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RELATING CONSUMER PERCEPTIONS OF PORK QUALITY TO PHYSICAL PRODUCT CHARACTERISTICS

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RELATING CONSUMER PERCEPTIONS OF PORK QUALITY TO PHYSICAL PRODUCT CHARACTERISTICS

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EXECUTIVE SUMMARY

1. Consumers form expectations about the quality of meat at the point of purchase based on the quality cues that are available to them in the shop. These expectations can either be confirmed or disconfirmed during consumption, depending on how capable the consumers actually are of predicting the quality that they will perceived when preparing and consuming the meat.

2.The study uses the Total Food Quality Model as a frame of reference to investigate how consumers' quality expectations and quality experience with regard to pork are formed, how they are interrelated, and how both of them are related to a number of physical product characteristics commonly used to assess objective pork quality.

3. 200 German consumers are interviewed using real samples of pork chops, alongside with technical measurements of the meat quality.

4. Results show that consumers use colour, fat marbling, share of fat and quantity of meat juice as product-specific quality cues to derive expectations about the quality of pork. Consumers associate the quality of pork with health-related and hedonistic dimensions, and both quality expectations and quality experience are determined by the perceived taste, tenderness, wholesomeness, nutritional value, freshness, juiciness and leanness of the meat.

5. Results also reveal a moderate accordance between quality expectations and quality experience, meaning that the quality expectations consumers derive are not fully predictive of the quality that will be experienced upon consuming the meat.

6. Finally, it is clear that both quality expectations and quality experience are only weakly related to objective product characteristics. In some cases, an objective product characteristic may even have a positive impact on quality expectations and a negative impact on quality experience, or vice versa.

7. Since consumers obviously lack competence in judging the quality of meat when choosing among different kinds of meat in a purchase situation, marketers of pork are faced with a serious problem. One way of dealing with this problem, in cases where quality experience exceeds expectations, is to market the meat as part of a quality mark programme which outlines relevant sensory characteristics of the meat to the consumers.

Introduction

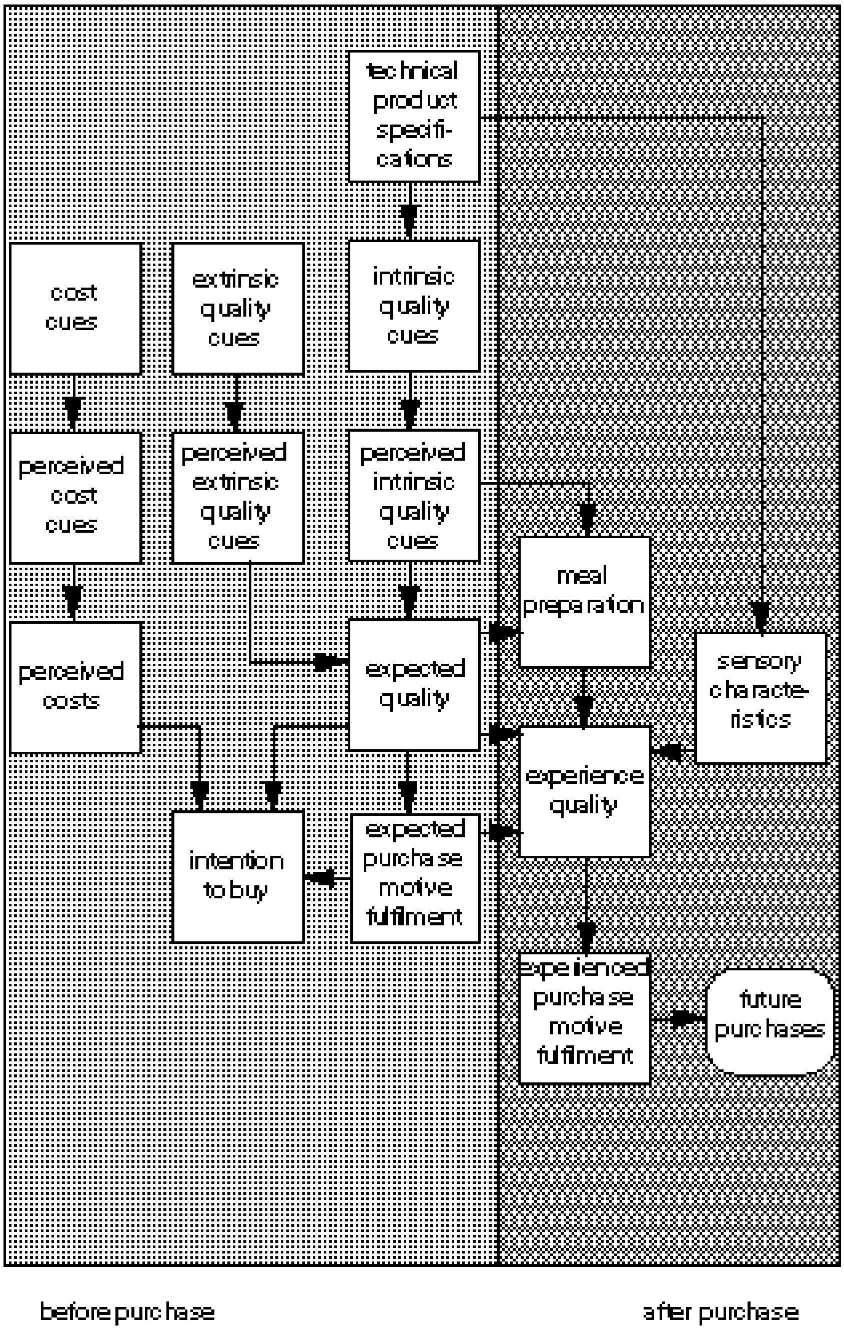
The relationship between physiological product characteristics and consumer quality perception is at the heart of market-oriented product development: In order to design products which consumers will accept, it is necessary to translate consumer demands into product specifications which are actionable from the producer's point of view. With regard to food, this relationship is especially complicated, because the way consumers perceive expected quality before a purchase is often different from the way quality is perceived after consumption, and may be related to various physiological product characteristics.

