of increased pork hot carcass weights on consumer visual acceptability and purchase intent of top loin chops cut to various thicknesses in a price labeled versus unlabeled retail display scenario. Pork loins ($n = 200$) were collected from 4 different hot carcass weight groups: a light weight group (less than 246.5 lb; LT), medium light weight group (246.5 to 262.5 lb; MLT), medium heavy weight group (262.5 lb to 276.5 lb; MHVY), and heavy weight group (276.5 lb and greater; HVY). Loins were fabricated into 4 pairs of chops of specified thicknesses (0.50, 0.75, 1.00, and 1.25 inches) at day 7, 8, and 9 postmortem. One chop from each specified thickness was then randomly assigned to be packaged with a label and the other to be packaged without a label. Consumers ($n = 393$; 8/panel) from the Manhattan, KS, area assessed chops from each weight group $\times$ thickness combination in both labeled and unlabeled scenarios. Chops were assessed on a 1 to 100 continuous line scale for desirability and purchase intent. Consumers were also able to indicate if the chop was either desirable or undesirable and if they would or would not purchase. Consumers gave greater ($P < 0.05$) appearance ratings to chops from HVY and MHVY weight group compared to chops from the LT weight group. Additionally, chops with a thickness of 1.00 and 1.25 were similar ($P > 0.05$) and had greater ($P < 0.05$) consumer appearance ratings than both 0.75- and 0.50-inch chops. For purchase intent ratings, consumers gave greater ($P < 0.05$) ratings to chops from HVY and MHVY carcasses compared to chops from LT carcasses. Consumers gave chops with a thickness of 0.50 inches the lowest ($P < 0.05$) purchase intent ratings compared to all other

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thicknesses. There was a carcass weight $\times$ chop thickness interaction ($P < 0.05$) for the percentage of consumers who indicated “Yes” the chop was desirable overall. For all weight treatments, 0.50-inch chops had the lowest ($P < 0.05$) percentage of consumers who indicated the chop was desirable. A greater ($P < 0.05$) percentage of consumers indicated they would purchase 1.00-inch chops compared to all other thicknesses, with 0.75- and 1.25-inch chops intermediate ($1.00 > 0.75 > 1.25 > 0.50$). Additionally, a greater ($P < 0.05$) percentage of consumers indicated they would purchase unlabeled chops compared to labeled chops. These results indicate that carcass weight and chop thickness can affect consumer preference and purchasing decisions and thus should be considered by retailers when marketing fresh pork loin chops.

Introduction

In the United States, there has been a long-term trend of increasing pork hot carcass weights.⁵ Industry efforts for increased efficiency and genetic improvements have resulted in an average of a 1.3-lb increase in pork hot carcass weights per year.⁶ It is unclear what the impact increased carcass weights will have on resulting pork chop size, weight, and thickness and what effect these changes could have on consumer acceptance and purchase intent.

Consumer preference is important to the meat industry as consumers will not purchase a product that does not meet their expectations. Consumers are more willing to pay for pork products with visual characteristics they find desirable.⁷ In beef, consumers more readily choose thicker steaks compared to thin steaks.⁸ Furthermore, consumers find thickness, rather than price, to be the most important factor in beef steak selection.⁹ This could indicate that consumers may prefer larger, thicker chops even with a subsequent price increase caused by increased package weight. However, currently there are no studies demonstrating how consumers view variability in chop size and thickness within pork. Therefore, the objective of this study was to determine the impact of increased carcass weight and varying chop thickness on consumer preference and purchase intent.

Procedures

The procedures used in this study were approved by the Kansas State University Institutional Review Board. The pork used in this study was collected from pigs that were

⁵Wu, F., K. R. Vierck, J. M. DeRouchey, T. G. O’Quinn, M. D. Tokach, R. D. Goodband, S. S. Dritz, and J. C. Woodworth. 2017. A review of heavy weight market pigs: status of knowledge and future needs assessment. *Transl. Anim. Sci.* 1:1-15. doi:10.2527/tas2016.0004

⁶USDA. 2018. Hogs: Federally Inspected Slaughter Average Dressed Weight by Month and Year, US https://www.nass.usda.gov/Charts_and_Maps/Livestock_Slaughter/hgdrwgx8.php Accessed 6 June, 2018.

