



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Consumer Acceptability of Vacuum Packaged Pork

by

Dolores C. Oreskovich, Research Assistant
Department of Animal Sciences
University of Illinois at Urbana-Champaign

Floyd K. McKeith, Assistant Professor
Department of Animal Sciences
University of Illinois at Urbana-Champaign

Peter J. Bechtel, Associate Professor
Department of Animal Sciences
University of Illinois at Urbana-Champaign

Jan Novakofski, Assistant Professor
Department of Animal Sciences
University of Illinois at Urbana-Champaign

Michael A. Hudson, Assistant Professor
Department of Agricultural Economics
University of Illinois at Urbana-Champaign

Introduction

Meat consumption patterns have changed dramatically in recent years. Following a period of growth in consumption during the fifties, sixties and early seventies, consumption of beef has slipped, with a relatively constant quantity moving into consumption only at lower real prices. Pork consumption has also shown signs of leveling off in recent years. In short, the red meats industry has entered an age of maturity, characterized by a leveling off of demand, increased competition from substitutes, and a loss of market power.

A recent survey suggests that the red meats industry no longer faces a common consumer, but rather the market is made up of several segments, including meat lovers, creative cooks, price driven, active life style, and health oriented groups (Yankelovich, Skelley, and White, 1984). In order to maintain or expand the demand for its products,

the red meat industry will need targeted marketing efforts aimed at these consumer segments. In addition, increased effort must be focused on reduction of processing, packaging, and handling costs associated with these new products to assure their competitiveness in the marketplace.

The purpose of this paper is to examine the acceptability of a product designed to reduce processing and handling costs. Vacuum packaged pork offers several packaging, processing, and distributional advantages, including ease of bulk shipping, improved storability, and reduced handling costs at the retail level. Furthermore, this type of packaging offers the potential for the development of pre-cooked products aimed at consumers in the active life style or convenience oriented segment of the population. However, vacuum packaging changes product appearance and results in different palatability characteristics which may or may not appeal to consumers.

The remainder of this paper documents the results of a survey designed to assess consumer acceptance of vacuum packaged pork based on visual appeal and palatability.

The paper is organized as follows. Previous research efforts regarding vacuum packaged pork are briefly summarized in the next section. The materials and methods of the study are presented in section three. Section four summarizes the results of the study. The paper concludes with a brief discussion of implications for the food industry, including suggestions for further research.

Background

Several studies have been conducted utilizing vacuum packaged pork. These studies indicate that vacuum packaging significantly extends the shelf life of fresh pork (Weakley, et al., 1986; Smith et al., 1974; Ramsey et al., 1973). In addition, vacuum packaging reduces shrinkage, surface discoloration and bacteria counts of fresh pork (Smith et al., 1974). Further, Weakley et al. (1986) reported that acceptable retail cuts were produced which had few differences in palatability attributes when vacuum packaged wholesale pork cuts were stored up to 28 days at 4°C.

These positive storage characteristics are distinct advantages for the processor and retailer; however, there has been only limited use of vacuum packaging for fresh pork. A possible concern of retailers trying to market pork in this manner is the color associated with vacuum packaged pork. Vacuum packaging reduces available oxygen which results in a color change from pink or grey to shades of dark red and purple (Pierson et al., 1970). Darker colored pork may have an adverse effect on consumer appeal if no educational program is associated with the product (Wachholz et al., 1978).

Materials and Methods

Twelve pork carcasses were acquired from the University of Illinois Meat Science Laboratory. Sixty, paired, boneless pork loin (longissimus muscle) roasts were prepared and

the external fat trimmed to 0.6 cm. One roast from each boneless pork loin pair was placed on a styrofoam tray and wrapped in polyvinyl chloride overwrap and the other was packaged in a vacuum bag. Each pair of roasts were marked designating the carcass. At approximately 2-3 week intervals, paired roasts were cut, trimmed, and packaged within 24 hours of distribution. The paired roasts were randomly given away to consumers at the University of Illinois Agricultural Sales Room. Each consumer was also given a questionnaire and asked to evaluate each of the roasts for visual and palatability characteristics.

Participants were asked to prepare both roasts at the same time, in the same manner and to evaluate them at the time of preparation and consumption. A preaddressed, stamped envelope was provided for return of the questionnaires.

A summary of the survey questionnaire is presented in Table 1. Demographics included age of the consumer, household income, family size and frequency of monthly pork consumption. The questionnaire was set up so the consumer could mark one of five boxes containing different comparisons of the two roasts for each of the visual appearance and palatability traits.

