



Preference Choice Survey of Pork Chop by French and Korean Consumers

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Abstract

Digital photographs of 16 pork chops were each modified to give 16 treatments, such as two levels each of fat cover, color, marbling and drip, giving a total of 256 images. Consumers from three locations in France and six locations in Korea selected their preferred chop from 16 treatments in different chops and repeated this selection process eight times from different groups of chops, respectively. Respondents were asked to complete a questionnaire on socio-demographic information. Both the results of the French and Korean surveys gave four clusters of consumers, but they were not the same in terms of the choice strategies used, or in terms of their relationships with the socio-demographic items. The interesting apparent similarities (such as, both color levels being equally important to consumers in both countries) and differences (such as, the strong preference for lean meat in France; no fat preference in Korea) suggest a need to compare the results from the two countries. However, due to the difference of the socio-demographic make-up of the consumer panels from the two countries, a simple and direct comparison of the clusters based on choice and their relationships with the questionnaire items is not possible, but is currently being explored.

Key words : consumers, preferences survey, pork choice, color, marbling

Introduction

Consumer preference and choice are believed to depend on the interaction of the objective qualities of the product with the attitudes and expectations of the consumers (Ngapo et al., 2003). Choice is product specific and for pork, early reports (Diamant et al., 1976; Romans and Norton, 1989; Wachholz et al., 1978; Zuidam et al., 1971) have been focused on the objective qualities of the meat, paying little attention to consumer preference. More recent studies (Becker et al., 2000; Glitsch, 2000; Melton et al., 1996; O'Mahony et al., 1991) have paid more attention to the variation between consumers and consumer attitudes in recognition of modern pig production practices and increased internationalisation of the pork trade.

Previous studies have shown that four meat characteristics

such as color, fat cover, marbling, and drip are the most critical factors for consumers preference when purchasing pork at the market (Becker et al., 2000; Glitsch, 2000; O'Mahony et al., 1991; Romans and Norton, 1989). At present, no systematic comparative research has been conducted to investigate the preference characteristics of pork for consumers from different countries. In 2001, a series of images of pork chops was published (Dransfield et al., 2001), making possible such a systematic comparison of consumer preference through surveys. A worldwide project of consumer preferences of pork chops was then initiated by these researchers (Ngapo et al., 2002), in which similar surveys were organized in more than 20 countries including Korea. The objectives of this study were to identify the most important characteristics of fresh pork which determine Korean consumer choice and to show any segmentation in choice related to their socio-demographic and cultural differences with French consumers.

Materials and Methods

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Pork characteristics

Difficulties encountered with the use of meat in consumer surveys were avoided through the use of a wide variety of digital images. The use of digital photographs allows controlled manipulation producing defined differences. Such images were produced from photographs of 16 pork chops which were computer-modified to give two levels each of four characteristics such as fat cover, color, marbling and drip. The selection of these characteristics was based on the results of the reported studies suggesting their importance. The pork chops were purchased at local supermarkets and butcher shops. Photographs (1284×1024 pixels) were taken using an Olympus Camedia C-1400L Digital Camera (1,410,000 Pixel CCD, Olympus Optical Co., Ltd., Japan) and were modified using Corel Photo-Paint (Version 9.337; Corel Co. Ltd., France). The resulting 256 (2×2×2×2×16) images have been published as a book (Dransfield et al., 2001) which can be used as a tool for analyzing the importance of those factors in consumer choice. A series constitutes 16 (A4) pages or 8 double-pages. Every double-page contains the 16 different chops and each chop represents one of the combinations of the four characteristics studied. The 16 different chop types were coded 'P----' whereby the first digit refers to color (dark=1, light=0), the second to fat cover (fat=1, lean=0), the third to marbling(marbled=1, not marbled=0) and the last to drip (drip=1, no drip=0). Both the order of presentation of the characteristics with respect to the chop and the order of the presentation of the chops in a double-page are randomized. It is important to note that the chop shape was not a factor studied, but was a distraction and a means to realistically present a range of characteristics to the consumer.