While this has been acknowledged repeatedly in the literature (eg, Grunert, Hartvig Larsen, Madsen & Baadsgaard 1995; Poulsen, Juhl, Kristensen, Bech & Engelund 1996; Steenkamp & van Trijp 1996), and despite the obvious practical consequences of better knowledge on how physiological product characteristics and quality perception before purchase and after consumption interact, research shedding light on this issue has been very sparse. In this paper, we present a study on the quality perception of pork, and its relations to physiological product characteristics. We start by discussing the theoretical approach employed and by relating our work to previous research.

The Total Food Quality Model

The conceptual framework for our study is the Total Food Quality Model proposed by Grunert, Hartvig Larsen, Madsen and Baadsgaard (1995), which integrates a number of more restricted approaches to food quality perception, notably means-end chain theory (Gutman 1982), multi-attribute attitude theory (Fishbein & Ajzen 1975), and economics of information approaches (Andersen 1994; Darby & Karni 1973). The model, which is depicted in figure 1, assumes that expected quality is based on a number of perceived quality cues, which may be both physical characteristics of the product (intrinsic quality cues) and other characteristics like brand name, price, distribution outlet etc. (extrinsic quality cues). Intrinsic quality cues are related to the technical product specifications, which also involve the physiological characteristics of the product.The technical product specifications are also related to the product's sensory characteristics, which influence experienced quality together with the way the meal is prepared and the expectations about the quality. In addition to the quality perception process, the model also notes that expected quality together with perceived costs will determine intention to buy, and that quality perception can be related to higher-order motivational constructs, which are here called purchase motive fulfilment.Purchase motives with regard to food can be family well-being, social relationships, enjoyment and pleasure, self-fulfilment etc.

Figure 1. The Total Food Quality Model



In our study, we only look at a part of the overall model. Notably, we will concentrate on intrinsic quality cues and therefore ignore extrinsic cues and cost cues. We will also ignore purchase motives and thus do not explain the higher-order motivational foundation of the quality aspects that consumers are interested in. Finally, we do not measure objective sensory qualities of the products.

Investigations of food quality perception and product development

The relationship between technical/physiological product characteristics and consumer quality perception has been formalised in the Quality Function Deployment technique (Hauser & Clausing 1988), which has the aim of facilitating market-oriented product development. Recent applications have shown that the Quality Function Deployment approach is feasible also in the food industry (Bech, Kristensen, Juhl & Poulsen 1997). However, it must be supplemented by the distinction between expected and experienced quality.

Steenkamp and van Trijp (1996) have presented the concept of Quality Guidance, which aims at bringing about consumer-related knowledge about the quality perception process as a useful input to product development. They suggest a statistical estimation of the relationships between physical product characteristics and both quality perception and quality performance, much in line with what is suggested in the Total Food Quality Model. Poulsen et al. (1996) have extended this framework by adding the Quality Formation concept, suggesting various ways in which expected quality and experienced quality determine the overall quality evaluation. More specifically, they point out that there may be cases in which consumers' overall quality evaluation is more dominated by expected rather than by experienced quality.