⁷Dransfield, E., T. M. Ngapo, N. A. Nielsen, L. Bredahl, P. O. Sjöden, M. Magnusson, M. M. Campo, and G. R. Nute. 2005. Consumer choice and suggested price for pork as influenced by its appearance, taste and information concerning country of origin and organic pig production. *Meat Sci.* 69:61-70. doi:https://doi.org/10.1016/j.meatsci.2004.06.006

⁸Sweeter, K. K., D. M. Wulf, and R. J. Maddock. 2005. Determining the optimum beef longissimus muscle size for retail consumers. *J. Anim. Sci.* 83:2598-2604. doi:10.2527/2005.83112598x

⁹Leick, C. M., J. M. Behrends, T. B. Schmidt, and M. W. Schilling. 2012. Impact of price and thickness on consumer selection of ribeye, sirloin, and top loin steaks. *Meat Sci.* 91:8-13. doi:https://doi.org/10.1016/j.meatsci.2011.11.021

intentionally raised to reach heavy weights and were selected to represent 4 different hot carcass weight groups: a light weight group (less than 246.5 lb; LT), a medium light weight group (246.5 to 262.5 lb; MLT), a medium heavy weight group (262.5 to 276.5 lb; MHVY), and a heavy weight group (276.5 lb and greater; HVY). Whole boneless pork loins ($n = 200$, Institutional Meat Purchase Specification #413); (North American Meat Processors Association, 2014) were collected on 2 separate harvest days ($n = 100/\text{day}$; $n = 25/\text{treatment/day}$) over a 4-d period and transported to the Kansas State University Meat Laboratory for fabrication.

Loins were fabricated on d 7, 8, and 9 postmortem. Loins were cut immediately posterior to the spinalis dorsi, and the posterior end of the loin was used for all analyses. Chops were fabricated from anterior to posterior, with consecutively cut chops paired and cut to a predetermined thickness (0.50, 0.75, 1.00, and 1.25 inches), with one pair from each loin cut to each of the 4 thicknesses. Chops were then individually placed on Styrofoam (Dyne-a-Pak, Toronto, Ontario) trays and overwrapped with a PVC film. One chop from each thickness pair was assigned to labeled or unlabeled packaging. For chops assigned to labeled packaging, a Kansas State University Meat Laboratory label containing cut identification, package weight, price/lb, and total price information was placed on the right side of the package without covering the chop. The price/lb used in this study was determined by averaging prices at local grocery stores to obtain a price (\$4.52/lb) for pork top loin chops in the Manhattan, KS, area. Both labeled and unlabeled chops were identified with an individual 4-digit code. Packages were held at 35 to 40°F for consumer visual panels later that same day.

Panelists ($n = 393$) were recruited from Manhattan, KS, and the surrounding areas. Panels were conducted in the Kansas State University Color Laboratory. Panelists were provided an electronic tablet (Model 5709 HP Stream 7; Hewlett-Packard, Palo Alto, CA) with a digital survey (Version 2417833; Qualtrics Software, Provo, UT) to evaluate chops. Appearance and purchase intent were evaluated on continuous line scales with anchors at 1 (extremely undesirable/extremely unlikely to purchase), 50 (neither desirable or undesirable/would neither purchase or not purchase), and 100 (extremely desirable/extremely likely to purchase). Additionally, consumers rated each chop as overall desirable or undesirable (yes/no), and if they would or would not purchase the individual chop. Each panel consisted of 8 panelists. Labeled and unlabeled chops were displayed at 30 to 40°F in two separate coffin-style retail cases (model DMF8; Tyler Refrigeration Corp., Niles, MI) under fluorescent lights to mimic a retail experience. After instructions, panelists were taken to the retail case containing the 16 unlabeled packages (one from each weight treatment $\times$ thickness combination). The order in which chops were viewed by consumers was randomly assigned by the survey program. After completing evaluation of the first case of unlabeled packages, consumers were directed to proceed to the second case containing labeled packages, with the paired chops from the unlabeled evaluations.

Results and Discussion

Consumers drive all decision factors in the meat industry. Studies have indicated that color and marbling are the most influential factors on which consumers base their

purchasing decisions in pork.¹⁰ In beef, results have shown that in addition to marbling and color, beef steak thickness also affects the purchasing decisions of consumers.^{4,11} Thus, it is important to understand how industry changes in carcass weights and the resulting changes in chop size affect consumer purchasing decisions in pork.