Consumers and location

Consumers, chosen at random, were asked to select their preferred chop from each of the double-page images. The selection was repeated eight times completing one series. The consumers then completed a short questionnaire where they were asked about basic socio-demographic and purchase- and eating-behaviour information. Repeated selection of consumer preferences provides an objective determination of their selection criteria from the modified characteristics and their combinations. In France, the surveys were undertaken at two agricultural fairs, 'SPACE' in Rennes (North Western France) in September 2001 and the Sommet de l'Elevage in Clermont Ferrand (Central

France) in October 2001, and in two government organisations in Montpellier and Avignon (Southern France). A total of 573 responses were obtained. In Korea, the survey was carried out in 16 cities located in six different provinces and the consumers were randomly selected in each province from April to July, 2002 as follows: Seoul 83 (8.18%), Kyunggi-do 493 (48.57%), Gyung-sang-do 137 (13.50%), Chunla-do 102 (10.05%), choong-chung-do 113 (11.13%) and Kangwon-do 87 (8.57%).

Analyses and Statistical Methods

Random choices

The choices made for each of the four characteristics studied were analysed individually and compared using the χ^2 test. The choices were also divided into three categories for each characteristic and random selection. The results were quantified by the definition that if 6 of 8 choices for one consumer are the same for a given characteristic, the choice is a real choice and not random ($p < 0.14$). If less than six choices are the same, the given characteristic is considered to be randomly selected. This test assumes a binomial distribution of the results ($p = 0.5$). Significant differences in the number of choices were observed using the χ^2 test. The level at which the choice is considered real was chosen at a cut off of six out of eight choices which has a p -value < 0.14 . Selection of a cut-off providing a p -value of 0.10 or 0.05, as is commonly used in statistical analyses, was not possible due to the required a whole number. A cut-off of seven out of eight choices with a p -value of 0.03, was considered too severe for this type of consumer-based selection, and hence the selection of 6 out of 8 choices.

Analysis of choices

The sum of the selection times and numbers for each consumers choice combined with pork characteristics was calculated. These combinations of characteristics were given codes P0000, P0100 etc, used to create the book of images. Using the sums of each combination, a contingency table was constructed comprising all the consumers and their choices. Using this contingency table, a correspondence analysis using all 15 dimensions was undertaken accounting for 100% of the variability.

The hierarchical cluster analysis was undertaken using the SAS CLUSTER procedure (SAS, 1996) to group consumers with similar strategies for pork chop selection. The coordinates of

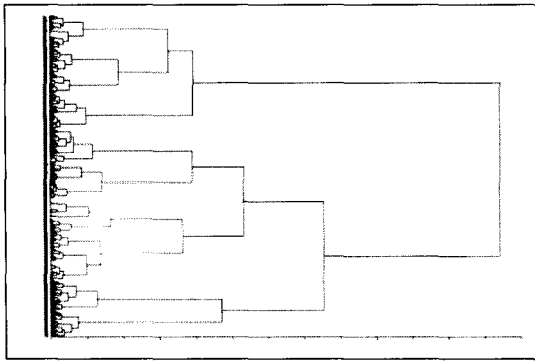


Fig. 1. Hierarchical cluster analysis based on consumer choice.

each consumer obtained in the 15 dimensions of the correspondence analysis were used as the basis for the cluster analysis. The number of clusters to be retained was selected by considering the distance between clusters and the profile of the resulting graph (Fig. 1). In this study, a disjoint cluster analysis was then carried out using the SAS FASTCLUS procedure (SAS, 1996) forcing the consumers into the four different clusters.

Analysis of the questionnaire

Links between the consumer choice-based clusters and questionnaire items were determined using χ^2 test. Note that χ^2 test requires a minimum of five responses and therefore a strong bias for a given response in the χ^2 test was not valid.

All the results were shown, and where significant, the validity was checked; when not valid, the relationship between clusters and the criterion was not further investigated. Similar to the choice data, correspondence and cluster analyses were undertaken to define clusters based on the questionnaire items.