Quality Function Deployment, Quality Guidance and Quality Formation all have the aim of aiding in market-oriented product development. From the producer's point of view, a central problem in product development is to translate consumer demands into technical/physiological product specifications. This problem becomes especially pronounced when it turns out that quality expectations and quality experience are formed in different ways, related to different sets of technical/physiological product specifications. A product then has to be designed both to a) communicate high quality at the time of purchase, and b) provide high quality under consumption. Since there may be trade-offs between various product characteristics, a producer may turn out to be in a situation where an improvement in experienced quality leads to a decrease in expected quality, and vice versa.

Knowledge about the relationships between physiological product characteristics, expected quality, and experienced quality is therefore crucial from the product development perspective. In this paper, we show how such knowledge can be obtained, and present results on the quality perception of pork and its relation to physiological product characteristics.

Previous research

Quality cues and quality criteria

In the following, we will denote the perceived physical characteristics of a product, which consumers use to infer expected quality, as quality cues. We will denote as quality criteria those more abstract, unobservable characteristics of the product which the consumer regards as making up quality. A detailed discussion of the distinction between the concepts can be found in Steenkamp (1989).

Both quality cues and quality criteria have been the subject of previous research. The results are relatively consistent. As for quality criteria, tenderness, taste, freshness and juiciness seem to be universal criteria, and recently supplemented by health, and nutrition. Colour and fat have been mentioned most often as intrinsic quality cues, supplemented by cut, trimming, gristle, and meat juice. It should be noted, however, that the distinction between quality cues and quality criteria has not always been made in previous research (Barton 1970; Grunert 1997; Maguire 1994; Shepherd & Towler 1992; Woodward 1988).

Physiological product characteristics

In meat research, "objective meat quality" is normally assessed by a number of physical characteristics of the meat.

The halothane gene in pigs has some positive but also some negative effects on the objective quality. The positive effect is increased leanness in the carcass and the negative effect is an increased incidence of pale, soft and exudative meat, ie, PSE meat. Roughly one third of all pigs with the halothane gene develop PSE (Jensen & Barton-Gade 1985).

PSE is a serious defect in fresh meat because it leads to poorer water holding capacity which reduces tenderness and juiciness. The colour of PSE meat is pale and it is sometimes shiny from the fluids on the surface (Hedrick, Aberle, Forrest, Judge & Merkel 1993).

Ultimate pH has little influence on meat quality at normal levels. However, low pH values can cause an acid flavour, whereas high pH levels result in dark, firm and dry meat (DFD meat). DFD meat is tender and juicy, but sometimes with an off flavour. Meat with high levels of pH also has a shorter shelf life (Hedrick et al. 1993).

Little is known about the effect of colour on the objective meat quality. However, colour has been shown to influence consumer acceptance of fresh meat (Jeremiah 1993; Topel, Miller, Berger, Rust, Parrish & Ono 1976; Zuidam, Schmidt, Oosterbaan & Sybesma 1971).

Blood splashes in the loin are not desirable in fresh meat, as it is expected to reduce the visual appeal of the meat.Thus, blood splashes reduce cutting yields in fresh meat, as it must be removed before presentation to consumers.

Intramuscular fat (IMF) is known to have a positive impact on the juiciness and taste of fresh meat (Bejerholm & Barton-Gade 1986).

Relationships between physiological product characteristics, quality cues, and quality criteria

The study by Steenkamp and van Trijp (1996) is the only one we know of which has combined physiological product characteristics, quality cues, and quality criteria. It was done with blade steak as product category. Six physiological characteristics were measured, some of them by several indicators: colour, fatness, pH value, water-binding capacity, shear force, and sarcomere length. Eight quality cue measures were combined into three latent constructs: freshness, visible fat and appearance, which together determined quality expectations. Likewise, seven quality criteria measures were combined into three latent constructs: tenderness, non-meat components and flavour, which together determined quality experience. Their main results were as follows:

- Colour has a significant impact on quality expectations only
- Fatness has a negative impact on quality expectations and a positive impact on quality experience
- Water-binding capacity, sarcomere length, and pH value have effect on both quality expectations and quality experience
- Shear force affects quality experience only
- There is no significant relationship between quality expectation and quality performance.