For overall appearance rating, consumers gave greater ($P < 0.05$; Table 1) appearance ratings to chops from MHVY and HVY weight groups than chops from LT and MLT weight groups. Chops from MLT and LT carcasses were similar ($P > 0.05$) for consumer appearance ratings. Chop thickness also had an impact ($P < 0.05$) on overall appearance ratings (1.25 = 1.00 > 0.75 > 0.50 in.). There were no differences ($P > 0.05$) between labeled and unlabeled chops for consumer appearance ratings. These results for appearance ratings are similar to the results found in beef studies that indicate consumers prefer thicker steaks.¹² Also, it is noteworthy that chops from heavier carcasses were more desirable in appearance than chops from lighter carcasses. This provides evidence that both chop size and, especially, thickness impact a consumer's perception of the overall desirability of chops at retail.

Consumers gave chops from the HVY and MHVY weight groups greater ($P < 0.05$) purchase intent ratings compared to chops from LT carcasses. Chops from MLT carcasses had similar ($P > 0.05$) consumer purchase intent ratings to chops from both MHVY and LT carcasses. Chops with a thickness of 1.00 inch had greater ($P < 0.05$) purchase intent ratings compared to 0.50 and 1.25 inch chops. Also, chops with a thickness of 1.25 inches had greater ($P < 0.05$) purchase intent ratings than 0.50 inch chops, which had the lowest ($P < 0.05$) purchase intent. Chops with a thickness of 0.75 inches were similar ($P > 0.05$) to both 1.00 and 1.25 inch chops for purchase intent ratings. There were no differences ($P > 0.05$) for consumer purchase intent ratings between labeled and unlabeled chops. For consumer purchase intent, consumers indicated they were more likely to purchase chops from heavier carcasses. Additionally, consumers were more willing to purchase 1.00 inch chops rather than excessively thick (1.25 inch) or excessively thin (0.50 inch) chops.

There was a carcass weight $\times$ chop thickness interaction ($P < 0.05$, Table 2) for the percentage of consumers who indicated "yes" the chop was desirable overall. Across each weight group, chops cut to 0.50 inches were found desirable a lower ($P < 0.05$) percentage of the time than chops of all other thicknesses. Within the LT weight group, a greater ($P < 0.05$) percentage of consumers indicated that 0.75-inch chops were more desirable than 1.25-inch chops. But, within the MLT group, no difference ($P > 0.05$) was found between 1.00-inch and 0.75-inch chops for the percentage of chops rated as desirable, both of which were greater ($P < 0.05$) than 1.25-inch chops. In the MHVY group, 0.50-inch chops were rated as desirable by the lowest ($P < 0.05$) percentage

¹⁰Brewer, M. S., L. G. Zhu, and F. K. McKeith. 2001. Marbling effects on quality characteristics of pork loin chops: consumer purchase intent, visual and sensory characteristics. *Meat Sci.* 59:153-163. doi:10.1016/S0309-1740(01)00065-1

¹¹Leick, C. M., J. M. Behrends, T. B. Schmidt, and M. W. Schilling. 2012. Impact of price and thickness on consumer selection of ribeye, sirloin, and top loin steaks. *Meat Sci.* 91:8-13. doi:https://doi.org/10.1016/j.meatsci.2011.11.021

¹²Leick, C. M., J.M. Behrends, T.B. Schmidt, M.W. Schilling. 2011. Consumer selection of constant-weight ribeye, top loin, and sirloin steak. *Meat Sci* 87:66-72. Doi:https://doi.org/10.1016/j.meatsci.2010.09.004

of consumers, with all other thicknesses similar ($P > 0.05$). A greater ($P < 0.05$) percentage of 1.00-inch chops were rated as desirable than either 0.75-inch or 1.25-inch chop within the HVY weight group. These results indicate that regardless of hot carcass weight, consumers preferred chops with a thickness greater than 0.50 inches.

When evaluating the percentage of consumers who indicated “yes” they would purchase the package, there was no difference ($P > 0.05$; Table 1) between weight treatments. However, among chop thicknesses, the percentage increased ($P < 0.05$) as chop thickness increased from 0.50 to 1.00 inches, with 1.25-inch chops intermediate ($1.00 > 0.75 > 1.25 > 0.50$ inch). Additionally, a greater percentage ($P < 0.05$) of consumers indicated “yes” they would purchase unlabeled chops compared to labeled chops. This indicates when price and weight were not known by the consumer, overall chop appearance influenced to a greater extent the consumer reported purchasing decisions. But, when consumers were presented with pricing information, regardless of chop thickness or weight group, they were more inclined to indicate they would not purchase the product.