Results and Discussion

Consumer panels

The characteristics of consumers and responses are presented in Table 1. For French consumers, there was an even spread of consumers in each of the four categories in the age category of from 16 to 54 years, with 21~23%; 11% were 55~64 years and 2% were over 64 years. Slightly more males (52%) than females (48%) responded and 60% of consumers were married or cohabiting. The number in the household ranged from 1 to 23% for 1~4 people, of which 60% are spouses, 41% are children, and 16% are parents; only 1% is grandparents and 12%

are others. A large proportion (37%) of the consumers was in the lowest monthly income category (< \$1,360), 40% were in the categories from \$1,361 to \$2,800, and the remainings were 17% over the categories > \$2,801. Sixteen percent of the consumers finished their studies at the ages of 17 and 18 years, 27% between 19 and 22 years, and 33% after 22 years of age. A large proportion of consumers ate out of home five times a week (34%), 16% do not eat out, 43% (5~10% for each response option) ate out from 1 to 7 times per week (excluding five times), and 6% ate out from 8 to 14 times per week. Only 28% of consumers were not meat purchasers in their households. Most of the consumers purchased meat in the supermarket (61%) or at the butcher (44%), while 21% purchased meat directly from the farmer. Only 24% of respondents cooked once a week or less often and pork was most often cooked by frying (64%), grilling (57%), or roasting (30%). Most consumers never ate alone (55%) or ate alone several times a week (30%). Most consumers ate meat once a day, everyday (37%), or several times a week (34%), 25% ate meat at every meal, everyday. A large proportion of consumers ate fresh pork at least once a week and another 25% at least once a month. Seventeen percent of consumers had changed their consumption habit of fresh pork in recent years, of which 54% had decreased and 32% had increased their consumption. Only 4% did not prefer fresh pork, while the other 96% preferred fresh pork for its taste (66%), price (51%), and versatility (48%) followed by availability (17%) and nutritional quality (14%). Ninety percent of consumers thought that the fresh pork they buy is always or almost always of good quality, while 86% thought it is not expensive. A large proportion of consumers (76%) has lived in the country or a village for more than 1 year, but only 58% currently lived in the country or a village.

For Korean consumers, there was a similar numbers of consumers in the age categories from 16 to 44 years, with 25~28% in each of the three categories: 45~54 years, 17%; 55~64 years, 3%; and over 64 years, 1%. There were 66% females and 34% males. More married people (57%) than single/ widowed (43%) responded. Most of the consumers that responded have four or more than five family members in the household (46% and 31%, respectively). Family members were composed of spouses (56%), children (52%), and parents (54%). Seven percent (7%) of the consumers lived with their grandparents, while 39% lived with others. In terms of monthly income, the \$1,361~2,080 category had the highest percentage (36%) among the

respondents, while the lowest monthly income category was < \$1,360 (26%). Only 8% of the consumers had income of more than \$3,521. Six percent (6%) finished studies before the age of 17 years, 2% at the ages of 17 and 18 years, 56% between 19 and 22 years, and 36% after 22 years. Fourteen percent (14%) of the respondents wore dental prosthesis. A large proportion of the consumers often eat out of home: 45% eat out 1~7 times per week; 29%, 8~14 times per week; and 26%, 15~21 times per week. Meanwhile, 1% of the consumers do not eat out. Only 14% of the respondents were not the ones purchasing meat for their respective household. Most of the Korean consumers surveyed purchased meat from the butchers (52%) and from the supermarket (46%), and not directly from the farmer. The

respondents cooking frequency at home is distributed as follows: less than once a week, 24%; once a week, 20%; several times a week, 27%; and everyday, 29%. Pork was mostly cooked by grilling (72%). Most consumers never eat alone (28%) or eat alone several times a week (35%). They also eat meat several times a week (35%) and once a week (40%). Also, there were consumers who eat pork only once a week (59%) or those at least once a month (32%). Twenty eight percent (28%) of the respondents have changed their pork eating habit in recent years, in which 39% reduced their pork consumption while 60% increased their pork consumption. Sixteen percent (16%) of the consumers did not like fresh pork while majority (84%) liked fresh pork for its taste (8%), price (11%), and versatility