The following study can be seen as an extension of the Steenkamp and van Trijp study. We use a different, though related, product category. We use a somewhat different set of quality cues and quality criteria. Both in their own right and when compared to the Steenkamp and van Trijp results, our results should shed more light on the meat quality perception process.

The present study

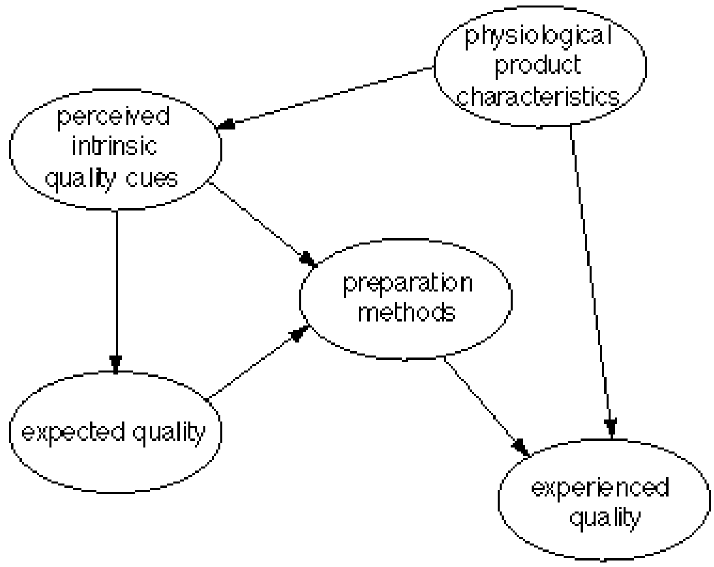
Aims

Our study was focused on the quality of pork and aimed at providing answers to the following questions:

- which criteria do consumers associate with the quality of pork?
- which intrinsic quality cues do consumers use to derive expectations of pork quality?
- what is the relationship between the expected pork quality and the quality that is actually experienced by consumers when consuming the product?
- how does the expected pork quality relate to physiological product characteristics?
- how does the experienced pork quality relate to physiological product characteristics?

Thus, the study investigated the composites of and relationships between intrinsic quality cues, expected quality, experienced quality and physiological product characteristics. An overview of the relations investigated in this study can be seen in figure 2.

Figure 2. Relationships investigated



The Total Food Quality Model does not deal explicitly with the impact of physiological product characteristics on perceived product quality, but rather suggests technical product specifications and sensory characteristics as determinants of expected and experienced quality, respectively. In this study, physiological product characteristics are measured with regard to their possible impact both on expected quality, via quality cues, and on experienced quality, omitting sensory characteristics as a mediating variable.

Respondents

200 German consumers who prepared and consumed pork at least twice a month and who had the main responsibility for shopping for food and cooking in their own household participated in the study. The sample was stratified by household size and age, and was restricted to consumers living in Nordrhein-Westfalia. No consumers above the age of 60 participated.

Products

Real samples of pork chops were used in the study. To ensure sufficient variation in the meat quality, the pork was obtained from three different suppliers. The pork chops were cut from 50 pig loins from each supplier, and as far as possible the loins were selected at random from one day's slaughter. Pig loins were chosen because they were generally thought to show the largest variation in the measures of physiological product characteristics.

Measurement of physiological product characteristics

Six physiological product characteristics were measured in the meat samples. These were halothane, PSE, pH, colour, blood splashes and intramuscular fat. The measurements, which were carried out by professional technicians, took place under controlled conditions and were based on meat from the same pig loins as were used in the consumer study.

The presence of halothane, the stress gene, was assessed by a DNA analysis of the meat or other biological tissue from the animal. The level of PSE was assessed by subjective judgement which included evaluating both the visual appearance and the texture of the meat. pH was measured by a pH meter, calibrated to official standards. The colour of the loins was measured by means of the Japanese Colour Scale based on a Minolta colour probe. The amount of blood splashes was judged subjectively on the silverside of the loins. Finally, intramuscular fat was analysed from the loin meat by chemical laboratory analysis. Table 1 documents the results of the physiological measurements per supplier.

Table 1. Physiological product characteristics

	Means and std. deviations	Means per supplier A	B	C
PH * (min. 5.28; max. 6.90)	5.68 (.13)	5.60	5.66	5.78
PSE * (min. 1; max. 4)	1.15 (.45)	1.05	1.33	1.07
Blood splashes * (min. 1; max. 3)	1.96 (.59)	1.54	2.27	2.06
Intramuscular fat (min. .7; max. 4.5)	1.86 (.69)	1.85	1.81	1.92
Colour * (min. 1.66; max. 4.78)	3.33 (.62)	3.23	3.49	3.28
Halothane * (min. 1; max. 3)	1.31 (.52)	1.04	1.89	1.01

* Significantly different means across suppliers ($p<.001$)

Selection of quality cues and quality criteria

The selection of intrinsic quality cues used by consumers to assess the quality of pork and the criteria associated with pork quality was based on a literature review and a focus group with consumers who regularly prepared and ate pork.