Table 1

Category	Traits Examined
Demographics	Age, Income, Household, Consumption Frequency
Visual Appeal	Color, Meat Juice in Package, Overall Appearance, Perception of Storage and Handling
Palatability	Odor, Flavor, Tenderness, Juiciness, Overall Acceptability

Comparisons for the roasts were: A is much better than B; A is better than B; A and B are about the same; B is better than A; and, B is much better than A, where A = vacuum packaged and B = polyvinyl chloride overwrap.

Visual comparisons were made on the uncooked roasts as they were distributed to the consumer. Visual traits evaluated included color, juice in the package (purge), overall appearance, and ease of storage and handling. Following preparation, palatability traits were assessed, including odor upon opening the package, flavor, tenderness, juiciness, and overall acceptability of the two pork loin roasts. The data were evaluated using mean percentages for each response and confidence intervals (Snedecor and Cochran, 1980).

Results

Usable responses were received from 51 of the 60 households participating in the study. The demographic characteristics of the respondents are summarized in Table 2. Age of participants was somewhat evenly distributed, with 29.4 percent of respondents in the under 29 age group, 37.3 percent of respondents in the 30 to 49 age group, and 33.3 percent in the over 50 age group. This age distribution is fairly consistent with Bureau of Census data for the midwest region (Bureau of Census).

The majority of household incomes of survey participants were under \$40,000, with 38.8 percent of respondents reporting incomes under \$20,000, 34.7 percent reporting incomes in the \$20,000 to \$40,000 range, and 26.5 percent reporting incomes over \$40,000. The distribution of incomes among respondents is thus somewhat skewed when compared with the midwest average annual income of \$24,990.

The consumers in the survey represented a variety of household sizes, with 49 percent being from 2 person households, 21.6 percent from 3 person households, and 21.6 percent from households of four or more. Only 7.8 percent of respondents were from single person households due to the fact that a limited num-

ber of consumers from single member households entered the meat market during the study period. The household sizes in the survey are fairly representative of the typical midwestern average of 2.71 persons per household (Bureau of the Census).

Pork was consumed at least once per month by 90.2 percent of the consumers who participated. Only 9.8 percent of respondents consumed pork less than once per month. The relatively small number of consumers in this category may be in part attributable to the fact that persons entering the meat market are likely to be moderate to heavy meat eaters. In addition, several persons who did not consume pork for a variety of reasons were not willing to participate in the survey. These figures on pork consumption compare favorably with midwestern data reported by the National Pork Producers Council (1984).

Consumer responses regarding visual evaluations of the fresh uncooked roasts are presented in Table 3. Over 80 percent of the consumers preferred the color and overall appearance of the roast wrapped in the PVC overwrap. Only six of the 51 respondents ranked vacuum packaged pork superior in terms of color. As noted above, vacuum packaging removes oxygen and results in a dark red or purple color. The apparent lack of consumer acceptability of the color of the vacuum packaged product is supported by Wachholz, et al. (1978), who reported that a majority of consumers will select pork that is a normal pinkish red color, discriminating against pork that is too light or too dark.

Approximately 50 percent of the consumers felt that vacuum packaged cuts were more desirable when they evaluated the roasts for purge or meat juice in the package (Table 3). It should be noted that the amount of purge observed in the vacuum packaged cuts was limited since all cuts were packaged 24 hours prior to distribution; in addition, participants appeared uncertain regarding the desirability of purge in meat packages, with some viewing purge as a plus for palatability and others finding it messy or an economic loss.

Table 2

Demographics of Survey Respondents^a

Characteristic	Survey Responses	Descriptive Category	Number of Responses	Percentage Response
Age of Consumer	N = 51	29 or less	15	29.4
		30 - 49	19	37.3
		50 or more	17	33.3
Household Income	N = 49	\$20,000 or less	19	38.8
		\$20,000 - \$40,000	17	34.7
		\$40,000 or more	13	26.5
Household Size	N = 51	1 person	4	7.8
		2 persons	25	49.0
		3 persons	11	21.6
		4 or more	11	21.6
Pork Consumption Frequency	N = 51	Less than once/month	5	9.8
		Less than 5/month	23	45.1
		Five times or more/month	23	45.1

^aFrom the 60 surveys distributed to participants, a total of 51 usable responses were received.