Table 1. Responses to questionnaire and link between questionnaire items and clusters of choices test by using χ^2 test for French(n=573) and Korean(n=1,014) consumers

| Items | Response option | Consumers | | | | | | | | | | | | | |
|-------------------|-----------------|-----------|----------|----|--------------|-------|----------|----|--------------|---|-------|----|-------|---|--------------|
| | | French | | | | Korea | | | | | | | | | |
| | | % | χ^2 | Df | P | % | χ^2 | Df | P | | | | | | |
| Age(y) | 16~24 | 21 | | | | 26 | | | | | | | | | |
| | 25~34 | 23 | | | | 28 | | | | | | | | | |
| | 35~44 | 22 | 23.81 | 15 | 0.068 | 25 | 34.82 | 12 | 0.001 | | | | | | |
| | 45~54 | 21 | | | | 17 | | | | | | | | | |
| | 55~64 | 11 | | | | 3 | | | | | | | | | |
| | 65+ | 2 | | | | 1 | | | | | | | | | |
| Gender | female | 48 | | | | 5.20 | | | | 3 | 0.157 | 66 | 43.34 | 3 | 0.000 |
| | male | 52 | | | | | | | | | | 34 | | | |
| Marital status | single/widowed | 40 | 12.14 | 3 | 0.007 | 43 | 26.26 | 3 | 0.000 | | | | | | |
| | married/defacto | 60 | 12.14 | 3 | 0.007 | 57 | 26.26 | 3 | 0.000 | | | | | | |
| Number in house | 1 | 21 | | | | 1 | | | | | | | | | |
| | 2 | 23 | | | | 6 | | | | | | | | | |
| | 3 | 17 | 16.08 | 12 | 0.188 | 15 | 18.38 | 12 | 0.105 | | | | | | |
| | 4 | 23 | | | | 46 | | | | | | | | | |
| | 5+ | 16 | | | | 31 | | | | | | | | | |
| Composed of | spouse | 60 | | | | | | | | | | 56 | | | |
| | children | 41 | | | | | | | | | | 52 | | | |
| | parents | 16 | | | | 54 | | | | | | | | | |
| | grandparents | 1 | | | | 7 | | | | | | | | | |
| | others | 12 | | | | 39 | | | | | | | | | |
| Salary (1,000won) | <1,360 | 37 | 18.72 | 15 | 0.227 | 26 | 20.29 | 15 | 0.161 | | | | | | |
| | 1,361~2,080 | 22 | | | | 36 | | | | | | | | | |
| | 2,081~2,800 | 18 | | | | 18 | | | | | | | | | |
| | 2,801~3,520 | 8 | | | | 11 | | | | | | | | | |
| | 3,521~4,240 | 9 | | | | 5 | | | | | | | | | |
| | >4,241 | 7 | | | (line) | 3 | | | | | | | | | |

Table 1. Continued.