Four quality cues were finally chosen:colour, share of fat, fat marbling and meat juice. Seven quality criteria were chosen: nutritional value, wholesomeness, freshness, leanness, juiciness, taste and tenderness. These quality criteria appeared to be used by consumers both to form expectations about the quality of pork in a purchase situation and to evaluate the meat quality after preparation and consumption.

Questionnaires

Two questionnaires were prepared for the consumer study. The first questionnaire listed measures of quality cues and of the expected quality of the pork samples, whereas the second questionnaire was used to assess experienced quality. Measures of demographic characteristics were also included, as were measures of preparation methods and frequency of meat and pork consumption. The quality cues were all assessed on evaluative scales, whereas the quality criteria were measured on descriptive scales, as follows:

In your opinion, how appealing is the colour of these pork chops? (quality cue)

1	2	3	4	5	6	7
Not at all appealing						Extremely appealing

In your opinion, how wholesome are these pork chops? (quality criteria)

1	2	3	4	5	6	7
Not at all wholesome						Extremely wholesome

Data collection

Every consumer evaluated three pork samples, one from each supplier, in two rounds, resulting in 600 observations. First, the consumers were invited to a test studio where they were shown real, fresh samples of the three kinds of pork and asked to evaluate the samples by filling in the first questionnaire. Then the consumers were given colour-labelled samples of each of the three kinds of pork to take home, and were asked to prepare and consume the meat for dinner the following three days according to a pre-specified order. The order was rotated among the respondents, and all samples were adjusted to household size. The respondents were asked to fill in the relevant part of the second questionnaire each day immediately after the meal. They were requested to use a preparation method that they were familiar with, and to use basically the same method on all three days. Finally, the respondents were asked to avoid hot spices. After the three days, an interviewer telephoned the respondents to collect the data the respondents had recorded in the questionnaire.

Analysis and results

The data were primarily analysed by means of principal component analysis and structural equation modelling. Structural equation modelling assumes that the measured variables are manifest indicators of a smaller set of latent variables. The method then simultaneously estimates the relationships among the latent variables and the factor loadings of the manifest variables with regard to the latent constructs. It is also worth noting that when estimating the weights of the individual items in order to determine the latent constructs, structural equation modelling takes into account inter-item correlations. This is highly relevant in our study, where a number of the quality criteria are highly correlated. As can be seen in table 2, this is particularly true for both expected and experienced nutritional value and wholesomeness, for expected and experienced tenderness and taste, and for experienced juiciness and taste and experienced juiciness and tenderness.

Table 2. Correlations of quality criteria

	Nutritional value	Wholesomeness	Freshness	Leanness	Juiciness	Taste	Tenderness
Nutritional value	1.00/ 1.00[1]						
Wholesomeness	.76/.80	1.00/1.00					
Freshness	.60/.59	.62/.62	1.00/1.00				
Leanness	.46/.29	.52/.42	.47/.35	1.00/1.00			
Juiciness	.53/.49	.52/.50	.60/.46	.38/.22	1.00/1.00		
Taste	.64/.49	.66/.53	.66/.57	.51/.27	.67/.73	1.00/1.00	
Tenderness	.64/.49	.63/.52	.56/.50	.61/.30	.62/.75	.73/.76	1.00/1.00

1 Expectations/experiences (all significantly different from zero, p<.001)

Principal component analysis was used first to investigate the dimensional structure of the data.The sets of indicators of quality cues, expected quality and experienced quality, were each factor-analysed to investigate their dimensionality. The analysis of quality cues and expected quality resulted in one-dimensional factor solutions (based on the Kaiser criterion), with 59% and 65% of variance explained, respectively. This indicates that the sets of indicators for both quality cues and expected quality are so highly correlated that they can be regarded as manifestations of one underlying common latent variable. Experienced quality turned out to be two-dimensional, and thus revealed a more complex structure than had been anticipated. The first factor covers the more hedonistic aspects of meat quality, which can all be directly assessed by the consumers when they consume the meat, namely juiciness, tenderness and taste. The second factor, on the other hand, consists of more health-related aspects, namely wholesomeness, nutritional value, leanness and freshness, which typically can only be indirectly assessed by consumers, even upon consumption[1]. Together, the two factors explained 73% of the variance in the data. The eigenvalues and factor loadings of the final solutions, varimax-rotated when more than one factor, can be seen in tables 3-5.