Table 3

Number of Responses, Percentage Responses and Confidence Intervals
For Visual Appearance of Fresh Pork Loin Roasts,
Vacuum Packaging Versus Polyvinyl Chloride Packaging

Response Category	Trait			
	Color ^a	Meat Juice in Package (purge)	Overall Appearance	Perceived Use of Storage and Handling
Number of Responses	51	51	51	51
PVC is much better than VP	20 (39.2 ± 13.4)	4 (7.8 ± 7.4)	20 (39.2 ± 13.4)	4 (7.8 ± 7.4)
PVC is better than VP	22 (43.1 ± 13.6)	12 (23.5 ± 11.6)	17 (33.3 ± 12.9)	9 (17.7 ± 10.5)
PVC and VP are about the same	3 (5.9 ± 6.5)	10 (19.6 ± 10.9)	9 (17.7 ± 10.5)	9 (17.7 ± 10.5)
VP is better than PVC	6 (11.8 ± 8.9)	24 (47.1 ± 13.7)	5 (9.8 ± 8.2)	24 (47.0 ± 13.7)
VP is much better than PVC	0 (0 ± 0)	1 (2.0 ± 3.8)	0 (0 ± 0)	5 (9.8 ± 8.2)

^aValues reported for each category represent the number of responses in each category. Figures in parentheses are percentage responses and their associated confidence intervals for responses in each category. Percentage responses were calculated by dividing the number of responses of each parameter by the total number of responses for that trait multiplied by 100. Confidence intervals were computed following Snedecor and Cochran, 1980.

In terms of overall appearance, over 70 percent of the consumers in the study rated the PVC overwrap package superior to the vacuum package. This result, however, is likely to be heavily influenced by their perceptions regarding product color.

Consumers generally perceived vacuum packages as having an advantage in ease of storage and handling with over 55 percent ranking the vacuum package superior to the PVC overwrap. This result was expected, as the use of packaging films that have limited vapor transmission rates, such as vacuum packaging materials, will prevent freezer burn and dehydration after prolonged storage (Urbain, 1978). In fact, the improved shelf life at 4°C may prevent the need for freezer storage (Weakley et al., 1986).

Consumer responses regarding palatability traits of the PVC overwrap and vacuum packaged roasts are presented in Table 4. The majority of the consumers, 66 percent perceived the odor of the roasts upon opening the packages as being the same. Odor of the meat cuts in vacuum packages was a concern because odors may not be dissipated through the film, thus an intense odor upon opening the package may be observed in this study and the results agree with reports of Vrana et al. (1984).

Over 49 percent of the consumers felt that the flavor and tenderness of the roasts was the same for the two packaging materials (Table 3). Flavor and tenderness of the vacuum packaged roasts were rated superior by over 27 and 31 percent of the consumers, respectively. In terms of juiciness, over 33 percent of respondents ranked the vacuum packaged and PVC overwrap roasts as having equal juiciness, while over 43 percent rated the vacuum packaged roasts juicier.

In terms of overall palatability acceptance, 38 percent of the consumers in the study rated the two products equally acceptable. The vacuum packaged product was rated superior in terms of overall acceptance of palatability by 42 percent of the respondents. These differences in palatability acceptability

are interesting in light of the fact that the paired roasts came from the same carcass. It would appear that vacuum packaging may reduce evaporative losses, thereby improving palatability of the product.

In summary, the results presented above indicate that vacuum packaged roasts were perceived by consumers as being as good or better than polyvinyl chloride overwrapped roasts for all traits examined, except color and overall appearance. Thus, if consumer objections to color and appearance can be overcome, vacuum packaging will offer the industry a valuable opportunity to improve the storability, shipping, and handling of fresh pork products. In addition, acceptance of this type of packaging offers new opportunities in the development of pre-cooked products for the convenience oriented consumer.

Implications

The implications of the results presented above for processors, wholesalers, and retailers involved in the fabrications and marketing of fresh pork products can be summarized along the following lines:

1. The use of vacuum packaging offers that opportunity to increase the shelf life of fresh pork an additional 7 to 10 days which would allow for centralized fabrication of cuts, reducing labor costs at individual stores. In addition, more efficient use of trimmings and by-products would be achieved. The cost savings associated with a centralized fabrication system, initially realized at the processing and retail levels could ultimately be passed along to consumers, allowing the product to appeal to the price driven segment of the population.[1]
2. The consumers surveyed in this study indicated that vacuum packaging offers advantages in ease of storage and handling, while also having positive effects on palatability attributes. The results also indicate that the major concern with vacuum packaged fresh pork is the color and appearance of cuts. The use of different lighting in the

Table 4

Number of Responses, Percentage Response, and Confidence Intervals
For Sensory Traits of Fresh Pork Loin Roasts,
Vacuum Packaging Versus Polyvinyl Chloride Packaging