| | | Consumers | | | | | | | |
|--------------------|------------------------|-----------|----------|----|--------------|-------|----------|----|--------------|
| | | French | | | | Korea | | | |
| | | % | χ^2 | Df | P | % | χ^2 | Df | P |
| Age studied to | up to 16y | 8 | | | | 6 | | | |
| | 17~18y | 16 | | | | 2 | | | |
| | 19~22y | 27 | 16.27 | 12 | 0.179 | 56 | 10.89 | 9 | 0.284 |
| | 23+ | 33 | | | | 36 | | | |
| | not yet finished study | 16 | | | | | | | |
| Ethnic origin | yes | 9 | 11.62 | 3 | 0.009 | 0 | | | |
| | no | 91 | | | | 100 | | | |
| Food influence | yes | 1 | 12.48 | 6 | 0.052 | 6 | 1.88 | 3 | 0.597 |
| | no | 88 | | | | 94 | | | |
| False teeth | yes | 13 | 5.10 | 3 | 0.165 | 14 | 23.19 | 3 | 0.000 |
| | no | 87 | | | | 86 | | | |
| Meals out (per wk) | 0 | 16 | | | | 1 | | | |
| | 1~2 | 18 | | | | 9 | | | |
| | 3~4 | 13 | | | | 11 | | | |
| | 5~6 | 41 | 29.02 | 27 | 0.360 | 13 | 38.87 | 27 | 0.065 |
| | 7 | 5 | | | | 12 | | | |
| | 8~14x/week | 6 | | | | 29 | | | |
| | 15~21x/week | 1 | | | | 26 | | | |
| Buys meat | no | 28 | 14.00 | 3 | 0.003 | 14 | 7.64 | 3 | 0.054 |
| | yes | 72 | | | | 86 | | | |
| | butcher | 44 | 1.57 | 3 | 0.667 | 52 | 3.42 | 3 | 0.332 |
| | supermarket | 61 | 2.77 | 3 | 0.429 | 46 | 3.58 | 6 | 0.733 |
| | farmer | 21 | 4.39 | 3 | 0.222 | 0 | 0.43 | 3 | 0.934 |
| Cooks | everyday | 42 | | | | 29 | | | |
| | several x/week | 34 | 1.42 | 9 | 0.058 | 27 | 6.51 | 9 | 0.688 |
| | 1x/week | 8 | | | | 20 | | | |
| | <1x/week | 16 | | | | 24 | | | |
| Cooking method | grill | 57 | 1.18 | 3 | 0.758 | 72 | 2.20 | 3 | 0.531 |
| | fry | 64 | 1.74 | 3 | 0.627 | 7 | 5.28 | 3 | 0.153 |
| | roast | 30 | 4.97 | 3 | 0.174 | 4 | 7.26 | 3 | 0.064 |
| | stew/curry | 14 | 1.81 | 3 | 0.613 | 6 | 6.61 | 3 | 0.085 |
| | boil | 7 | 2.76 | 3 | 0.429 | 8 | 2.59 | 3 | 0.460 |
| | other | 4 | 3.15 | 3 | 0.369 | 8 | 2.77 | 3 | 0.429 |
| Meal preparation | <30 min | 45 | | | | 34 | | | |
| | 30 min ~ 1 h | 48 | 4.07 | 6 | 0.668 | 56 | 7.35 | 6 | 0.29 |
| | >1 h | 7 | | | | 10 | | | |
| Possess: | fridge | 100 | 7.92 | 3 | 0.048 | 99 | 8.80 | 3 | 0.032 |
| | microwave | 67 | 3.49 | 3 | 0.322 | 85 | 4.84 | 3 | 0.184 |
| | hotplates | 96 | 0.26 | 3 | 0.967 | 28 | 3.57 | 3 | 0.312 |
| | oven | 92 | 1.32 | 3 | 0.724 | 37 | 3.33 | 3 | 0.343 |
| | freezer | 82 | 1.55 | 3 | 0.672 | 50 | 17.81 | 3 | 0.000 |

Table 1. Continued.