Table 3. Factor loadings of quality cues

	Factor 1 Eigenvalue: 2.34
Colour	.82
Share of fat	.81
Fat marbling	.84
Meat juice	.55

Eigenvalue of 2nd factor: .80

Table 4. Factor loadings of expected quality criteria

	Factor 1 Eigenvalue: 4.56
Nutritional value	.83
Wholesomeness	.84
Freshness	.80
Leanness	.69
Juiciness	.76
Taste	.87
Tenderness	.85

Eigenvalue of 2nd factor: .66

1 Enforcing a two factor solution in the principal components analysis of the indicators of expected quality did not reveal the same pattern, as all the indicators, except leanness, loaded primarily on the first factor.

Table 5. Factor loadings of experienced quality criteria

	Factor 1 Eigenvalue: 4.12	Factor 2 Eigenvalue: 1.00
Nutritional value	.41	.72
Wholesomeness	.40	.80
Freshness	.45	.65
Leanness	.00	.73
Juiciness	.88	.19
Taste	.86	.27
Tenderness	.86	.26

Eigenvalue of 3rd factor: .75

An analysis of the intercorrelations of the six physiological characteristics showed all correlations to be under .3, except for PSE and halothane where the correlation was .48. These results can be seen in table 6. Since the correlations were generally low, the six variables were regarded as indicators of one latent construct each in the subsequent analysis.

Table 6. Correlations of physiological product characteristics

	PH	PSE	Blood splashes	Intramus-cular fat	Colour	Halothane
PH	1.00					
PSE	-.25**	1.00				
Blood splashes	.08	.48**	1.00			
Intramus-cular fat	.00	.06	-.16**	1.00		
Colour	.28**	-.11*	.01	.01	1.00	
Halothane	-.11*	.48**	.21**	.01	.14*	1.00

*: p<.01, **: p<.001

The data were then subjected to structural equation modelling using LISREL, with the items used as indicators of the latent constructs corresponding to the pattern detected in the principal components analyses. Thus, expected quality was indicated by seven items, experienced hedonistic quality by three items and experienced health-related quality by four items. Due to the apparent uni-dimensionality of the quality cues they were also used as indicators of one common construct, which we have called visual appearance. Since most preparation methods were standardised across the meat samples, this construct was represented by one item only, namely the reported frying time, and since frying time can be considered a directly observable variable, which can be measured without error, the reliability of this item was set to 1. Likewise, the reliabilities of the measures of halothane, pH value and intramuscular fat were set at 1. Based on previous research, the reliabilities of PSE and colour were set at .85, while the reliability of the measure of blood splashes was set at .5.

The measurement models which result from the analysis can be used to assess the relative importance of the various items in determining the constructs. The measurement models along with the estimated reliabilities of the individual items are listed in table 7. The item reliabilities are defined – as in classical measurement theory – as the correlation between the item value and the true value.

Table 7. Measurement models

Latent variables	Indicators	Completely standardised loadings	Item reliabilities
Intrinsic quality cues	Colour	.82	.67
	Fat marbling	.76	.58
	Share of fat	.68	.46
	Liquid/meat juice	.36	.13
Expected quality	Taste	.86	.73
	Tenderness	.83	.70
	Wholesomeness	.78	.61
	Nutritional value	.77	.60
	Freshness	.77	.59
	Juiciness	.74	.55
	Leanness	.65	.42
Experienced health-related quality	Wholesomeness	.84	.70
	Nutritional value	.79	.63
	Freshness	.73	.54
	Leanness	.49	.24
Experienced hedonistic quality	Tenderness	.87	.76
	Taste	.86	.75
	Juiciness	.84	.71

The measurement model for visual appearance shows the colour of the meat to reflect the construct best. Second and third best are the perceived pleasantness of the fat marbling and the perceived pleasantness of the overall fat content. How much meat juice that is perceived to have seeped from the meat seems to be a less good indication of this construct.

All seven quality criteria seem to be significant elements of expected quality. Expected quality is, however, somewhat better reflected in taste and tenderness, and less well in leanness.

The experienced hedonistic quality seems to be almost equally determined by perceived tenderness, taste and juiciness of the meat, while the experienced health-related quality is related somewhat more differentially to the quality criteria, and again related the least to leanness.