Overall, carcass weight, chop thickness, and label type affected consumer overall desirability and purchase intent for fresh pork. Consumers indicated that chops from heavier carcasses and chops that were thicker were more desirable. However, as carcass weight increased, thicker chops became less desirable to consumers. Additionally, consumers were more likely to purchase chops with a thickness of 1.00 inch, indicating that chops could become too thick or too thin. In beef, consumers rank overall appearance as more important than price when making purchasing decisions.¹³ Similar to the work in beef, in our study, consumers’ valuation of price was not dependent on appearance (weight and thickness). Thus, chops from heavy weight groups were not discriminated against due to increased price by our consumers.

¹³Savell, J. W., H. R. Cross, J. J. Francis, J. W. Wise, D. S. Hale, D. L. Wilkes, and G. C. Smith. 1989. National consumer retail beef study: Interaction of trim level, price and grade on consumer acceptance of beef steaks and roasts. *J. Food Qual.* 12:251-274.

Table 1. Least squares means for consumer ($n = 393$) visual ratings for appearance and purchase intent for chops of various thicknesses from carcasses of various weight categories

Treatment	Appearance rating ¹	Purchase intent rating ²	Purchase % yes ³
Carcass weight ⁴			
LT	61.1 ^c	58.9 ^c	62.0
MLT	62.1 ^{bc}	59.7 ^{bc}	63.7
MHVY	63.1 ^{ab}	60.9 ^{ab}	65.9
HVY	64.5 ^a	62.2 ^a	66.8
SEM ⁵	0.90	0.10	0.80
<i>P</i> - value	<0.01	<0.01	0.08
Chop thickness, inches			
0.50	54.8 ^c	51.9 ^c	45.9 ^d
0.75	64.1 ^b	63.2 ^{ab}	71.5 ^b
1.00	66.3 ^a	64.3 ^a	73.9 ^a
1.25	65.7 ^a	62.3 ^b	65.0 ^c
SEM ⁵	0.80	0.91	0.77
<i>P</i> - value	<0.01	<0.01	<0.01
Package label ⁶			
Labeled	62.8	60.2	63.2 ^b
Unlabeled	62.7	60.7	66.0 ^a
SEM ⁵	0.74	0.84	0.66
<i>P</i> - value	0.83	0.36	<0.01

^{abc}Least squares means lacking a common superscript within the same main effect (carcass weight, chop thickness, and package label) differ ($P < 0.05$).

¹Consumer appearance and purchase intent ratings: 0 = extremely undesirable; 100 = extremely desirable.

²Consumer purchase intent ratings: 0 = extremely unlikely to purchase; 100 = extremely likely to purchase.

³Percentage of consumers who answered: indicated "Yes" they would purchase.

⁴LT = light. MLT = medium light. MHVY = medium heavy. HVY = heavy. Carcass weight groups: LT = less than 246.5 lb, MLT = 246.5 to 262.5 lb, MHVY = 262.5 to 276.5 lb, and HVY = 276.5 lb and greater.

⁵SEM (largest) of the least squares means.

⁶Package label: labeled contains price and weight information and unlabeled package.

Table 2. Carcass weight $\times$ chop thickness interaction ($P < 0.05$) for the percentage of consumers who indicated “yes” the chop was desirable

Chop thickness, in.	Carcass weight ¹			
	LT	MLT	MHVY	HVY
0.50	54.0 ^c	55.9 ^c	57.2 ^b	61.8 ^c
0.75	73.1 ^a	73.6 ^a	73.9 ^a	70.3 ^b
1.00	70.5 ^{ab}	73.5 ^a	73.6 ^a	78.5 ^a
1.25	65.8 ^b	66.4 ^b	71.6 ^a	69.7 ^b
SEM ²	2.20	2.20	2.20	2.10
<i>P</i> - value	< 0.01	< 0.01	< 0.01	< 0.01

^{abc}Least squares means lacking a common super script with in the same column differ ($P < 0.05$).

¹LT = light. MLT = medium light. MHVY = medium heavy. HVY = heavy. Carcass weight groups: LT = less than 246.5 lb, MLT = 246.5 to 262.5 lb, MHVY = 262.5 to 276.5 lb, and HVY = 276.5 lb and greater.

²SEM (largest) of the least squares means.