| | | Consumers | | | | | | | |
|---------------------|--------------------------|-----------|----------|----|-------|-------|----------|----|--------------|
| | | French | | | | Korea | | | |
| | | % | χ^2 | Df | P | % | χ^2 | Df | P |
| Eat alone | everyday | 7 | | | | 9 | | | |
| | several x/wk | 30 | | | | 36 | | | |
| | 1x/wk | 4 | 9.64 | 12 | 0.647 | 12 | 10.78 | 12 | 0.548 |
| | <1x/week | 5 | | | | 15 | | | |
| | almost never | 55 | | | | 28 | | | |
| Eat meat | every meal, everyday | 25 | | | | 3 | | | |
| | 1x/day, everyday | 37 | | | | 3 | | | |
| | several x/week | 34 | 14.73 | 12 | 0.256 | 35 | 12.86 | 9 | 0.169 |
| | 1x/week | 2 | | | | 40 | | | |
| | <1x/week | 1 | | | | 19 | | | |
| Eat pork | everyday | 2 | | | | 2 | | | |
| | >1x/week | 68 | 3.43 | 9 | 0.945 | 59 | 15.80 | 9 | 0.071 |
| | >1x/month | 25 | | | | 32 | | | |
| | <1x/month | 5 | | | | 7 | | | |
| Consumption | same | 83 | 3.94 | 3 | 0.268 | 72 | 1.62 | 3 | 0.655 |
| | changed | 17 | | | | 28 | | | |
| | increased (% changed) | 32 | 6.06 | 3 | 0.109 | 60 | 3.02 | 3 | 0.389 |
| | decreased (% changed) | 54 | 2.34 | 3 | 0.505 | 39 | 5.60 | 3 | 0.133 |
| Like pork | yes | 96 | 0.53 | 3 | 0.912 | 84 | 2.46 | 3 | 0.483 |
| | no | 4 | | | | 16 | | | |
| | for availability | 17 | 3.52 | 3 | 0.318 | 65 | 1.85 | 3 | 0.603 |
| | for nutritional quality | 14 | 2.27 | 3 | 0.518 | 34 | 4.73 | 3 | 0.193 |
| | for versatility | 48 | 1.68 | 3 | 0.639 | 12 | 0.95 | 3 | 0.814 |
| | for taste | 66 | 1.66 | 3 | 0.646 | 8 | 1.59 | 3 | 0.662 |
| | for price | 51 | 2.47 | 3 | 0.480 | 11 | 3.28 | 3 | 0.351 |
| | for other reasons | 7 | 2.72 | 3 | 0.437 | 3 | 3.87 | 3 | 0.276 |
| Good quality | always | 31 | | | | 11 | | | |
| | almost always | 59 | | | | 29 | | | |
| | sometimes | 10 | 7.63 | 9 | 0.571 | 48 | 9.80 | 9 | 0.367 |
| | almost never | 0 | | | | 9 | | | |
| | never | 0 | | | | 3 | | | |
| Expensive | no | 86 | 1.14 | 3 | 0.767 | 63 | 18.35 | 3 | 0.000 |
| | yes | 14 | | | | 37 | | | |
| Live in | town/city | 42 | 0.76 | 3 | 0.860 | 15 | 15.02 | 3 | 0.002 |
| | country/village | 58 | | | | 85 | | | |
| Lived in country | <1 year | 24 | 4.02 | 3 | 0.259 | 53 | 15.02 | 3 | 0.000 |
| | >1 year | 76 | | | | 47 | | 3 | 0.002 |

(12%), followed by availability (65%) and nutritional quality (34%). Forty percent (40%) of the consumers believed that the fresh pork they buy is always or almost always of good quality, while 63% thought it is not expensive. A large proportion of consumers (53%) have lived in the country or a village for more than 1 year, but only 47% currently live in the country or a village.

Choices of pork chop

The choices made for each of the four characteristics studied were analysed individually using the entire data set of 573 French consumers (Fig. 2). Results of the χ^2 tests show that within a characteristic there were significant differences in the number of choices for all four characteristics ($p < 0.05$). The data was divided into three categories for each characteristic, the third category being the characteristic which was not consistently selected. Significant differences in the number of choices were observed for fat cover, marbling and drip ($p = 0.0001$). However, most of the choices for marbling (67%) and drip (60%) may have been random (inconsistent selection). Using the entire data set of 1,014 Korean consumers, the following choices(%) were made for each of the four characteristics studied when analysed individually (Fig. 3). For each characteristics, significant differences in the number of choices were observed for color, fat cover, marbling and drip ($p < 0.0001$). However, most of the choices for fat cover (67%) was random inconsistent selection).

While the consumers in UK, Sweden, Ireland, Germany, and Italy considered color as the most important criteria for pork chop selection followed by leanness (Glitsch, 2000), U.S. consumers considered leanness (81%) as an important selection factor followed by color (48%). This result was based on the questionnaire surveys conducted for consumers' purchase behaviour (Romans and Norton, 1989).