To further investigate how well consumers are able to predict the quality of pork after preparation and consumption, correlation analyses were carried out based on the ratings of expected and experienced product quality on the seven criteria. As can be seen in table 8, these analyses showed particularly high correlations between expected and experienced nutritional value and wholesomeness. This must be seen in the light of the fact that both nutritional value and wholesomeness are credence characteristics, where experience will usually not clearly disconfirm expectations (at least not in the short run). The other quality criteria are experience characteristics, where disconfirmation is more likely, leading to lower correlations between expected and experienced measures.

Table 8. Correlations between expectations and experiences of quality criteria

Nutritional value	.53[1]
Wholesomeness	.60
Freshness	.46
Leanness	.49
Juiciness	.34
Taste	.36
Tenderness	.36

1 All: $p<.001$

The initial LISREL estimations of the relationships between the constructs indicated (via the modification indices) that a causal link from experienced hedonistic quality to experienced health-related quality would significantly improve the fit of data to the model. Since this is also theoretically justifiable (it seems reasonable to assume that the credence characteristics are inferred from experience characteristics), this relation was added to the model.

The estimations also showed that frying time has no significant relationships with any other variable. The frying time appears to be a matter of convention or coincidence rather than something which is adjusted based on the expected quality of the meat, as the visual appearance and expected quality can hardly explain any variance in this variable. This may also explain the low impact of frying time on experienced quality. Frying time was therefore eliminated from the model.

As for the physiological product characteristics, the measurement of the pH value had no significant relationship to either quality cues or experienced quality. Blood had a significant relationship to the quality cues only, while PSE turned out to be significantly related only to the two constructs of experienced quality. After removing all insignificant relationships from the model, the remaining relationships were re-estimated, resulting in the model shown in table 9.

The coefficients show a very strong relationship between perceptions of the quality cues and expected quality. This means that the product quality which consumers expected was largely inferred from the intrinsic quality cues which were measured.

Table 9. Structural models

Relations	Completely standardised coefficients	R^2
Visual appearance –		.05
• colour	-.07 *	
• halothane	.10**	
• blood	-.13 *	
• intramuscular fat	-.09 *	
Expected quality –		.91
• visual appearance	.95**	
Experienced hedonistic quality –		.24
• expected quality	.46**	
• halothane	-.12**	
• PSE	-.10 *	
• intramuscular fat	.11**	
Experienced health-related quality –		.70
• expected quality	.40**	
• experienced hedonistic quality	.57**	
• colour	-.09**	
• halothane	.12**	
• PSE	-.07 *	

*: $p<.10$ **: $p<.05$.

The health-related quality that consumers actually experience when preparing and consuming the meat is reasonably well explained by the expected quality and by the experienced hedonistic quality. This may be related to the fact that health-related quality aspects are mainly credence characteristics, which cannot be directly experienced during consumption. They are therefore inferred from expectations and from the quality aspects which can be readily ascertained, ie, hedonistic quality.

Experienced hedonistic quality is related to expected quality, but only 24% of the variance in experienced hedonistic quality is explained in the model, showing that most of the variance is due to unknown factors.

The relations of the physiological product characteristics with the consumer perceptions are generally well in line with our expectations: halothane contributes positively to experienced health-related quality, PSE has a negative impact on experienced meat quality, blood splashes are undesirable, and intramuscular fat increases experienced hedonistic quality.

It is interesting that intramuscular fat has a reversed effect on expected and experienced quality, so that higher levels of intramuscular fat actually reduce the consumers' expectations of the quality of the meat (via the visual appearance), while higher levels of intramuscular fat in fact contribute positively to tenderness, taste and juiciness and thus the experienced hedonistic quality of the meat. It is equally interesting that halothane shows reversed effects on the two components of experienced quality. Higher levels of halothane clearly reduce the experienced hedonistic quality of the meat, but at the same time increase the consumers' experience of health-related quality. While the relationship with health-related quality is as we would expect, the impact on experienced hedonistic quality is in fact the opposite of what could be anticipated. The only plausible reason for this seems to be the paler colour of meat with high levels of halothane, something which consumers apparently regard as attractive.