Response Category	Trait				
	Odor upon opening package ^a	Flavor	Tenderness	Juiciness	Overall Acceptability
Number of Responses	50	51	51	51	50
PVC is much better than VP	2 (4.0 ± 5.4)	3 (5.9 ± 6.5)	1 (2.0 ± 3.8)	3 (5.9 ± 6.5)	1 (2.0 ± 3.9)
PVC is better than VP	7 (14.0 ± 9.6)	7 (13.7 ± 9.4)	9 (17.6 ± 10.4)	9 (17.6 ± 10.4)	9 (18.0 ± 10.6)
PVC and VP are about the same	33 (66.0 ± 13.1)	27 (52.9 ± 13.7)	25 (49.0 ± 13.7)	17 (33.3 ± 12.9)	19 (38.0 ± 13.5)
VP is better than PVC	6 (12.0 ± 9.0)	10 (19.6 ± 10.9)	13 (25.5 ± 12.0)	16 (31.4 ± 12.7)	19 (38.0 ± 13.5)
VP is much better than PVC	2 (4.0 ± 5.4)	4 (7.9 ± 7.4)	3 (5.9 ± 6.5)	6 (11.8 ± 8.9)	2 (4.0 ± 5.4)

^aValues reported for each category represent the number of responses in each category. Figures in parentheses are percentage responses and their associated confidence intervals for responses in each category. Percentage responses were calculated by dividing the number of responses of each parameter by the total number of responses for that trait multiplied by 100. Confidence intervals were computed following Snedecor and Cochran, 1980.

retail meat case, along with targeted educational programs may mitigate these concerns.

3. Consumer acceptance of vacuum packaging for fresh pork cuts will open new avenues in the processed product market. In light of this, industry efforts should be devoted to development of pre-cooked, portion controlled, vacuum packaged pork products which will appeal to the active lifestyle or convenience oriented segment of the population. Educational programs should also be developed to acquaint these and other consumers with the concept of vacuum packaging, including its convenience, storability and cost advantages.
4. Finally, the results of this study suggest the need for further research into consumer acceptance of vacuum packaged products. Issues which should be considered include alternative packaging to minimize unacceptable visual attributes, investigation of consumer acceptance of pre-cooked vacuum packaged products, such as pork roasts, and examination of vacuum packaged product quality over extended periods of time.

Endnotes

- [1] The actual value of the cost savings is difficult to estimate. The cost savings in terms of centralized distribution and fabrication will be largely a result of scale economies and are therefore related to plant size, volume, etc. Larger savings at the retail level will also vary depending upon whether union or non-union labor is involved. In short, these issues merit farther study to determine the relationship between the benefits and costs of vacuum packaging versus other forms of packaging. The results here suggest further investigation is warranted.

References

Bureau of the Census. 1986. *Statistical Abstract of the United States 1986*, 106th Edition, U.S. Department of Commerce.

National Pork Producers Council. 1984. *Summary Report - Consumer Tracking - Wave IV*, Wiese Associates Inc., December.

Pierson, M. D., D. L. Collins-Thompson, and Z. J. Ordal. 1970. Microbiological, sensory and pigment changes of aerobically and anaerobically packaged beef. *Food Technol.* 24:1171.

Ramsey, C. B., K. D. Lind, L. F. Tribble, and C. T. Gaskins, Jr. 1973. Diet, sex and vacuum packaging effects on pork aging. *J. Anim. Sci.* 34:40.

Smith, G. C., S. W. Rape, R. R. Motycka, and Z. L. Carpenter. 1974. Packaging systems for extending the storage life of fresh pork cuts. *J. Food Sci.* 39:1140.

Snedecor, G. W. and W. G. Cochran. 1980. The normal distribution, pp. 39-63. In *Statistical Methods*, 7th ed., The Iowa State University Press, Ames, IA.

Urbain, W. M. 1978. Meat preservation, pp. 402-451. In *The Science of Meat and Meat Products* (2nd ed.), eds. J. F. Price and B. S. Schweigert, W. H. Freeman, San Francisco, CA.

Vrana, J. A., J. W. Savell, C. W. Dill, G. C. Smith, J. G. Ehleu and C. Vanderzant. 1984. Retail appearance, odor and microbiological characteristics of pork loin chops packaged in different oxygen-barrier films as affected by loin storage treatment. *J. Food Prot.* 48:476.

Wachholz, D., R. G. Kauffman, D. Henderson, and J. V. Lochner. 1978. Consumer discrimination of pork color at the marketplace. *J. Food Sci.* 43:1150.

Weakley, D. F., F. K. McKeith, P. J. Bechtel, S. E. Martin, and D. L. Thomas. 1986. Effects of packaging and processing procedures on the quality and shelf-life of fresh pork loins. *J. Food Sci.* In Press.

Yankelovich, Skelley, and White. 1984. "Beef: Usage, Attitudes and Opportunities in Food Service and Consumer Markets." Beef Industry Council of the Meat Board, Chicago, Illinois.