Clustering the consumers

Four clusters were defined based on French consumers choices as follows: Cluster 1, 188 consumers (33%) who have a strong preference for dark red meat, as well as lean but marbled meat with no drip; Cluster 2, 115 consumers (20%) who prefer light red meat with no marbling; Cluster 3, 114 consumers (20%) who have strong preferences for light red meat without drip and a slight preference for lean meat; Cluster 4, 156 consumers (27%) who strongly prefer lean meat and have a

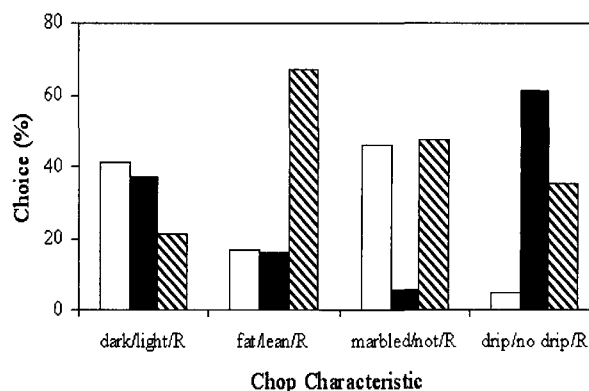


Fig. 2. French consumers choices of the four chop characteristics studied, with random selection separated. Significant differences observed for three characteristics (fat, marbling and drip) using χ^2 test within a chop characteristic ($p < 0.0001$).

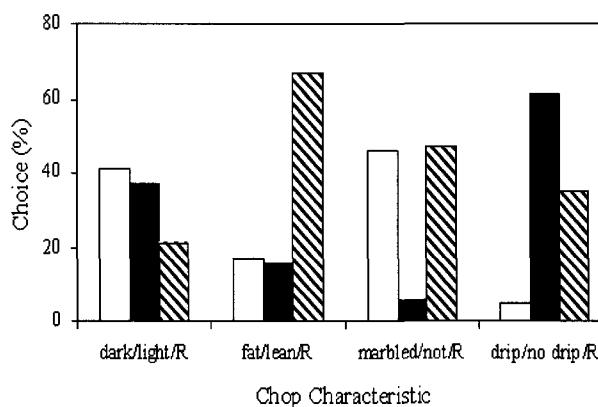


Fig. 3. Korean consumers choices of the four chop characteristics studied, with random selection separated. Significant differences observed for all four characteristics using χ^2 test within a chop characteristic ($p < 0.0001$).

slight preference for no drip. Clustering based on French consumers choices for each of the four clusters are shown in Table 2. For each characteristic, there is a significant difference between the percentage of choices using the entire panel and those for a given cluster, and the percentages in bold show significant differences when compared to the entire panel.

Four clusters based on Korean consumers choice were also retained and they were as follows : Cluster 1 of 97 consumers (10%) who have strong preference for light red meat; Cluster 2 of 81 consumers (8%) who prefer light red meat with some fat cover and no drip; Cluster 3 of 430 consumers (42%) who have a strong preference for dark red meat with marbling without drip; Cluster 4 of 406 consumers (40%) who have a strong preference for light red, marbled meat without drip. Clustering based on Korean consumers choice for each of the 4 clusters

Table 2. French consumer's percent selection of chop characteristics for each cluster with significant differences compared to results of the entire panel shown in bold ($p < 0.001$)

| Clusters | Color | | | Fat cover | | | Marbling | | | Drip | | |
|--------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----|----|------|-----------|-----------|
| | Dark | Light | R | Fat | Lean | R | Marbled | Not | R | Drip | No drip | R |
| 1 | 84 | 0 | 16 | 9 | 30 | 62 | 35 | 7 | 58 | 10 | 27 | 63 |
| 2 | 9 | 50 | 41 | 28 | 23 | 50 | 5 | 22 | 73 | 9 | 17 | 74 |
| 3 | 4 | 55 | 40 | 12 | 31 | 57 | 11 | 17 | 72 | 1 | 68 | 32 |
| 4 | 18 | 26 | 56 | 0 | 95 | 5 | 16 | 15 | 69 | 7 | 27 | 66 |
| Entire panel | 35 | 28 | 37 | 11 | 46 | 43 | 19 | 14 | 67 | 7 | 33 | 60 |