Table 10 provides the most important fit measures for the derived model. To reduce the vulnerability of the chi-square value to sample size, it is common to divide it by the degrees of freedom. As a rule of thumb, the resulting value should then be lower than 5,while RMSEA should be lower than .08 and, preferably, lower than .05. GFI and AGFI should be at least .90, while standardised root mean square residuals should be lower than .10 before the fit of the data to the model can be regarded as acceptable (Hildebrandt 1983). As can be seen in the table, the goodness-of-fit measures reveal a moderate fit in this case. An inspection of the modification indices did not reveal possibilities for improving the model by specifying additional causal links with a reasonable substantial interpretation.

Table 10. Goodness-of-fit measures

Chi-square	635.63
degrees of freedom	202
Chi-square/degrees of freedom	3.14
Root Mean Square Error of Approximation (RMSEA)	.062
Goodness of Fit Index (GFI)	.91
Adjusted Goodness of Fit Index (AGFI)	.87
Standardized Root Mean Square Residual (SMR)	.044

DISCUSSION

In this paper we have presented a conceptual framework for analysing the relations between consumers' perceptions of food quality and physiological product characteristics. The empirical application clearly demonstrates the necessity of also taking consumer quality perceptions into account when developing new products that are to be marketed to consumers as high quality products.

Summarizing, the results of our study show that the consumers associate the quality of pork both with health-related and hedonistic dimensions, in terms of nutritional value, wholesomeness, freshness, leanness, juiciness, taste and tenderness. The intrinsic quality cues which the consumers use to determine the quality of pork are colour, share of fat, fat marbling and, perhaps to a lesser extent, the amount of meat juice. Our results point to a fairly strong relationship between expected and experienced quality, though expectations cannot be said to be fully predictive of the quality that will be experienced upon consuming the meat. Finally, the consumer perceptions are generally not well explained by the physiological characteristics of the meat, but some interesting relationships are found, though.

The results of our study on perceptions of pork quality deviate in two major ways from the results achieved by Steenkamp and van Trijp (1996) in their study of consumer perceptions of blade steak.While our results point to a moderate relationship between expected and experienced quality, in Steenkamp and van Trijp's study this relationship is barely significant. At the same time, the variations in the consumer quality perceptions are better explained by the physiological product characteristics in the study by Steenkamp and van Trijp than in our study. It seems that these differences can to some degree be explained by the different methodologies that were applied.While Steenkamp and van Trijp measured expected and quality performance (ie experienced quality) by global measures, we assessed and analysed these concepts as latent variables constituted from quality criteria such as wholseomeness and taste. This may not only influence the relationship between expected and experienced quality, but also the relation to the objective measures applied, and do so to the extent that the latent variable does not conceptually cover the same aspects as the global measures of perceived quality. In addition,Steenkamp and van Trijp's definition of quality cues obviously covers not only concrete product attributes but also more abstract attributes which we regard as part of the actual quality constructs. Finally, some of the differences in the results may be owed to the fact that Steenkamp and van Trijp used Partial Least Squares (PLS) to estimate their model, whereas we used structural equation modelling.

It is interesting that colour was found only to influence quality expectations in the Steenkamp and van Trijp study, while we found effects on both quality expectations and quality experience. Different measures of colour were applied in the two studies, however. This indicates that further research on the validity of the colour measures would be desirable.

It is important to note that the differences which we have pointed out here between our study and the study by Steenkamp and van Trijp may also find some explanation in the fact that two different, though related, products were applied. It is, in fact, probable that consumer purchase behaviour and experience, and consequently quality perception, differ with regard to beef and pork and with regard to different cuts, just as different technical measures of the meat quality may be required to assess the objective quality of the meat.

Generally, our study shows divergence in a number of ways between the subjectively-based consumer perceptions and the objective quality of pork. pH is for example used extensively in the meat industry as a measure of meat quality, whereas our study shows that this characteristic has, in fact, no significant impact on consumers' quality perceptions with regard to pork. Likewise, the relationship of intramuscular fat to consumer perceptions warrants special attention. The diverse effects on expected and experienced quality point to serious problems in optimising the product with regard to this characteristic. The same goes for halothane, which has an ambiguous impacts on the two aspects of experienced quality.

The practical implications of the study are primarily focused on the optimisation problems that arise from the diverse effects of intramuscular fat and halothane on consumer quality perceptions. At the same time, the experienced quality generally exceeds the expectations which the consumers had formed in advance on the basis of the visual appearance of the meat. This shows that consumers lack competence in judging the quality that they will experience in meat when choosing between different kinds of meat in a purchase situation. One way of dealing with this problem, in cases where experience exceeds expectations, is obviously to market the meat as part of a quality mark programme which emphasises the relevant sensory characteristics of the meat to the consumer.

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