Table 3. Korean consumer's percent selection of consumer selection within chop characteristics for each cluster with significant differences by χ^2 ($p < 0.001$) compared to results of the entire panel shown in bold

| Clusters | Color | | | Fat cover | | | Marbling | | | Drip | | |
|--------------|-----------|-----------|-----------|-----------|-----------|----|-----------|-----------|-----------|-----------|-----------|-----------|
| | Dark | Light | R | Fat | Lean | R | Marbled | Not | R | Drip | No drip | R |
| 1 | 18 | 47 | 35 | 14 | 21 | 65 | 14 | 15 | 70 | 12 | 26 | 62 |
| 2 | 23 | 41 | 36 | 31 | 10 | 59 | 19 | 9 | 73 | 5 | 42 | 53 |
| 3 | 88 | 0 | 12 | 11 | 23 | 66 | 41 | 6 | 53 | 8 | 45 | 47 |
| 4 | 1 | 74 | 25 | 22 | 8 | 70 | 65 | 4 | 31 | 0 | 89 | 11 |
| Entire panel | 41 | 37 | 21 | 17 | 16 | 67 | 46 | 6 | 47 | 5 | 61 | 35 |

were shown in Table 3. For each characteristic there was a significant difference between the percentage of choices using the entire panel and those for a given cluster and the percentages in bold show significant differences when compared to the entire panel.

Conclusion

For a balanced systematic study, only four characteristics such as color, fat cover, marbling, and drip were investigated and were determined as the most important factors in the previous study; two levels of each characteristic were used in the present study. Although relationships were found when individual questionnaire items were compared with the choice-based clusters, extreme caution must be considered to extrapolate these results for the entire population of each country. This is because consumer samples used in this study are not necessarily representative of the entire population, or of certain regions. However, this investigation, using the systematic image

manipulation, provides fundamental information for comparisons of international meat marketing strategy in the future.

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References

1. Becker, T., Benner, E., and Glitsch, K. (2000) Consumer perception of fresh meat quality in Germany. *British Food Journal* **102**, 246-266.
2. Diamant, R., Watts, B. M., and Cliplef, R. L. (1976) Consumer criteria for pork related to sensory, physical and descriptive attributes. *Canadian Institute of Food Science and Technology Journal* **9**, 151-154.
3. Dransfield, E., Martin, J.-F., Miramont, J., and Ngapo, T. M.

- (2001) Meat Appearance: Pork Chops. A tool for surveying consumer preferences. INRA, France, ISBN 2-7380- 0976-X.
4. Glitsch, K. (2000) Consumer perceptions of fresh meat quality: cross-national comparison. *British Food Journal* **102**, 177-194.
 5. Melton, B. E., Huffman, W. E., Shogren, J. F., and Fox, J. A. (1996) Consumer preferences for fresh food items with multiple quality attributes: evidence from an experimental auction of pork chops. *American Journal of Agricultural Economics* **78**, 916-923.
 6. Ngapo, T. M., Martin, J.-F., and Dransfield, E. (2002) Consumer preferences of pork chops: an international cross-cultural comparison. Proceed. 48th Int. Cong. Meat Sci. Technol., Rome, Italy, pp. 150-151.
 7. Ngapo, T. M., Martin, J.-F., and Dransfield, E. (2004) Consumer choices of pork chops: results from three consumer panels in France. *Food Quality and Preference* **15**, 349-359.
 8. Ngapo, T. M., Dransfield, E., Martin, J.-F., Magnusson, M., Bredahl, L., and Nute, G. R. (2003) Consumer perceptions: pork and pig production. Insights from France, England, Sweden and Denmark. *Meat Science* **66**, 125-134.
 9. O'Mahony, R., Cowan, C., and Keane, M. (1991) Consumer preferences for pork chops with different levels of intramuscular fat. *Food Quality and Preference* **3**, 229-234.
 10. Romans, J. R. and Norton, H. W. (1989). Consumer evaluation of fresh pork quality. Proceed. 35th Int. Cong. Meat Sci. Technol., Copenhagen, Denmark, pp. 614-618.
 11. SAS (1996) SAS Users Guide: Statistics. Version 6.12, SAS Institute Inc., Cary, USA.
 12. Zuidam, L., Schmidt, R. G., Oosterbaan, J., and Sybesma, W. (1971) Effect of fresh pork colour on consumer acceptance. Proceed. 2nd Int. Symp. Cond. Meat Qual. Pigs Wageningen, pp. 282-286.
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